Defense Development as Internal Balancing: The Political Determinants of Successful Emulation

Patrick J. Thompson
University of Miami, pjthompson81@gmail.com

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UNIVERSITY OF MIAMI

DEFENSE DEVELOPMENT AS INTERNAL BALANCING: THE POLITICAL DETERMINANTS OF SUCCESSFUL EMULATION

By

Patrick J. Thompson

A DISSERTATION

Submitted to the Faculty of the University of Miami in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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DEFENSE DEVELOPMENT AS INTERNAL BALANCING: THE POLITICAL
DETERMINANTS OF SUCCESSFUL EMULATION

Patrick J. Thompson

Approved:

________________________________________  __________________________________________
Joseph Parent, Ph.D.                          Roger Kanet, Ph.D.
Associate Professor of Political Science      Professor of Political Science

________________________________________  __________________________________________
William C. Smith, Ph.D.                       Guillermo Prado, Ph.D.
Professor Emeritus of Political Science       Dean of the Graduate School

________________________________________  __________________________________________
Bruce Bagley, Ph.D.                           
Professor of International Studies
What are the political determinants of successful defense development in developing countries? Leveraging insights from the international relations and comparative politics literatures, I argue that successful defense development is a function of elite perceptions of external vulnerability at strategic junctures. As elite perceptions of external vulnerability increase, I expect state power for defense development to increase, thus improving defense development outcomes. I compare the relative utility of this novel argument by comparing it to three existing theories: the defense dependency approach; neorealism; and the institutional capacity approach. Using comparative historical analysis and process tracing, I test these four theories against the cases of the Brazilian and Indian aeronautics enclaves. The conclusion I reached is that while the existing approaches to defense development all capture important aspects of this process, the neoclassical realist model is more powerful, if less parsimonious. This is so because it systemically incorporates systemic and unit-level variables to explain defense development, thereby filling a lacuna in the defense development literature.
To my grandparents:

John F. Thompson and Catherine T. O’Connell
Acknowledgments

I have heard many times the dissertation process described as a lonely one. I certainly found it to be so. However, throughout this isolated time, I had the good fortune to be buoyed by three outstanding communities, whose generous support constantly reminded me that, “No man is an island, entire of itself; every man is a piece of the continent, a part of the main. If a clod be washed away by the sea, Europe is the less…” (Donne 2010, 98).

Without the support of my dissertation committee, my colleagues, and my family this project would have been impossible and I may well have been washed away by the sea.

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Notwithstanding your help and support, this project has inherent flaws and limitations, for which I alone bear full responsibility.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INTRODUCTION</td>
</tr>
<tr>
<td></td>
<td>1.1 Delimiting the Process of Defense Industrialization and Defining Success</td>
</tr>
<tr>
<td></td>
<td>1.2 The Defense Development Literature</td>
</tr>
<tr>
<td></td>
<td>1.3 Methodology and Data</td>
</tr>
<tr>
<td></td>
<td>1.4 Project Overview</td>
</tr>
<tr>
<td>2</td>
<td>A NEOCLASSICAL REALIST TREATMENT OF DEFENSE DEVELOPMENT</td>
</tr>
<tr>
<td></td>
<td>2.1 The Argument</td>
</tr>
<tr>
<td></td>
<td>2.2 Testing the Argument</td>
</tr>
<tr>
<td></td>
<td>2.3 Contributions and Inherent Limitations</td>
</tr>
<tr>
<td>3</td>
<td>BASELINES OF STATE POWER AND AERONAUTICS INDUSTRIALIZATION IN BRAZIL AND INDIA</td>
</tr>
<tr>
<td></td>
<td>3.1 The Old Republic, State Power, and Aeronautics Sector Development</td>
</tr>
<tr>
<td></td>
<td>3.2 State Power and Aeronautics Sector Development Under the Raj</td>
</tr>
<tr>
<td></td>
<td>3.3 Comparative Insights and Theory Testing</td>
</tr>
<tr>
<td>4</td>
<td>THE ORIGINS OF AERONAUTICS ENCLAVES</td>
</tr>
<tr>
<td></td>
<td>4.1 The <em>Estado Novo</em> and the Brazilian Aeronautics Sector</td>
</tr>
<tr>
<td></td>
<td>4.2 Independent India and the Indian Aeronautics Sector</td>
</tr>
<tr>
<td></td>
<td>4.3 Comparative Insights and Theory Testing</td>
</tr>
<tr>
<td>5</td>
<td>INSTITUTIONAL REFORM AND STASIS IN AERONAUTICS ENCLAVES</td>
</tr>
<tr>
<td></td>
<td>5.1 Institutional Reform in the Brazilian Aeronautics Sector</td>
</tr>
<tr>
<td></td>
<td>5.2 The Institutional Status Quo of the Indian Aeronautics Sector</td>
</tr>
<tr>
<td></td>
<td>5.3 Comparative Insights and Theory Testing</td>
</tr>
<tr>
<td>6</td>
<td>CONCLUSION</td>
</tr>
<tr>
<td></td>
<td>6.1 Contributions to the Study of Defense Development</td>
</tr>
<tr>
<td></td>
<td>6.2 Limitations</td>
</tr>
<tr>
<td></td>
<td>6.3 Future Research</td>
</tr>
</tbody>
</table>

LIST OF FIGURES........................................................................................................ ix

LIST OF TABLES........................................................................................................... x

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INTRODUCTION</td>
</tr>
<tr>
<td></td>
<td>1.1 Delimiting the Process of Defense Industrialization and Defining Success</td>
</tr>
<tr>
<td></td>
<td>1.2 The Defense Development Literature</td>
</tr>
<tr>
<td></td>
<td>1.3 Methodology and Data</td>
</tr>
<tr>
<td></td>
<td>1.4 Project Overview</td>
</tr>
<tr>
<td>2</td>
<td>A NEOCLASSICAL REALIST TREATMENT OF DEFENSE DEVELOPMENT</td>
</tr>
<tr>
<td></td>
<td>2.1 The Argument</td>
</tr>
<tr>
<td></td>
<td>2.2 Testing the Argument</td>
</tr>
<tr>
<td></td>
<td>2.3 Contributions and Inherent Limitations</td>
</tr>
<tr>
<td>3</td>
<td>BASELINES OF STATE POWER AND AERONAUTICS INDUSTRIALIZATION IN BRAZIL AND INDIA</td>
</tr>
<tr>
<td></td>
<td>3.1 The Old Republic, State Power, and Aeronautics Sector Development</td>
</tr>
<tr>
<td></td>
<td>3.2 State Power and Aeronautics Sector Development Under the Raj</td>
</tr>
<tr>
<td></td>
<td>3.3 Comparative Insights and Theory Testing</td>
</tr>
<tr>
<td>4</td>
<td>THE ORIGINS OF AERONAUTICS ENCLAVES</td>
</tr>
<tr>
<td></td>
<td>4.1 The <em>Estado Novo</em> and the Brazilian Aeronautics Sector</td>
</tr>
<tr>
<td></td>
<td>4.2 Independent India and the Indian Aeronautics Sector</td>
</tr>
<tr>
<td></td>
<td>4.3 Comparative Insights and Theory Testing</td>
</tr>
<tr>
<td>5</td>
<td>INSTITUTIONAL REFORM AND STASIS IN AERONAUTICS ENCLAVES</td>
</tr>
<tr>
<td></td>
<td>5.1 Institutional Reform in the Brazilian Aeronautics Sector</td>
</tr>
<tr>
<td></td>
<td>5.2 The Institutional Status Quo of the Indian Aeronautics Sector</td>
</tr>
<tr>
<td></td>
<td>5.3 Comparative Insights and Theory Testing</td>
</tr>
<tr>
<td>6</td>
<td>CONCLUSION</td>
</tr>
<tr>
<td></td>
<td>6.1 Contributions to the Study of Defense Development</td>
</tr>
<tr>
<td></td>
<td>6.2 Limitations</td>
</tr>
<tr>
<td></td>
<td>6.3 Future Research</td>
</tr>
</tbody>
</table>
List of Figures

Figure 1.1: A Conceptualization of the Process of Military Emulation .......... 13
Figure 1.2: The Value-Added Chain in Aerospace..................................... 40
Figure 1.3: The External Vulnerability Equation ....................................... 42
Figure 2.1: A Neoclassical Realist Theory of Defense Development .......... 74
List of Tables

Table 1.1: The Hierarchy of Defense Industrial Production................................. 21
Table 1.2: Summarizing Extant Theories of Defense Development ...................... 33
Table 2.1: Kholi’s State Structure Typology .................................................. 52
Chapter 1: Introduction

A core prediction of neorealist theory past and present is that under conditions of anarchic competition, states will emulate the proven innovations of systems-leading states (Waltz 1979, 127). Thus, from the vantage of neorealism, the ambitious defense industrialization programs launched in developing countries since the middle of the twentieth century are not surprising. In choosing to foster the development of defense industries ultimately capable of producing high technology weapons systems, like those produced by great powers, policymakers in developing countries have opted to emulate the proven strategies of the great powers. However, in seeking to emulate great powers, success in defense industrialization has been uneven. In many cases, defense industrialization has ended in costly failure, as epitomized by the case of India. Yet, in other cases such as that of Brazil, Israel, South Korea, and Taiwan, efforts at defense development have been much more successful. This raises the question, what are the political determinants of successful defense industrialization in developing countries?

The process of defense development and the underlying politics require attention for three key reasons (Elman 1999, 7-10). First, defense development is recognized to cause several domestic and foreign policy problems. A key feature of defense development programs highlighted by those critical of developing countries’ aspirations is that the allocation of scarce national resources to build weapons is theorized to retard national economic development and can increase the destitution of the population. Additionally, defense development can exacerbate security dilemmas and lead to regional arms races, as in the case of India and Pakistan, which remain deadlocked in a militarized
high-intensity rivalry. Finally, and perhaps of greatest contemporary interest, if China realizes its long-held ambition of a modern and autarchic defense industrial base, China may opt to challenge U.S. hegemony and destabilize the liberal international order.

It is set against these real-world policy problems that the paucity of theoretical literature offering explanations for defense industrialization outcomes in developing countries is important. The conventional scholarly wisdom regarding the prospects for defense industrialization on the periphery centers on three sets of explanations. First, the largest group of scholars interested in defense industrialization in developing countries, collectively called defense dependency theory, argues that the dynamics of the modern international arms production and transfer system (APTS) make it impossible for developing countries to establish their own indigenous defense industries. Second, neorealism offers little guidance as to the political determinants of defense industrialization. The sole work dedicated to explicating the relationship between external threats and defense industrialization outcomes in developing countries argues that as the level of external threat increases, so too will the rationality of defense industrial policy, leading to better defense development outcomes. The shortcoming for these theories is that their structural vantage does not explain unit-level variation. For instance, while defense dependency theory has little trouble explaining Indian failure, it cannot explain Israeli, South Korean, or Taiwanese success. Likewise, neorealism cannot explain why Brazil was able to build a full-scale defense industrial base despite low and decreasing external threats over the course of the twentieth century, while the Indian defense industrialization has produced lackluster results, despite a high intensity rivalry with China and Pakistan. Though parsimonious and powerful at times, pure systems-
level theory in and of itself elucidates little regarding the question of who varies and why; the key question at the heart of this project.

Second, at the unit-level of analysis, a few scholars have illustrated the importance of institutional capacity in formulating defense industrial policy consistent with the needs of industry. Most notably Patrice Franko-Jones (1992) and Ken Conca (1997) have done well in the case of Brazil to explain the unique institutional underpinnings of successful defense development. Yet, to the extent that institutional explanations focus on institutional capacity to explain defense development outcomes and not the political context that gives rise to institutions, this explanation also affords little analytic leverage on the determinants of defense industrialization. Institutions are tools arising from politics that states use to achieve some societal goal, in this case defense industrialization, as such they lack independent causal power.

The goal of this dissertation is to fill this lacuna in the international relations literature on the subject of defense development outlined above by focusing on the political determinants of this process. I make two arguments in this dissertation. First, I argue that defense development outcomes are a function of state power. Consistent with scholars like Stephen Krasner, I define state power as the ability of a state to formulate and implement national policy goals over the interests of international and domestic actors (Krasner 1978, 10-11). Though this definition of state power is not novel, the way I propose to measure state power has yet to be attempted in the literature on defense development. Specifically, drawing on the work of Atul Kohli (2004), whose work focused on variations in economic development outcomes among developing countries, I measure state power by focusing on the cohesiveness of states’ authority structures,
defined in terms of elite ideology, state organization, and state-society linkages; all relationships that are decidedly political in nature. I hypothesize that as state power increases, so too will defense development outcomes. If state power explains variation in defense development outcomes across developing countries, what explains variations in state power across time and space?

Second, drawing on a punctuated equilibrium model of institutional origins and subsequent development, I argue that state power varies across time and space because of the environment in which states exist. This argument is rooted in a historical institutionalist perspective that understands institutions to be costly to build and which will reflect to a large degree the interests of dominant elites, and are valued even by minority interests because societal norms, values, and expectations converge around these rules. While institutions are costly to build and widely valued, they are also very difficult to change in the short-term and prove durable even over the long-term. Given this perspective, I argue that the impetus for developing state institutions dedicated to promote national defense industrialization is the result of rapid shifts in perceived levels of external vulnerability. Perceived levels of external vulnerability is an independent variable defined to include external threats and opportunities for alliances to hedge against threats. Once established, I argue that state power can also change when the state is perceived as ill-suited to discharging its responsibilities because of the pressures from above and below.

I test these two arguments by examining the development trajectories of the Brazilian and Indian aeronautics sectors. Further justification for the selection of these cases is provided in what follows. Suffice it to say, that defense development outcomes
matter more in some countries than others because of their latent great power potential.

Very few countries possess the right combination of geography, population, or economic potential to enter the ranks of the great powers. For instance, even were a country like Switzerland to develop a modern defense industrial base capable of autarchic production of the full gamut of modern weapons, for reasons of size and population, it has little potential to upset the distribution of relative power in the international system and thus endanger the U.S.-led liberal international order. The same is not true for large aspirational powers like Brazil, India, or China. In each of these three cases, defense development has long been pursued as a means to achieve the same international rule making authority as the great powers currently enjoy.

To be clear, for reasons beyond this project’s scope, neither Brazil nor India have been nor are they expected to become revolutionary powers. Yet, the *China Dream* articulated by President Xi Jinping combined with Chinese actions in the South China Sea suggest to some, Graham Allison (2014) most publicly, that China is pursuing a revolutionary foreign policy that makes war between China and the U.S. more likely than not in the coming decades. Surely the capacity for autarchic production of modern weapons systems is a prerequisite for a Chinese challenge to U.S. hegemony. However, Chinese defense development is not treated here primarily because I lack the language skills necessary to adequately study the developmental trajectory of the Chinese defense industrial base. However, as discussed in the conclusion, I do expect that the theory of defense development I develop herein could be applied to the Chinese case in the future.

The remainder of this introductory chapter proceeds as follows. The first section defines and delimits successful defense industrialization in developing countries. The
second section briefly reviews the literature on defense development on the periphery. My focus then shifts to a discussion of methodology in the third section. Finally, the fourth section provides a schematic overview of the work to follow in the body of this study.

1.1 Delimiting the Process of Defense Industrialization and Defining Success
The first steps in creating a unified theory of defense industrialization requires an answer to two questions. First up is a most basic social science question: What is defense development a case of? In answering this question, two definitions are provided. First, the creation of a defense industrial base in developing countries with the goal of one day producing highly sophisticated, first rate weapons systems akin to those produced in developed countries, is the quintessential example of an internal balancing strategy of military emulation. Second, defense industrialization conceived of as a process of military emulation is defined by two analytically distinct, yet inseparable processes: institution-building and state-led development.

The second key question requiring an answer concerns developmental success and failure. Simply put, which countries have been most successful and which have been the least successful in their efforts at defense industrialization? Clearly, no developing country has yet attained the ability to produce highly sophisticated weapons systems like M1 Abrams tanks or F-22 Raptor fighter jets. Yet, to deny that some measure of defense development has occurred in developing countries is to neglect the very real, albeit dependent industrialization, that has taken place. I will offer a functional definition of successful defense development, which focuses on the attainment of core competencies, rather than export sales or the ability to produce stealth fighter jets. However, it should
be noted that success of the products in other markets does lend support to the functional
definition of defense development outcomes.

1.1.1 Defense Industrialization as a Process of Military Emulation
According to neorealist theory, the logic of anarchy socializes states to balance power by
means of alliances and through the conversion of societal resources into military power
(Waltz 1979, 127; Resende-Santos 2007, 13). Though external and internal balancing
frequently occur simultaneously, the latter is theorized to be a first best strategy because
alliances are inherently plagued by junior states’ concerns about the credibility of more
powerful states’ commitments to alliances. Though three internal balancing strategies
have been elaborated, it is emulation, or “…the conscious, purposeful imitation, in full or
in part, by one state of any institution, technology, or governing practice of another state”
that is theorized to be the dominant strategy adopted by lesser states (Resende-Santos
1996, 199).¹ The logic behind this argument is that lesser states, such as developing
countries, lack the domestic resources to pursue innovation as an internal balancing
strategy and so seek to employ the same strategies of systems-leading states because of
their proven efficacy (Resende-Santos 2006, 50).² The point to be made here is that
policymakers in developing countries that have undertaken defense industrialization with
the ultimate goal of independently producing technologically sophisticated weapons
systems for the purpose of enhancing national prestige and protecting or increasing
political autonomy, have engaged in a process of military emulation.

¹ Taliaferro notes that the three possible internal balancing strategies are persistence, emulation, and
innovation (Taliaferro 2009, 200-202).
² It is important to note that when external threat is particularly acute, Resende-Santos theorizes that even
system-leading states will adopt an internal balancing strategy of emulation (2007, 72-75).
What is military emulation? João Resende-Santos, the only neorealist to investigate the process of emulation, argues that military emulation is “…the deliberate imitation by one state of any aspect of another state’s military system that bears upon its own military system. This emulation brings the emulator’s military (or specific components of it) into reasonably close correspondence with the model that is being emulated” (Resende-Santos 2007, 9). This process is theorized to occur following what Resende-Santos calls strategic junctures, which are more commonly referred to as critical junctures, and are theorized to lead to cross-national convergence in terms of military institutions (2007, 12).

The pace and intensity of emulation in a given country are theorized to be a function of variations in levels of external threat and opportunities for external balancing (Resende-Santos 2006, 86-92). At the lower end of the spectrum of emulation intensity would be the adaptation of proven tactics such as the adoption of maneuver warfare following the First World War. In the case of high intensity emulation, we should expect to see “extensive restructuring or modernization of the entire military system based explicitly on that of another country” (Resende-Santos 1996, 200). An example of such high intensity emulation, would certainly include the creation of general staffs in Argentina, Brazil, and Chile based on European models in the nineteenth and early twentieth centuries (Resende-Santos 2007, Chapters 4, 5, 6).

Though policymakers in developing countries undertake defense industrialization for diverse reasons, national security concerns, defined in terms of political autonomy, have been a key impetus. Notably, those countries which are dependent on third parties for weapons systems and military stores have found their policy autonomy severely
diminished. The reason for this is simple: Weapons systems and military stores are not simple commodities like flat-screen televisions or tennis shoes. Rather, war materiel is explicitly political, as force or the threat of force are frequently key determinants of outcomes in politics among nations.

Countries, both developed and developing, whose foreign or national security policies are dependent on imported weapons systems and military stores have been prone to three key problems. First, weapons exports may be restricted or halted altogether if the foreign and security policies of importers are not compatible with those of exporters. Second, weapons systems may not be available for purchase because exporting countries’ defense industrial bases could be operating at capacity in order to fill domestic demand and/or to supply allies embroiled in conflict. Finally, weapons manufacturers have repeatedly oversold and under-delivered in terms of the performance of weapons systems sold to developed countries. Given these barriers to accessing war materiel, policymakers in developing countries have undertaken defense industrialization to increase their political autonomy.

It is worth mentioning that scholars have observed that policymakers in developing countries have also undertaken defense development for reasons of international status. Larson, Paul, and Wohlfforth define status in the international system as follows:

We define status as collective beliefs about a given state’s ranking on valued attributes (wealth, coercive capabilities, culture, demographic position, sociopolitical organization, and diplomatic clout). In international politics, status manifests itself in two distinct but related ways: as membership in a defined club of actors, and as relative standing within such a club. Membership in international society—sovereignty—is a status sought by many substate groups. Once this status is conferred via recognition by others, a state may eventually seek
membership in a status group within the overall system of states, most notably great-power status (Larson, Paul, and Wohlforth 2014, 7).

There are two important points to be made here, particularly with respect to aspirational powers, such as Brazil, India, and China. First, while each of these countries has been long recognized as sovereign, none has yet been recognized as members in the great-powers club. Second, successful defense development signals international status to great powers in two ways. On the one hand, the acquisition of the coercive capabilities that factor into assessments of international status can be a fruit of successful defense development. On the other hand, successful defense development may also send signals regarding the capacity of particular sociopolitical organizations to mobilize and extract societal resources for national ends.

Much as in developed countries, institutions have emerged in developing countries that drive and guide the process of defense industrialization. These institutions are defined by the relationships among a constellation of actors that, at a minimum includes, but is not limited to politicians, scientists, the military, and production facilities/companies. In developed countries, the United States in particular, the institutionalized relationships among the relevant actors in the process of defense production is usually referred to as the military-industrial complex, denoting the

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3 It is important to note as Larson, Paul, and Welch do that status in the international system is collective, subjective, and relative (2014, 8). By collective, Larson, Paul, and Welch note that status, “...refers to higher-order beliefs about a state’s relative ranking—beliefs about what others believe” (2014, 8). The subjective element of status refers to the social construction of status. Specifically, “Although some attributes that serve as the basis for status are measureable—such as the size of the national economy or military forces—more intangible assets such as cultural achievements, soft power, and moral authority are not...Which states occupy a higher position than others is not an environmental attribute of perception and observable by all; it is a social construction” (Larson, Paul, and Welch 2014, 8-9). Finally, status is relative, meaning that, “As a ranking, status is measured relative to others. Status is often described as a “positional good.” Status is socially scarce in the sense that it cannot be enjoyed everywhere by everyone. If everyone has high status, then no one does...Elite groups restrict membership to avoid diluting their status and privileges. If every state is a great power, none is” (Larson, Paul, and Welch 2014, 9).
“…fusion of interests of the armed forces, the defense industries, and the political leadership that allocates the resources” (Gupta 1997, 16). While many of the very same actors are involved in the process of defense industrialization in developing countries, their institutionalized relationships are often very different than those in developed countries. This distinction thus requires a different term to describe the relationship between actors and their interests in developing countries’ nascent defense industrial bases.

Rather than military-industrial complex, the term strategic enclave will be used to describe the institutionalized relationship between stakeholders in the process of defense industrialization in developing countries. In his analysis of Indian strategic enclaves, specifically the nuclear and aerospace enclaves, Itty Abraham defines such structures as follows:

This enclave is defined as a subset of research establishments and production facilities that are responsible for the development of these new programs. It is “strategic” because the end product of the efforts forms the most advanced technological means toward the goal of national security and represents the currency of international prestige and power today. It is an “enclave” because institutionally, spatially, and legally, the high-technology sectors of space and nuclear energy are distinct and different from the existing structure of the Indian military-security complex (Abraham 1992, 233).

Abstracting from the specificities of Abraham’s example, I here borrow the concept of strategic enclaves to describe the institutionalized relationships among the actors involved in defense industrialization. However, this term needs further refinement for analytical clarity.

Seen exclusively from the vantage of the neorealist process of military emulation, a strategic enclave is a dependent variable. That is to say, while all strategic enclaves are comprised of a research establishment and production facility, the particular institutional,
spatial, and legal separation from other actors within the government, the military system, and society will vary and serve to define one enclave from another. Indeed, to the extent that the literature on defense industrialization has focused on the fortunes of specific sectors of the defense economy, examples of variation between enclaves within the same country and between countries have been observed (Franko-Jones 1991, 13-34; Conca 1997, 39-64). As will be noted below, while systemic incentives, including external threats and external balancing opportunities, are key to understanding the motivation, the pace, and scope for defense industrialization, variations in the composition of strategic enclaves are a function of unit-level variables.

Before moving forward, subsuming defense industrialization under the broader heading of military emulation requires a distinction to be made between emulation and diffusion. Of this distinction, Resende-Santos notes that, “Conceptually, emulation is akin to, but different from diffusion. The latter term is a purely descriptive notion that says nothing about the causes, nature, intent, direction, or content of the process. Emulation leads to the diffusion of best practices...” (Resende-Santos 2007, 10). To put a finer point on this distinction, whereas emulation is a concept concerned with why states’ economies, political systems, and military systems tend towards isomorphic convergence, studies that take as their object of analysis the diffusion of security best practices are concerned with the rate and pattern of adoption.  

1.1.2 Military Emulation: Institution-building and State-led Development
The neorealist theory of emulation is at once theoretically ambitious and limited. On the one hand, Resende-Santos’ effort builds a theoretical link between external threats and

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4 See also Elman (1999), Goldman and Eliason (2003), Zarzecki (2002), and Horowitz (2010).
the isomorphic convergence of states’ military systems because of the socializing effects of international anarchy are commendable and important. On the other hand, the narrow scope of this theory means that the factors that determine the efficacy or success of military emulation are not explicitly considered (Resende-Santos 2007, 11). Taking into account what the neorealist theory of emulation can and cannot do, scholars interested in explaining successful defense industrialization on the periphery are left to specify a causal process or processes that link systemic incentives to defense development outcomes at the unit-level of analysis. In fact, two analytically distinct, yet inseparable, causal processes, conceptualized in Figure 1.1, are involved in the process of defense industrialization: institution-building and state-led development.

Figure 1.1: A Conceptualization of the Process of Military Emulation

Institution-building
A clear implication of the neorealist theory of emulation is that external threats have important implications for the internal organization of states. Indeed, the classic example of internal balancing behavior is the process by which the modern nation-state took shape. Charles Tilly described this process in the now classic volume, *The Formation of Western States in Western Europe* (1975). The core of this bellicist theory of state

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See also Tilly 1992. For an alternative theory of state formation, see Spruyt 1994.
formation is the idea that the modern nation-state took shape because rulers needed to extract resources from their subjects to wage interstate war. The need to directly tax their subjects led European kings to create the institutions now popularly associated with the state: an administrative apparatus (a rationalized bureaucracy) and a coercive apparatus (a military and/or police force). The centralization of enormous power under a regent and the extraction of economic rents were legitimized by nationalism. Thus, the aphorism, “war made the state, and the state made war.” This theory has gained great acceptance among scholars and has been applied in a number of different contexts, including the rapid economic development of East Asian countries in the context of the Cold War (Johnson 1982; Kohli 2004; Woo 1991; Amsden 1992; and Solingen 2007).

From the perspective of this study, what is of interest is not the general pattern of state formation, but the origins and institutional development of the specific institutions I have termed strategic enclaves. Analytically, what one would want to specify is the how system structure shaped the preferences of the relevant actors facilitating collective, purposeful action or retarding it. For example, if Indian defense industrialization outcomes between 1947 and 1962 were the dependent variable of a study, primary analytic attention would focus on how the enduring rivalry that emerged between India and Pakistan, as well as India’s desire to be a third force in world politics, shaped the preferences of Nehru, Minister of Defence Krishna Menon, the three service chiefs, management at public sector defense firms like Hindustan Aeronautics Limited, and so

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6 I define institution here, “…as the formal or informal procedures, routines, norms and conventions embedded in the organizational structure of the polity or political economy. They can range from the rules of a constitutional order or the standard operating procedures of a bureaucracy to the conventions governing trade union behaviour or bank-firm relations” (Hall and Taylor 1996, 938). For similar definitions used commonly in comparative politics and international relations, see North (1990) and Krasner (1978), respectively.
on. Did the Pakistani threat really drive elite collective action between elites? If so, how was that collective action institutionalized in strategic enclaves to meet the challenge of that enduring threat? How did concerns regarding international status factor into decisions about defense industrialization? Did such concerns foreclose one path of industrialization in favor of another? The answers to these questions are of course explicitly political.

Why such a narrow focus on strategic enclaves? Quite simply, the narrow focus of the formation of the strategic enclave is critical. As Ken Conca notes:

Military industrialization demands stable institutions—routinized sets of rules, roles, procedures, and practices—because, even on the lesser scale seen in most Third World countries, the defense sector brings together a heterogeneous array of manufacturing and supply firms, civilian and military bureaucratic organizations, research institutes, and other groups…Institutionalized rules, predictable routines, unquestioned goals, clear divisions of responsibility, and established hierarchies of authority are needed to give order and predictability to this uncertain process (Conca 1997, 12).

For analysts and scholars interested in examining defense industrialization as a process of military emulation, the relationship between system structure and the institutionalization of the strategic enclave is paramount. It is important to be clear, as will be discussed below in Section 1.2, the institutional origins and subsequent development of strategic enclaves are to date the most neglected or least studied dimension of defense development.

State-led Development
The second process involved in military emulation is state-led development, which has been the dedicated focus of an extensive literature. State-led development is defined by state intervention in the economy to correct supply and demand side market failure, with
the goal of fostering the creation of modern industry.\textsuperscript{7} Long-term patterns of state intervention in the economy are referred to as industrial policy. In the case of commercial and military development, a key reason why states have become deeply involved in these processes is to help overcome barriers to entry in high technology economic sectors.

Much as is true of markets for other sophisticated and high technology products, the international defense economy is hardly a free market, rather it has tended toward oligopoly. Andrew Moravcsik has made this point well, observing of major multinational defense corporations (MNDCs) that they are:

…nearly always monopolistic in their domestic markets and oligopolists in global markets characterized by market imperfections such as increasing returns to scale, learning economies, massive overcapacity, government intervention, and a small number of firms…many product lines in the armaments industry are approaching conditions of “natural” oligopoly—in which economic forces would reduce the number of profitable worldwide firms to a handful or, in extreme cases, to a single global monopolist (Moravcsik 1993, 132).

Operating under these conditions, established firms, nearly all from countries with advanced industrialized economies, seek to defend both their competitive advantages, especially in terms of technology and human capital, and their market share in developing countries. To be sure, developing countries seeking to develop a defense industrial base are engaging in an uphill battle.

\textsuperscript{7} On the supply side, government intervention can include, but is not limited to, overcoming a shortfall of entrepreneurship, capital, labor, and technology (Kohli 2004, 13). On the demand side, state intervention has been aimed at stimulating demand for key inputs into a given economic sector, purchasing goods, and facilitating exports (Kohli 2004, 13).
Yet, defense industrialization is little different than the process of industrialization in other high-technology sectors. Speaking broadly to the process of development, Chris Smith observes that:

The process of absorbing and assimilating technology is considered fundamental to development. Through a range of complicated mechanisms involving bilateral arrangements and multilateral agencies and institutions, the technologically advanced countries either sell or transfer gratis under the right political conditions skills, production capability and capacity which in principle would permit developing countries to marry development needs to technology. In addition, the recipient countries may also enter into arrangements to import the managerial and administrative skills to organize and co-ordinate this process (Smith 1994, 144).

To be sure, there are differences between the international commercial and defense political economies including certain restrictions on the technologies transferred from the global north to the global south, as well as end use restrictions. Yet, Smith’s description of the development process suggests that the core competencies of strategic enclaves in defense development are much the same as those required of state institutions in the broader process of state-led development in commercial sectors of the global economy.

While the pro-market versus anti-market industrial policies of developing countries once dominated the debate regarding the broader developmental success of these countries, consensus has converged on an institutional explanation for success. Simply put, the institutional capacity or power of developing countries has been a key determinant of developmental success or failure. That is to say, the technocratic skill to create industrial policy free from political pressure, which is responsive to the needs of

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8 Following Laura D’Andrea Tyson, I use high technology sectors here as a technical term, denoting economic sectors as on in which, “…knowledge is a prime source of competitive advantage for producers, who in turn make large investments in knowledge creation. Reflecting this definition, high-technology industries are usually identified as those with above-average spending on research and development, above-average employment of scientists and engineers, or both” (1993, 18).

9 For a good overview of the state versus market debate in determining economic development outcomes, see Wade 2003, xiii-liv.
economic sectors targeted for development, is the sine qua non of successful industrial policy. This argument is nearly identical to the argument made in the defense industrialization literature by scholars such as Conca (1997) and Patrice Franko-Jones (1992).

To summarize, defense industrialization has been defined and delimited at two levels of analysis. First, at the systems-level of analysis, defense industrialization is a process of military emulation. Policymakers undertake defense industrialization for a host of reasons, national security among them. Strategic enclaves have emerged in developing countries that are responsible for managing the process of defense industrialization and these mimic in terms of form the military-industrial complexes found in developed countries. While isomorphic convergence has occurred, there remains a sharp distinction between the functional capability between states in the global north and south, as well as among developing countries. In order to explain the success or failure of emulation that accounts for this functional divergence, the process of emulation needs to be understood at the unit-level of analysis. To this end, emulation has been broken down into two constituent processes at the unit-level of analysis, that are analytically distinct, yet inseparable, if defense industrialization outcomes in developing countries are to be understood. Depicted in the context of the broader process of emulation in Figure 1.1, these processes include institution-building and state-led development. All of this is to suggest that a theory explaining defense industrialization outcomes in the global south needs to connect system structure to the institutional origins and development of strategic enclaves, as well as the relationship between the
institutional capacity of strategic enclaves and their capacity to develop and implement defense industrial policy.

1.1.2 What Constitutes Successful Defense Industrialization on the Periphery?
What constitutes successful defense industrialization in developing countries? It goes without saying that no defense industrial base in the developing world has yet demonstrated the capability to make weapons systems of the same level of sophistication as those produced by major exporters like Britain, France, Russia, and the United States. Looking at Israel, which has been touted as possessing the most sophisticated defense industrial base among developing countries, it still relies heavily on the United States for many of its most sophisticated weapons platforms, including fighter jets and ballistic missile defense systems, as well as key subsystems for domestically developed weapons (Freilich 2017). Notably, China has a similar relationship with Russia, insofar as Chinese defense firms are still dependent on Russian firms for critical subsystems (Schwartz 2015, 1-4). Yet, to deny that Israel or China have moved up in the defense production cycle since their founding in the post-war era clearly does not capture reality either. Thus, for analytic purposes, it is imperative to define exactly what constitutes successful defense industrialization in developing countries.

Following the literature on defense industrialization written from the perspective of a systems-level of analysis (discussed in Section 1.2 of this chapter) success is defined herein functionally, or in terms of acquired capabilities. Writing in the early 1990s, Keith Krause (1995) created a generalized model of a hierarchically structured, international APTS. This model is composed of four basic levels and locates countries in a given tier based on their overall capabilities with regard to weapons production. The countries that populate the apex of this hierarchy are defined by their exclusive ability to innovate in the
different segments of the defense industry. Conversely, those countries in the bottom tier of the hierarchy are distinguished by the fact that while they may be able to produce some weapons systems under license, they rely almost entirely on imports for weapons and in many cases for spare parts. Following Krause and Timothy Hoyt (2006), this hierarchy is shown in Table 1.

The simple and straightforward metric for success implicit in the tier structure detailed above is the ability of a country to move up from one tier to the next. Upward movement is theorized to be a sign that the strategic enclave in a given country has acquired and mastered the requisite skills that permit upward mobility in the highly stratified international APTS. For instance, looking at the case of the Brazilian aeronautics sector, from the late-1940s through the late-1960s, a strategic enclave was developed that systematically mastered important aspects of aircraft design, development, and production that allowed it to become an important niche producer in the global aeronautics market. Central to the success of the Brazilian aeronautics sector was Embraer’s acquisition of the ability to perform systems integration, the core competency of every major aeronautics and aerospace firm in business today. Thus, the Brazilian aeronautics sector has moved over the long-term from being in the fourth tier in the 1940s to the third tier in the late-1960s.
Table 1.1: The Hierarchy of Defense Industrial Production

<table>
<thead>
<tr>
<th>Global Defense Hierarchy Tier</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1</td>
<td>States with, “…the largest R&amp;D investments and domestic markets, will produce the entire range of modern weapons systems at the technological frontier and be the dominant arms producers” (Krause 1995, 32).</td>
<td>United States, Russia</td>
</tr>
<tr>
<td>Tier 2</td>
<td>These states, “…will have much lower overall R&amp;D, domestic procurement and production base, and will depend more heavily on exports or state subsidies. Their export share will be limited by their inability to produce arms at the technological frontier for the same cost as first-tier states” (Krause 1995, 32).</td>
<td>Britain, France, Germany, Japan</td>
</tr>
<tr>
<td>Tier 3</td>
<td>Third tier suppliers, “…will be even more heavily dependent upon exports, and will find their comparative advantage in a competitive market in specialized niches for low-cost and unsophisticated or easy to operate weapons based on low R&amp;D investments. Their share of the global production and exports will also be relatively limited” (Krause 1995, 32).</td>
<td>Brazil, China, South Korea, Taiwan</td>
</tr>
<tr>
<td>Tier 4</td>
<td>Fourth tier industries may have the ability to assemble weapons systems, but their major competency will rest in their ability to perform basic maintenance.</td>
<td>Argentina, Iraq, Iran</td>
</tr>
</tbody>
</table>

By assessing successful defense industrialization based on the acquisition of capabilities, rather than export performance, a key advantage is gained over other metrics of success. If export performance is the metric by which successful defense industrialization is to be achieved, how would defense industrialization in Brazil be compared to that of India? In the case of the former, an export-oriented industrialization policy was pursued because of concerns related to slack domestic demand, whereas in the later an import-substitution strategy was pursued exclusively for political reasons. While the economic rationale of an export-oriented strategy of industrialization may well have led to better outcomes than an import-substitution strategy, using export success as a
barometer of successful defense industrialization means that Indian performance might not be accurately measured.

Notwithstanding the fact that I have chosen a functional definition of defense development as a metric for success, success within the chosen market domain does support the functional capability of a strategic enclave. Again, taking the Brazilian and Indian aeronautics sectors as examples once more, the enclaves of both countries had very different experiences within the markets they chose to operate in. As is well known, the Brazilian strategic enclave did well to design, develop, and produce products that were able to compete with companies from developed countries in the global market. On the other hand, in the words of a well-known scholar of Indian defense policy, none of the Indian strategic enclaves have produced weapons systems the services in their home market in some 50 years (Cohen and Dasgupta 2010, 32). Given that the Indian Air Force was unwilling to purchase the wares of the Indian aeronautics sector it is unlikely that foreign countries would have purchased them either. Ultimately, success in a chosen market reinforces assessments of the capabilities of a strategic enclave.

1.2 The Defense Development Literature
The existing scholarly literature on the determinants of defense industrialization outcomes in developing countries can be broken down into two broad categories suggested in Figure 1.1. One the one hand, there are structural theories purporting to explain defense development outcomes on the periphery with regard only to systemic incentives. Defense dependency is perhaps the best known of the systemic approaches and posits that the hierarchical structure and dynamics of the global APTS that has evolved since 1945 makes defense industrialization on the periphery near impossible. The second systemic theory comes from the neorealist paradigm, proposing levels of
external threat as the key determinant of defense industrialization outcomes. Third, at the unit-level of analysis, scholars have focused on the second process in defense industrialization, state-led development, arguing that defense industrialization is a function of a country’s market opportunities and institutional capacity.

While all three of these theories offer valuable insight into the process of defense industrialization in developing countries, they are all critically flawed. For instance, as alluded to at the outset of this chapter, systems-level theories are not sensitive enough to explain questions of unit-level variation because they eschew explanatory power for theoretical parsimony. Additionally, institutional theories are at best descriptive because institutions are endogenous. The key point not to be missed in the following discussion with respect to each theory is that none of them incorporate the explicitly political process of institution-building that is part and parcel of defense development, as the process was defined in Figure 1.1.

1.2.1 Defense Dependency Theory
What herein is termed the defense dependency theory is far and away the most expansive literature on defense industrialization in developing countries to date. It is important to note at the outset that this group of scholars does not constitute a unified theory and in fact, Timothy Hoyt highlights three broad positions within this scholarship (Hoyt 2006, 8-14). However, from the vantage of this project, what unites this group of scholars into one group is their level of analysis and their prediction. To foreshadow, approaching defense industrialization on the periphery from a systems-level of analysis, nearly all of these scholars predict the failure of defense industrialization efforts in developing countries.
The theoretical core of the defense dependency school of thought comes from the pioneering work of Robert Harkavy (1975) and Keith Krause (1995). This deeply structural theory of international defense production envisions a hierarchically structured APTS (illustrated in Table 1, Section 1.1.2). At the apex, first tier weapons producer(s) are distinguished by the fact they alone have the capability to innovate in the various segments of the defense industry. The second tier of the producers is populated by countries that have a limited capacity for innovation in weapons systems, but which possess the human and financial capital to produce the full gamut of weapons systems and may need to rely on defense exports to maintain their defense industrial base. The countries comprising the third tier are capable of licensed production of major weapons systems and the ability to adapt them to local conditions as needed. Finally, those countries comprising the fourth tier may be able to maintain and operate weapons systems, but they rely almost entirely on imports for their weapons systems.

Of particular interest for this study, is that the historical approach to defense industrialization associated with Krause and Harkavy argues that movement between the production tiers is in fact possible. Krause specifically notes that licensed production and reverse engineering have been useful means of moving upward in the hierarchy of defense producers. Yet, the ability to move up in the international defense hierarchy is dependent on systems-level conditions. Specifically, Hoyt distills two hypotheses from this school of thought that spell out the potential for upward mobility in the international hierarchy of defense production. On the one hand, “When unit costs are low, and generations of equipment turn over rapidly, states replace their arsenals frequently and this in turn permits economies of scale that allow multiple producers” (Hoyt 2006, 140).
On the other hand, “As unit costs increase, the number of major producers falls, and more states are forced to rely on licenses and other transfers” (Hoyt 2006, 140). From the vantage of defense dependency theory, the point to be made with respect to developing countries that aspire to move up in the global APTS is that the chances of that happening are inversely related to the cost of the dominant weapons systems of an era. In the context of the global APTS that has emerged since 1945, nearly all defense dependency theorists are pessimistic about the chances for a developing country to move upwards between tiers.

The origin of the current hierarchical structure of the global APTS that has emerged since 1945, along with the associated trend of globalizing arms production, is the “autarky-efficiency dilemma.” As a consequence of the abrupt acceleration of the industrialization of warfare that began in the late 1800s, it became impossible for state armories to match the innovation and productive capacity of private defense firms (Moravcsik 1991, 29). Still private weapons production presented a problem for states: for weapons manufacturers to have enough demand to bother being in business, states had to allow free trade in weapons. Thus, if states wanted access to cutting-edge weapons at affordable prices, a liberal weapons market was required. This is the essence of the “autarky-efficiency dilemma” and the root cause of why the interests of defense firms are theorized to be key determinants of arms production and transfer policies (Moravcsik 1991, 23). While there are nuances with regard to the different theorists that comprise what here has been termed the defense dependency school, the autarky-efficiency dilemma is the glue that binds these theories together.
During the Cold War, autarky-efficiency is theorized to have been a key pillar of American hegemony. Mary Kaldor (1981) in particular argues that the U.S. leveraged access to American weapons systems and the associated production capacity to bind together allies. Notably, countries seen as important in containing the global spread of communism, such as Japan, South Korea, or West Germany, had much greater access to American weapons systems and the associated production technology than did countries in Latin America, like Brazil, or non-aligned countries like India. Within the broader context of the current U.S.-led, liberal international order, several scholars argue convincingly that the U.S. possesses and retains a large comparative advantage in weapons research and design due to the volume of domestic demand, which it leverages internationally to pursue a monopoly on access to cutting-edge weapons platforms (Kapstein 2004; Nueman 2006, 2010; and Caverley 2007). Proponents of defense dependency theory argue that the dependence of other states, particularly the second-tier European powers, on the U.S. for access to the most advanced weapon systems and technology, helps to ensure the continued dominance of the U.S.-led, liberal international order. To be sure, policymakers in the developing world have long chaffed at the political leverage their defense dependence affords Washington.

1.2.2 Security-based Explanations
Threat or security-based explanations are a second systemic approach to explaining defense development outcomes on the periphery. The paucity of security-based explanations for defense development is fascinating because within the sub-discipline of international relations, neorealism which takes hard power as its independent variable, has been the dominant paradigm for decades. In fact, as noted at the outset of this chapter, Waltz makes only two predictions regarding the behavior of states (Taliaferro
2009, 207-210). First, under conditions of anarchy, balances of power will tend to form. And second, states will seek to emulate the practices of systems-leading powers. Given this reality and the widespread concern shared by policymakers and scholars alike about weapons proliferation on the periphery during the 1980s, the dearth of security centered theories regarding defense industrialization is striking. To date, the best, if only example of such a theory formulated by Hoyt.

In his book, *Military Industry and Regional Defense Policy* (2006), Hoyt explicitly attempts to provide a security based explanation for defense industrialization outcomes. In order to fill this lacuna in the defense industrialization literature, he undertakes an inductive comparative analysis of defense industrialization in three countries: India; Israel; and Iraq. Based on his analysis and building on Walt’s (1990) balance of threat argument, Hoyt hypothesizes that as external threats increase, the defense industrialization policies pursued by policymakers become more rational and thus more successful (Hoyt 2006, 170).

To be sure, there is much to commend in Hoyt’s effort, not the least of which is the connection he makes between external threat and defense industrialization outcomes. However, where Hoyt’s work is deficient is in its lack of attention to the important role of institutions in the process of defense industrialization. Simply put, he is missing a causal link in his explanation. If one removes institutions from the equation of defense industrialization in developing countries, how is it possible to explain outcomes in similarly situated states? By neglecting the insights of institutional theory as it has been applied to defense industrialization on the periphery, Hoyt has sacrificed theoretical power for parsimony.
1.2.3 Institutional Explanations
Much as is the case for security-based explanations of defense development, institutional
explanations for such outcomes are relatively scarce as well. This is interesting because
by the early 2000s, scholarly consensus had converged on institutions as a key variable
explaining variations in economic development outcomes on the periphery. One reason
for the relative paucity of institutionalist literature on defense development on the
periphery is that only a few countries have been studied in depth, particularly those that
presented an acute proliferation risk (Zarzecki 2002, 29). Nonetheless, the very best
institutionalist literature on defense industrialization to date is that on Brazil, which
echoes the embedded autonomy hypothesis articulated most clearly by Peter Evans.\(^\text{10}\)

Since Chalmers Johnson’s (1982, 1999) early work on the developmental state,
the broader literature investigating the relationship between industrial policy and
economic development converged in the early 2000s on an institutional explanation
(Evans 1995; Rodrik 2004, 2007, 2008).\(^\text{11}\) Building upon work dating back to the 1970s,
Evans and Dani Rodrik have argued convincingly that industrial policy is an important
public good that fosters economic development by resolving information and
coordination externalities among firms.\(^\text{12}\) In this view, what matters in determining the
economic outcomes of government policies is less the degree of state intervention than
the degree to which state intervention promotes institutional capacity and entrepreneurial
activity.

\(^{10}\) For other, less developed institutionalist accounts of defense industrialization in developing countries see
the following: Klieman 1985; Nolan 1986; Reiser 1989; and Gupta 1997.
\(^{11}\) See also Johnson 1999.
\(^{12}\) For important early work contributing to the convergence on an institutional explanation for development
outcomes on the periphery, see Cardoso and Faletto 1979; Evans 1979; Hirschman 1981; Wade 2003;
Evans (1995), the best known of the scholars to generalize Chalmer’s work, argues that the outcomes of industrial policy are determined by two variables: sectoral opportunity and institutional capacity. Sectoral opportunity refers to the structure or characteristics of a given economic sector that determine the type and scope of policy interventions required to successfully enter an economic sector. Evans defines his second independent variable, institutional capacity, along two seemingly contradictory dimensions: autonomy and “embeddedness.” First, institutional autonomy refers to the degree to which the relevant government agencies responsible for a policy area are free from political interference, particularly from private capital. Second, embeddedness refers to the degree to which a dense network of state-society relations exists, defined by merit rather than clientelism, forming a complex web of linkages between the state and capital. The hypothesis advanced by the embedded autonomy approach is as follows: As institutional capacity, defined in terms of embedded autonomy, increases so too does the probability of successful government economic policy intervention.

The two most comprehensive institutionalist accounts of defense industrialization to date are those on Brazil by Franko-Jones (1992) and Conca (1997). What both of these accounts share is their central focus on how important Brazilian state institutions were in resolving coordination problems and gaining access to global markets. For her part, Franko-Jones’s explicitly economic approach to the development trajectory of the Brazilian defense industry from the 1970s to the late-1980s excels in linking institutions with policies. In contrast to other defense industrializers in the developing world who pursued defense development with security objectives foremost in mind, owing to their unique understanding of the relationship between defense and development,
policymakers in Brazil crafted industrial policies with economic fundamentals in mind (Franko-Jones 1992, 2-3). This defense industrial policy was created and implemented by institutions that she characterizes as innovative in that they were “based on pragmatic cooperation between public and private sector and not exclusively state or military ownership, promoted indigenous technological development, international marketing and industrial expansion of suppliers serving primary defense contractors” (Franko-Jones 1992, 3). Though her work predates that of Evans on embedded autonomy, it is important to be clear that Franko-Jones’s observations of the institutions supporting defense industrialization are supportive of the embedded autonomy hypothesis.

In contrast to Franko-Jones’s economic approach to the development of the Brazilian defense industry, Conca’s approach was more consistent with a political science approach. Conca argues that the rise and fall of the Brazilian defense industry was a result of the convergence between international market conditions and the capabilities of domestic institutions. On the one hand, international market conditions facilitated access to defense technology and a market niche existed for low to medium technology weapons systems that Brazilian firms could fill. On the other hand, the institutional structures created by the military for defense industrialization fit international defense market conditions well. However, the decline of the defense industry in the mid-1980s due to changing international market conditions and Brazil’s transition to democracy eroded the ability of defense firms to compete in international markets because the domestic political-economy no longer supported the defense economy. To put a finer point on Conca’s findings in terms of the embedded autonomy approach, during the rise of the Brazilian defense economy, these institutions exhibited both embeddedness and
autonomy, which made these firms able competitors in niche global markets. However, as the global defense economy changed, the autonomy of the defense economy from the broader Brazilian economy meant that defense firms could no longer count on the state support to make the technological leaps necessary to remain competitive, particularly in the context of a transition to democracy.

These institutional explanations for defense industrialization outcomes are at once very valuable and yet have a critical weakness. The value of these two studies, one not seen in many other works on defense industrialization in developing countries, is that they highlight the importance of market opportunities and institutional capacity, which have been demonstrated to be key determinants in development outcomes. However, from the perspective of this project, the fact that both Franko-Jones and Conca rely on institutions as independent variables limits the value of their work. As Adam Przeworski (2004) and others have observed, to the extent that institutions are endogenous, they have no independent causal power. That is to say, institutions are tools that states use to accomplish some desired end; in this case mobilize, extract, and employ societal resources for defense industrialization. So, while institutions are an important part of understanding defense industrialization, what is critical are the politics that create and maintain institutions.

To put a finer point on the problem with institutional explanations for developmental outcomes, it is useful to return to criticisms of Johnson’s developmental state model and the embedded autonomy approach. As Bruce Cumings observed of Johnson’s work, to the extent that the developmental state model focuses on institutional

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14 This insight of institutions as tools comes directly from Taylor (2012, 120-123).
capacity and not politics, it resembles a web with no spider (Cumings 1999, 87). That is to say, following Riker (1980), institutions and the associated policies reflect the interests of some groups, yet neither the developmental state model nor the embedded autonomy approach explain how domestic structural imperatives constrain or enable elites’ developmental agenda. In fact Evans specifically indicates such a discussion is beyond the scope of his work (Evans 1995, 45). Rather, in a functionalist fashion, proponents of the developmental state model and the embedded autonomy approach assume that institutions simply emerge because they are needed to promote policy coordination (Doner 2009, 18-19).

Additionally, it is worth noting that there is a difference of opinion between Franko-Jones and Conca on the impact of security concerns on the defense industrialization outcomes. Based on her reading of the political history of Brazil, Franko-Jones suggests that national security has in fact been an important element in the push for defense industrialization. In his analysis of the same literature, Conca argues that in fact national security concerns did not have a causal impact on defense industrialization. Thus, this raises the question, what role have national security concerns had in the process of defense industrialization?

To summarize, to date three basic explanations for defense industrialization outcomes in developing countries have been developed, each of which is summarized in Table 1.2 (below). By far the most expansive is the defense dependency school of

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15 It should be noted also of this apolitical focus on institutions as a crucial element in economic development that Jack Knight (1992) has criticized Douglass North (1990) and the new institutional economists for the fact that they never include asymmetric power differentials into their analyses.

16 While I criticize Evans’ more recent work as does the scholarship concerned with the politics of economic development I have cited above, Evans’ early work, especially Dependent Development (1979), does take a broader view that incorporates class interests.
thought, which while insightful in terms of enumerating the economic structural variables developing countries face it cannot explain unit-level variation. Also at the systems-level of analysis, a security-based explanation has been developed, which posits a positive relationship between elite perceptions of external threats and successful defense industrialization. While this explanation fills an important gap in the literature, because it fails to link systemic variables to institution-building or institutional power, its explanatory power is potentially limited. Finally, institutional explanations have done well to explain the role of both market opportunities and the importance of institutional capacity in defense industrialization, however because institutions are endogenous, they by definition cannot have independent causal power. All of this is to say that none of the existing approaches to defense development has addressed the political determinants of defense development on the periphery.

*Table 1.2: Summarizing Extant Theories of Defense Development*

<table>
<thead>
<tr>
<th>Defense Dependency Theory</th>
<th>Neorealist Theory</th>
<th>Institutional Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Summary of Theory</strong></td>
<td>Defense development is dependent on the cost of weapons systems in the international arms production and transfer system.</td>
<td>Defense development is dependent on the level of external threat a country faces.</td>
</tr>
<tr>
<td><strong>Key Independent Variable</strong></td>
<td>Cost of weapons systems</td>
<td>External threat levels</td>
</tr>
<tr>
<td><strong>Prediction</strong></td>
<td>As the cost of weapons systems increases, the likelihood of successful defense development decreases.</td>
<td>As the level of external threat increases, the rationality of defense industrial policy increases, yielding better development outcomes.</td>
</tr>
</tbody>
</table>
1.3 Methodology and Data
The goal of this project is straightforward: I seek to explain successful defense
industrialization in very large developing regional powers. The core analytic task of this
project is to test the novel hypothesis proposed in the introduction of this chapter,
specifically, the argument that defense industrialization outcomes are a function of the
relationship between external vulnerability and state power. As external vulnerability
increases, so too will state power and the quality of defense industrial policy. In effect,
much as Kohli did, I seek to find an explanation for which states “…command more
power or less power and then demonstrate that the purposive use of power by state elites
is indeed consequential for economic outcomes” (Kohli 2004, 386). This will be
accomplished by means of comparative historical analysis and process tracing.

1.3.1 Research Design: Scope and Case Selection
In addition to being described as the method of last resort when variables outnumber
cases, comparative historical analysis (CHA) traces the evolution of causal processes in
an attempt to highlight complex interactions of variables (Skocpol 1979, 35-36). CHA is
the most appropriate approach for this project because defense industrialization has
herein been defined as a path dependent process in which states furnish demand-side and
supply-side support, in an effort to overcome market failures, thereby facilitating
development. The scope of this project will be confined to a consideration of the
relationship external vulnerability and the developmental trajectories of aeronautics
enclaves in Brazil and India from 1880s to 1990s.

The choice of the Brazilian and Indian aeronautics enclaves as objects of analysis
reflects the decision to use Przeworski and Teune’s “most similar systems” logic of
inquiry (Seawright and Collier 2010, 338). Brazil and India are two long-standing
aspirational powers that have sought to develop their own national aeronautics sectors for security reasons, yet only Brazil has had success in this effort. With differing levels of external threat, but broadly similar institutional capacity as defined by Evans, and different state authority structures at times manifesting similar levels of state power as observed by Kohli, Przeworski and Teune’s most similar system logic of inquiry should afford the analytic leverage to test the hypothesis under scrutiny. Not only will cross-case analysis be employed in this project, but the longitudinal nature of this project also allows for within-case analysis as well, thus too, multiplying the number of observations generated. Additionally, the aeronautics sector has been selected because it serves as a most-likely test of the security-based defense industrialization developed by Hoyt that closely mirrors Johnson’s developmental state model.

The definition of defense industrialization as long-term and path dependent process necessitates that time, or more specifically sequencing, is taken into account. One way to highlight the importance of sequencing in a study such as this is through an exhaustive chronological account of the process of defense industrialization. However, the limitation of a synchronic account is that the specificity of such an effort would undermine the broader goal of this study in drawing useful generalizations about the political determinants of successful defense industrialization. The second method of accounting for the sequencing in a process is by means of a diachronic analysis that focuses on changes at critical junctures. Indeed, in keeping with the neorealist theory of emulation, I wholly expect for military emulation to be observed at and following certain

17 Following Collier and Collier, I here define a critical juncture as, “A specific historical period in which particular political choices, or the emergence of a particular historical alternative, strongly dispose a given case to follow one path of change, and not others. The crucial juncture can alternatively be viewed as involving a high degree of agency, or strong structural determinism” (Collier and Brady 2010, 323).
critical junctures. Given that the relationship between external vulnerability and
domestic institutional organization was the focus of his work, Resende-Santos refers to
critical junctures as strategic junctures, which he defines as follows: “an externally-driven
disturbance or threat significantly alters the local balance, and thus each state’s level of
vulnerability, prompting the state to undergo a thorough internal reorganization and to
improve its domestic institutions, technology, and governing practices” (Resende Santos
1996, 200). Notably, while this term suggests a specific cause of institutional change, its
usage is nearly identical to that of the term critical juncture and these terms will be used
interchangeably.

In this study, I focus on two primary critical junctures. The first and perhaps most
important critical or strategic juncture I will focus on in both cases are moments of
national political consolidation. In the case of Brazil, between 1930 and 1945, political
elites faced the daunting task of centralizing political power in Rio de Janeiro to deal with
an economic crisis and to balance against three sets of threats: the internal forces of
regionalism; regional threats in South America; and extra-regional revisionist powers in
Asia and Europe. Lacking the requisite human and financial capital to undertake defense
industrialization, Brazilian civilian and military elites pursued a foreign policy of
approximation with the United States and invested heavily in developing heavy industry,
as well as the science and technology base required for defense industrialization.
Brazilian elites were willing to support the development of the aeronautics sector during
this period because aviation was seen as a key way to help integrate the country and to
help defend against aggressors, at least within the region.
In India, between 1947 and 1962, the process of national political consolidation was much simpler than in Brazil, though decidedly more violent. Under the hegemony of the Raj, a highly institutionalized, national, and modern political system evolved slowly and built around the Indian National Congress. Following the transfer of power from Britain to India, the crafting of a constitution was an exercise in compromise and was completed by 1955. However, partition without unity on the Subcontinent saw the creation of a vehemently hostile Pakistan and rampant communal violence between Hindus and Muslims, in which a 500,000 people are estimated to have perished. In addition, some two months after independence, Pakistan and India fought the first of four wars, which ended along a negotiated cease fire line in Kashmir. Yet, rather than making the requisite institutional investments to upgrade and expand the capacity of the defense industrial base inherited from the Raj, Indian elites purchased weapons from abroad, including a large number of combat aircraft.

The second strategic juncture of interest is the period from 1964-1969 in Brazil and the period from 1962-1965 in India. Regarding the former case, the Brazilian military put an end to civilian rule in 1964 because of its fear of growing communist subversion. Rather than returning to the barracks after a short transition period, the Brazilian military retained power for 20 years, legitimating their rule on the basis of economic performance. The institutional matrix supporting the Brazilian aeronautics sector underwent very few visible changes following the military coup, except for the addition of the public-private partnership realized in the founding of Embraer. Following its creation, a period of import-substitution industrialization was pursued in order for the executives and workers at Embraer to learn how to run and manage an aircraft factory.
Further strategic partnerships between MNDCs and Embraer were subsequently pursued so as to acquire specific competencies in the aeronautics market. Through the acquisition learned in strategic partnerships with foreign firms, Embraer became rather skilled at systems integration, so much so that when it pursued and export-oriented growth strategy in the 1980s, it was able to provide virtually bespoke aircraft to customers.

In the case of India, between 1962 and 1965, India fought two wars, the first with China and the second with Pakistan. In each case, the Indian military experienced severe shortages of critical war materiel because of the duration of the Sino-Indian War and arms embargoes resulting from the second war with Pakistan. These wars were a major catalyst for full scale defense industrialization. While the Indian Army was the major beneficiary of the military modernization and expansion program, there was a massive expansion of the aeronautics industrial base to accommodate production of the MiG-21 under license from the Soviet Union. However, the fate of the Indian aeronautics sector during this period was largely one of stagnation. This was so because despite the unilateral defeat imposed by the Chinese on the Indians and the honorable draw said to be achieved in the Second Round of the Indo-Pak conflict, neither war sparked a process of institutional revision to the aeronautics enclave.

1.3.2 Methods and Data
Because this project seeks to examine the causal role of systemic structures and state power in the process of creating an aeronautics industry, process tracing and qualitative comparison are the preferred methods of choice for this dissertation project. Accordingly, the aim of this project is to gather causal process observations that speak to
variations in states’ power to furnish demand-side and supply-side support, in an effort to overcome market failures, thereby facilitating development.\textsuperscript{18}

As previously noted, I operationalize my dependent variable, successful defense industrialization along two dimensions: firm capability and sectoral depth. Prime contractor capability is defined as the ability of a defense firm in the aeronautics sector to design an aircraft, manage a complex supply chain, and perform final assembly. That is to say, successful defense industrialization in the aeronautics sector has occurred if an aeronautics firm demonstrates the ability to perform systems integration. Sectoral depth is measured by the domestic versus imported content of major subsystems and components; the higher the domestic content of a finished product, the deeper the level of development. Figure 1.2 serves to visualize the supply chain in the aeronautics sector. Movement from right to left, up to the point of systems assembly and integration is indicative of firm capability. The number of firms contributing vital subsystems to national aeronautics firms is indicative of the depth of the sector.

\textsuperscript{18}Causal process observations can are here defined as: “Pieces of data that provide information about context, process, or mechanism and contribute distinctive leverage in causal inference” (Seawright and Collier 2010, 318).
It should be pointed out that in a very real sense, the measurement of my dependent variable, successful defense industrialization, has already been done widely in both industry and scholarly publications. Embraer’s capacity to deliver virtually bespoke products on time and budget to customers in both the developing and developed world alike has served to make it the third most valuable aeronautics firm in the world, behind Boeing and Airbus (Castellar Pinheiro and Bonelli 2012, 217). However, the Brazilian aeronautics sector has not developed much beyond systems integration. That is to say, very few Brazilian firms exist that are capable of designing any of the critical subsystems required for combat or civilian fleets. In India, HAL executives may well point to a long history of licensed production of sophisticated combat aircraft, as well as making minor mid-life upgrades to the MiG-21 to extend its useful life in the Indian Air Force. Notwithstanding the potential talking points of HAL executives, the capabilities of this firm are not well respected within the industry, or even by its end users. First, HAL has

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19 This figure was taken in its entirety from Samuels and Whipple (1988, 288).
yet to demonstrate a well-developed systems integration capacity. Second, though a fully vertically integrated company, HAL has had significant trouble developing any of the subsystems that comprise their products, all of which are sold to the military, as they are not economically competitive.

There are two causal variables of interest in this project. The first variable of interest is external vulnerability, which is the independent variable in this study. As noted above, external vulnerability is defined along two dimensions by Santos, which I adopt, with one caveat. The first of these dimensions is external threat, which reflects states’ “…worry about their rivals’ overall military capabilities,” as well as “…the likelihood and ability of rivals to make an effective conquest, given their own geographic assets and liabilities and overall military capabilities” (Resende Santos 1996, 8). The second dimension of external threat is external balancing opportunities. External balancing opportunities are here theorized to act as a retarding force for military emulation in general and defense industrialization more specifically (Resende-Santos 2006, 86-92). Metaphorically speaking, were statesmen simple utility calculators, the value assigned to the variable external vulnerability would be a mathematical equation seen in Figure 1.3. The expectation here is that higher levels of external vulnerability lead to increased levels in states’ power to mobilize, extract, and employ societal resources for national security. More specifically, in the case of military emulation and defense industrialization in particular, higher levels of vulnerability are theorized to create more effective strategic enclaves. The simple caveat I add to this definition, which will be further explained in the following chapter, is that what matters are elite perceptions of external vulnerability as neorealists would have it.
I will make use of the extensive historical literature on elite understandings of their strategic environment in both the Brazilian and Indian cases to measure external threat. I do expect that the values on this particular variable will differ from most standard assessments of threats to these countries. That is to say, conventional wisdom suggests that levels of external threat were always low in the case of Brazil and high in the case of India. To be specific, since independence in 1822, Brazil has only fought two wars with its neighbors: the La Plata War (1851) and the War of the Triple Alliance (1865). In stark contrast, since independence in 1947, India has fought five wars against neighbors: the First Kashmir War (1947); the Sino-India War (1962); the Second Kashmir War (1965); the war for Bangladeshi independence (1971); and the Kargil War (1999). India’s primary adversaries in these wars were China and Pakistan, two neighboring countries with nuclear weapons. Yet, it is obvious that if external threat drives internal balancing, then successful development would be observed in the Indian aeronautics sector not in Brazil.

I will also make use of the same extensive historical literature on elite understandings of their strategic environment in both the Brazilian and Indian cases to measure external balancing opportunities. In terms of defense development in developing countries, the choice of which systems-leading country to emulate is theorized to be a function of whom a country’s allies are. If a country is aligned was aligned with the Soviet Bloc for instance, one would expect the development of strategic enclaves and industrial policies similar to the institutions and strategies of the Soviet Union. If a country was a member of the Western Bloc, one would expect the
development of strategic enclaves and industrial policies consistent with the institutions and strategies of the U.S. or European countries. Thus, alignment serves to determine the scope and type of the policy interventions necessary for aeronautics sector development, or sectoral opportunities.

In general, one can say the following about the sectoral opportunities facing both Brazil and India over the time periods in question in this study. Though high barriers to entry characterize the aeronautics industry, since the 1970s this sector has increasingly become a buyers’ market. The underlying cause of this sectoral opportunity has been the ever-increasing technological sophistication and cost associated with modern weapons systems; a trend called structural disarmament. This trend began in Europe and has turned even major weapons producers like France, Great Britain, West Germany, and the U.S. into major weapons exporters. What is important to demonstrate with regard to sectoral opportunity is the different opportunities and constraints both Brazil and India faced. I seek to highlight differences between the way Brazilian and Indian states have leveraged their monopsony power in the military aeronautics market to demand performance requirements in weapons purchases, their capacity to regulate domestic

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20 Laura Tyson described the aerospace industry as follows: “…immense technological risk and huge upfront development costs, as well as economies of scale, scope, and learning, drive the industry toward a natural monopoly with a single producer dominating the global market. Such an outcome is desirable for production efficiency, but this is not the only criterion for evaluating the welfare consequences…” (Tyson 1992, 156).

21 The aerospace market is characterized by monopsony as a result of the fact there are a few very large firms competing against and the fact that governments are both the only buyers of advanced combat aircraft and the regulators of the aerospace firms. See Caverley (2007, 610-611). For an overview on the globalization of the arms industry, see Bitzinger (2009, 6-12).

22 Performance requirements are here defined as regulations designed to manage the behavior of multinational corporations abroad to the benefit of the host country (Rodrik 1987, 633). In the specialized literature on the international trade in major conventional weapons systems performance requirements are called defense trade offsets (DTOs) and defined as, “…the range of industrial and commercial compensation practices required as a condition of the purchase of defense articles and/or defense services” (Martin 1996, 31). I have elected to use a more the more familiar term performance requirements to engage a broader audience than specialists in the field of defense economics.
aviation, state support for research and development efforts, and their ability to direct credit to encourage firms to work collectively to develop a national aerospace sector.

The final causal variable of interest for this project is state power, which serves as an intervening or mediating variable at the unit-level of analysis. State power affects state-led development because it determines a state’s power to formulate and pursue sectoral development. In this project, I measure the power of the state by way of the concept of state authority structure, which is defined and measured using three explicitly political factors: ideology; organization; and state-society linkages. While each of these factors is crucial, I am not so much concerned with measuring the minute variations of each of these factors, but rather the way these combine to shape variation in state power. The key in operationalizing these factors is to ask specific questions about how these elements of the state impact the creation of the aeronautics industry. In addition to government documents, the determinants of state authority structure can be measured over time and space with a variety of secondary sources, including the scholarship of historians, political scientists, and policy analysts.

1.4 Project Overview
This project will proceed as follows. In the following chapter, I will develop the theoretical basis for the argument made in this dissertation. Following, the admonition of Dan Slater that path-dependent arguments need to pay attention to both critical antecedents and critical junctures, Chapter three is dedicated to elaborating the state authority structure existing in both Brazil and India prior to each country’s moment of national consolidation. Chapters four and five focus on explaining how external vulnerability at strategic junctures affected state power, the quality of defense industrial policy, and thus defense industrialization outcomes in both Brazil and India. The sixth
and final chapter of this dissertation discusses the generalizability of the theory developed and tested herein, discusses obvious limitations, and makes suggestions for future research
Chapter 2: A Neoclassical Realist Treatment of Defense Development

In this chapter, I my model of defense development. This model fills the lacuna in the defense development literature by leveraging insights from the international relations and comparative politics literatures to highlight the political determinants of defense development outcomes. With this goal in mind, I proceed as follows. First, I unpack the logic of my model of defense development. Second, I discuss the appropriate means for testing this model. Third and finally, I demonstrate the contributions of this theory, as well as indicate its inherent limitations.

In the interest of full transparency, I digress briefly before presenting my model of defense development to justify my choice of theoretical framework. I utilize a neoclassical realist approach in this project for two key reasons. First, the goal of this project is to explain the foreign policy behavior of two countries in a systematic way. Foreign policy has been the core dependent variable of the neoclassical research agenda since it emerged in the scholarship of Randall Schweller (1998), Jack Snyder (1991), Aaron Friedberg (2000), and Fareed Zakaria (1998) since its emergence in the 1990s. Moreover, in marrying the theoretical rigor of Waltz’s (1979) structural realism with classical realism of E.H. Carr ([1939] 1964), Hans Morgenthau ([1948] 2006), or Arnold Wolfers (1965), variables such as ideology returned to the realist research program, addressing the constructivist challenge to realism. Second, as noted in the preceding

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23 On the neoclassical research agenda, see Gideon Rose (1998) and Taliaferro, Lobell, and Ripsman (2009). For the possibility of a rapprochement between realism and constructivism, see Sterling-Folker (2002).

24 For an interesting explanation the origins and synthesis of classical and structural realism, see Parent and Baron (2011).
chapter, the existing literature on defense development suggests that international structural and domestic institutional variables affect defense development outcomes. In adopting the neoclassical realist model of the resource extractive state, developed by Jeffery Taliaferro (2006, 2009), I am able to hypothesize a testable theory that incorporates the known drivers of defense development outcomes.

2.1 The Argument
The core argument of this dissertation is that successful defense development is a function of a state’s ability to generate power for that end. The determinants of state power are explicitly political. They are found in the structure of state authority, defined in terms of elite ideology, state organization, and state-society linkages. I argue that, all other things equal, the more cohesive a state’s authority structure, the more power it will be able to generate for defense development. Therefore, cohesive states are more successful at building national defense industrial bases than are less cohesive states. In the following section, I unpack the logic of this argument in two steps. First, I define and operationalize state power. Second, I embed state power in a punctuated equilibrium model of institutional development to explain variations in state power over time and space.

2.1.1 The State, State Power, and State Authority Structure
Since the reemergence of the state as a primary actor in political science in the late-1970s and early-1980s, state power has been used to explain a diverse array of outcomes. Included among these outcomes are domestic political violence (Bates 2008), patterns of

25 It should be clear that successful defense industrialization is a multi-causal process, which includes a variety of variables that cannot be measured in any theory or model that strives to strike a balance between parsimony and power. Among those variables that I have not explicitly included in the argument developed in this chapter include the size of the national economy, level of economic development, and other material factors, such as access to raw materials for weapons systems.
internal balancing (Christensen 1996, Zakaria 1998, Friedberg 2001, and Taliaferro 2009), foreign policy (Krasner 1978), and economic development (Kohli 2004 and Doner 2009). Notwithstanding the broad use of the state as a key variable in explaining these diverse outcomes and others, comparatively little devoted scholarly attention has been paid to measuring state power beyond efforts at categorizing states as either strong or weak. This section is consequently dedicated to putting forth a metric of state power based on the analytic construct that I call state authority structure.

The first step in attempting to define and measure state power is to define the state. Following Michael Desch (1996, 240), I draw upon the Gianfranco Poggi’s institutional approach, who argues that the state is:

…perhaps best seen as a complex set of institutional arrangements for rule operating through the continuous and regulated activities of individuals acting as occupants of offices. The state, as the sum total of such offices, reserves to itself the business of rule over territorially bounded society; it monopolizes in law and as far possible in fact, all faculties and facilities pertaining to that business (Poggi 1978, 1).

As Desch notes, this definition of the state clearly comports with that offered by Weber, who offered perhaps the most parsimonious and widely used definition of the state (Desch 1996, 240). As noted by Friedberg, Weber further clarifies that the offices that comprise the state are those of the executive branch of government, the bureaucracy, and not the legislature (Freidberg 2000, 9). The distinction to be made between the executive and legislative branches is that the former actually governs, while the latter simply creates laws.

Having defined the state as a set of institutions created for the purpose of governance, as has Poggi, it is now possible to define state power, the proximate variable
on which the outcome of interest to this study turns. I offer a traditional and well accepted definition of state power. In general, state power has been defined as the ability of a state to formulate and implement national policy goals over the interests of international and domestic actors (Krasner 1978, 10-11). Yet, power is defined differently at the system and domestic levels of analysis, with the former being the product of the latter. The question remains: What are the factors that constitute and determine a state’s internal power?

In contrast to the distributional and zero-sum conception of state power offered in the strong/weak state approach, this study understands state power to be a function of legitimate authority. The legitimate authority of the state is based on its relationship to society. Legitimate authority derives from a social contract between the state and the society it governs, in which the latter cedes authority to the former in exchange for a valued good: political order. Society values political order because it provides a measure of safety and security against threats both foreign and domestic. On the one hand, in an anarchical world in which war is an omnipresent possibility, the state is the only vehicle that can provide security for a society. In order to deter or defeat foreign threats, states have the legitimate authority to extract and mobilize societal resources. On the other hand, in the domestic realm, to the extent that the state truly is the lawgiver and enforcer in a state, it makes laws and only those who break them need fear violence. Such a

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26 For an example of the strong/weak state approach to political and economic development see Joel Migdal (1988, 1-44). For a discussion of the strong/weak state approach in foreign policy, specifically the foreign policy of great powers, see Krasner (1978, 55-61).

27 It should be noted that in this conceptualization of the state, many states that currently exist, such as those in Iraq or Afghanistan, do not meet this definition, necessarily limiting the scope of the theory presented in this chapter. This scope condition however does not limit the theory developed for present purpose however, because I do not expect that a state such as Iraq or Afghanistan is likely to have the power or resources to pursue defense development in the near to medium term. For a similar scope condition, see Taliaferro (2009, 214).
hierarchically ordered realm of affairs serves not only to deter and defeat threats to domestic tranquility, it also lowers the transaction costs among societal actors allowing for a wide variety of social and economic outcomes to obtain. For instance, the establishment of strong laws protecting private property is frequently cited as a prerequisite for the growth of a capitalist economy.\textsuperscript{28} Legitimate authority can be disaggregated along two dimensions: scope and cohesion.

Following Desch (1996, 241), state authority is partially defined by the scope of the business it undertakes.\textsuperscript{29} At the lower bound of a state’s scope of authority, the minimalist state serves only to protect society from all threats foreign and domestic, provide the administration of justice, and resolves market failures. The upper bound of states’ scope of authority includes the same functions as does the minimalist state, as well as wealth redistribution, infrastructure development and maintenance, and even economic development.

Cohesion is the second dimension of legitimate authority. Though Desch does well to define the dimensions of legitimate authority, he misses the mark in explaining cohesion, stating that, “…the cohesion of states in turn varies between divided and unified. Strong states are highly cohesive and tend to be maximalist states; weak states are divided and tend to be minimal states” (Desch 1996, 241). Highlighting a correlation between cohesion and the scope of a state’s authority is useful, however Desch does not stretch his argument to its logical conclusion: cohesion leads to state power.

That cohesion is the taproot for state power is not a point lost on a new wave of political scientists studying the political determinants of economic development on the

\textsuperscript{28} On this point see North and Weingast 1989.
\textsuperscript{29} For a very similar rendering of the scope of a state’s authority, see Zakaria (1998).
periphery. Eschewing the narrow institutionalist consensus on economic development outcomes exemplified by the work of Evans (1995) and Rodrik (2004, 2007), these scholars revive an older scholarly tradition of which Barrington Moore, Jr. (1966) and Theda Skocpol (1979) are the exemplars. In particular, scholars like Breznitz (2007), Doner (2009), Kohli (2004), and Waldner (1999), all retain the state-society linkages emphasized in institutionalist theories of development, however they bring politics back into development by arguing that a state’s capacity or power to formulation and implement coherent industrial policies is crucially determined by the claims made on it by its constituents. Stripped of some nuance, the point these scholars are making is that policies require political support whether in the realm of tax levies or economic development, especially because state policy creates winners and losers. The pursuit of rapid industrialization in a capitalist society requires policies and institutions that are business friendly at the expense of short-term demands for redistribution. Thus, to the extent that a state can narrowly form a coherent industrial policy in favor of capital and exclude the demands of labor, its power for development increases. That is to say: As state capacity increases, so too does the efficacy of industrial policy. Atul Kholi is among the better-known scholars to make this argument, but more importantly, his work has focused directly on the cases of present interest, Brazil and India.

Kholi argues in State-directed Development (2004), that the intensity and speed of industrialization in late-late developing countries is a function of a state’s authority structure. In making this argument, Kholi constructs a continuum, or typology of state authority structures that he hypothesizes vary in terms of state power, summarized in Table 2.1 (below). The point to be made about this analytic framework, in the context of
this project, is that while it explains extreme cases of developmental success (South Korea) and failure (Nigeria) the close attention Kohli pays to issues such as class incorporation, the role of the military, and regime type and their relationship to state cohesiveness makes this framework a sensitive enough tool to explain intra-group variation.

Table 2.1: Kohli’s State Structure Typology\textsuperscript{30}

<table>
<thead>
<tr>
<th>State Type</th>
<th>Ideology</th>
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<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td>Cohesive Capitalist</td>
<td>• Elite consensus on developmental vision</td>
</tr>
<tr>
<td></td>
<td>• Nationalism used to mobilize public for economic development</td>
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<tr>
<td></td>
<td>• Competent bureaucracy is essential</td>
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<tr>
<td></td>
<td>• Authoritarian</td>
</tr>
<tr>
<td></td>
<td>• Military dominates</td>
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<tr>
<td></td>
<td>• Tight state-capital alliance characterized by embeddedness and autonomy</td>
</tr>
<tr>
<td></td>
<td>• Corporatist labor incorporation</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Cases</td>
</tr>
<tr>
<td></td>
<td>South Korea (1961-1979)</td>
</tr>
<tr>
<td></td>
<td>Brazil (1937-1945 and 1964-1985)</td>
</tr>
<tr>
<td>Fragmented-multiclass</td>
<td>• Elite consensus on state intervention in economy varies</td>
</tr>
<tr>
<td></td>
<td>• State elites are sensitive to the legitimating rationale for their authority</td>
</tr>
<tr>
<td></td>
<td>• Bureaucratic competence varies</td>
</tr>
<tr>
<td></td>
<td>• Democratic or authoritarian</td>
</tr>
<tr>
<td></td>
<td>• Military may be subordinate to civilian authority</td>
</tr>
<tr>
<td></td>
<td>• State-capital alliance and variable levels of embeddedness and autonomy</td>
</tr>
<tr>
<td></td>
<td>• State-labor relationship ranging from corporatist incorporation to political mobilization</td>
</tr>
<tr>
<td></td>
<td>Variable</td>
</tr>
<tr>
<td></td>
<td>Cases</td>
</tr>
<tr>
<td></td>
<td>Brazil (1945-1964)</td>
</tr>
<tr>
<td></td>
<td>India</td>
</tr>
<tr>
<td>Neo-patrimonial</td>
<td>• No coherent ideology</td>
</tr>
<tr>
<td></td>
<td>• Ideological statements made to cover personal aggrandizement of state elites</td>
</tr>
<tr>
<td></td>
<td>• No competent, professional bureaucracy</td>
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<td>• Democratic or authoritarian</td>
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<td>• Military likely to function as a personal army for a state leader</td>
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<td>• Few interests are articulated and politics tends to be pre-class, along tribal or feudal lines</td>
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\textsuperscript{30} As noted, Kohli’s typology is tripartite including a neopatrimonial type state (2004, 9-12). I have elected not to include this type of state in the table because none of the candidates for national defense development and enhanced international status are neopatrimonial states. Moreover, given Kohli’s observation that the low level of economic development achieved by neopatrimonial states often obtained in spite of the state suggests they are not worth consideration in this study (Kohli 2004, 22).
I adopt Kohli’s typology to measure variation in levels of state power for defense development in Brazil and India. Thus, I propose three domains across which I can assess the cohesion or fragmentation of state power. The first important marker of state power is that of ideology. Kohli notes that national ideological cohesion has two important dimensions: intra-elite cohesion and elite-mass cohesion (Kohli 2004, 10). Perhaps because of the ambition and scope of his work, Kohli does not define this element of state cohesion well. Following Taliaferro, I will measure ideology along two dimensions: elite theories of state and elite sponsored nationalism (Taliaferro 2009, 219-221).

With regard to elite theories of the state, the point that needs to be made is that political elites have myriad functions; the most basic among them is deterring or defeating foreign enemies.31 In this role, state elites must both evaluate their strategic position within the world and formulate a grand strategy to husband national means to ends to provide for security. While objective definitions of external threats or vulnerabilities have been furnished by a variety of scholars, national security or national insecurity is an inherently subjective condition, which depends on elite assessments of the security environment. Assessments of the strategic environment and the existence of national security threats is commonly seen as a role for political elites, particularly those in the state because they have access to private information the average citizen does not have (Christensen 1996, 17). Nonetheless, there may well be a lack of cohesion within a state about the imminence or direction of a threat because of asymmetric information between policymaker and the publics, as well as different discount rates between elites

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31 It is important to note that the concept of elite theories of state is similar to concepts advanced by Parent (2011, 13), Snyder (1991, Chapter 2), and Schweller (2010, Chapter 2).
and the public (Christensen 1996, 17-18). One can look to Brazil during the interwar period and see clearly that the pro-American political elites saw Germany as the true threat to Brazil and the pro-German political elites saw believed the U.S. was the true threat to Brazilian interests.32

The importance of ideology is not limited strictly to identifying the threat posed by internal or external foes; it is also involves creating plans to mitigate these threats. Elite cohesion can also break down in terms of creating a strategy to deal with national security threats. One can imagine one group of elites not entirely convinced of the importance of some strategic challenge choosing to take a cautious diplomatic approach rather than pushing for full-scale wartime mobilization. It is important to bear in mind that in polities with a well-developed public arena, in which elites are accountable for government performance, elites are likely to be sensitive to the costs they impose on society.

Before moving forward, two points should be emphasized regarding the theorized relationship between elites’ ideology and defense development. First, intra-elit cohesion has two dimensions: threat assessment and ameliorative strategy. To the extent that a high level of consensus exists among elites on both the nature of a threat facing a country and an ameliorative strategy, then a high level of elite cohesion can be said to obtain on this aspect of ideology. Secondly, as the concentration of political power becomes more diffuse in a country, I expect that elite consensus on threats and ameliorative strategy to become increasingly difficult to arrive at.

32 On elite cleavages in Brazil between a pro-American and pro-German faction see Hilton (1975, 39-109) and Flynn (1978, 69-84).
The second core component of elite ideology of interest is state-sponsored nationalism. As noted above, states provide political order in exchange for the resources to provide that political order. These resources are mobilized and extracted from the governed. When states make the case that there is a serious threat to society that needs to be mitigated, this requires people to make sacrifices, be it in taxes and/or in the form of a lack of redistribution. Such sacrifices must be justified, or to put it as Thomas Christensen (1996, 13) has, political hurdles to mobilization need to be overcome if the government is to ameliorate a threat. State-sponsored nationalism is a tool used by elites to garner support for national security policies. This occurs by heightening the contrast between members of the national group and those that are not members of the group. The goal here for elites is to foster identification with the ethnic group so that members will be willing to undertake the sacrifices required to defend the group from its enemies. With specific regard to state-sponsored nationalism and state power, this is an important determinate of the latter because it promotes elite-mass cohesion.

The second key domain across which state power is measured is state organization. Based on Kohli’s work, there are four specific domains of state organization I will focus on. The two domains of state organization that require the least explanation are regime type and the type of economy. With regard to regime type, Kohli observes that in those settings most conducive to development, the regime was authoritarian (2004, 22). This was not a coincidence. With state goals defined narrowly in favor of industrialization and thus capital, authoritarian states chose a specific class commitment and in so doing excluded other groups, namely labor, from the interests represented by the state. This does not mean of course that labor has no demands, such
as improved wages, secure job tenure, and etc. (Kohli 2004, 22). In these situations, a strong and well institutionalized government is required to discipline labor in order for national development goals to be achieved. This is a point observed by both Kohli (2004, 22) and Evans (1979, 48-49). Given this reality, the regime type and the way it is institutionalize matter a great deal for state power because the state needs to repress and exclude large segments of the population in order to realize its goals.

How does regime type matter in terms of defense industrialization? Quite simply, the type of regime and its degree of institutionalization matters for defense development for precisely the same reasons as it does for broader economic development. If defense development is included in the narrowly defined interests of the state, with capital as a primary beneficiary, then a cheap and flexible labor supply is also to be valued. Strong state institutions that are able to manage or suppress labor’s demands then figure prominently in the ability of the state to pursue defense development.

The second important aspect of state organization is the role of the state versus the market in the process of development. For Kohli, what was common across all of the cases he studied was that given conditions of late-, late-development, the state was afforded a major role in shaping the future direction of the economy (2004, 12-16). Yet, variation existed in terms of how much control the state ceded to the market. In South Korea, the state was ruthlessly pro-capitalist, in Brazil the state was at different points in time ruthlessly pro-capital but still willing to undertake state production when the market failed, and in India a social democratic regime reserved specific sectors as the exclusive preserve of the state. The point to be made here is that even though each of these three states were private economies, each differed in terms of how much the market would be
allowed to determine development outcomes. In opting for state production, though to varying degrees, Brazil and India crowed-out some private capital that may well have been better able to accomplish national ends.

As far as defense development goes, the power ceded by the state to the global defense market varied much as it did in the broader economy, with similar effects. In Brazil, the private sector was actively courted to participate in the project of national defense development, however the Brazilian military’s approach to defense development led to some crowding out of private capital once the private sector proved unequal to the tasks at hand. Thus, much of the defense economy remained the purview of the state and private firms were limited to supplying key inputs. Ultimately as Conca notes, because the Brazilian state crowded out private capital in the defense market, the cost of Brazilian dirigisme was relatively shallow defense industrialization in up-stream phases of the defense industrial bases (Conca 1997, 85-95). In India, the state reserved to itself entirely the process of defense industrialization thus crowding out private sector participation in total and sought to limit international inputs as much as possible. This decision, taken early on seriously limited the ability of the national defense industrial base to develop insofar as it limited access to foreign capital (human and financial) and in lieu of armed conflict with a peer competitor seriously diminished the sensitivity of political elites to the economics of defense development.

The remaining two dimensions of state organization, which include bureaucratic competence and civil-military relations, require a slightly more nuanced discussion. With respect to the former, bureaucratic competence can be defined simply as the qualifications and professionalism of the strategic enclave. Kohli found that in South
Korea, Brazil, and India, there was modest variation in the skill and professionalism of the individuals who staffed the economic bureaucracy of interest to him. What was of greater import for his analysis was the degree to which the bureaucracy was embedded, yet autonomous from political interests. Having discussed the embedded autonomy hypothesis in the preceding chapter, I refrain from doing so here. The key point to be made from the vantage of Kohli’s work is whether or not the process of crafting long-term and coherent industrial policy was politicized (2004, 10). Did politicians debase the quality of bureaucrats by using government jobs as patronage to shore up political support? Was the bureaucracy subject to capture by the private interests it interacted with? As needs for patronage and bureaucratic capture declined, the economic bureaucracy was more cohesive and better able to formulate more efficacious industrial policy. I adopt this straightforward understanding of bureaucratic competency offered by Kohli.

Yet, because the focus of this project is on defense development, carried out by strategic enclaves, I add to the bureaucratic dimension of state organization a concern with the institutionalized relationship between state organizations. Scholars have done well to point out that politicians, the military, state scientific establishments, and defense producers each have their own unique interests when it comes to defense development (Moravcsik 1993, 130-137; Gupta 1997, 11-22). For politicians, it is important to have a defense industrial base not unduly influenced by external actors in order that independent foreign policies can be pursued. Additionally, politicians must weigh the cost of guns and butter as it were. Militaries on the other hand have frequently been observed to want the latest cutting edge weapons platforms in order to carry out their missions, though in
some cases the officer corps has taken a longer-term developmental approach to weapons procurement. The defense science establishment is frequently dependent on access to foreign capital for producing results and frequently it can cultivate a relationship with political leadership to pursue its own objectives, which may be more or less focused on basic science or specific weapons platforms. Finally, defense production facilities are left to the chore of engaging in serial production, frequently a daunting process. I make mention of each of these differing perspectives because more than one scholar of defense development has noted how important the relative power of each actor in the strategic enclave is in producing defense development outcomes (Moravcsik 1993, 130-131; Gupta 1997, 21-22). To make a long story shorter, one cannot look simply at the skills or professionalism or the embeddedness and autonomy of a strategic enclave; how well members of the strategic enclave work together within the state the state is equally important.

The final dimension of state organization that can help one assess the cohesiveness of the state is civil-military relations. Patterns of civil-military relations are a complex topic, which for the expert on this matter can quickly evolve into a finite parsing of the different relationships between politicians and their officer corps. A recitation of the civil-military problematique is well beyond the scope of this study, suffice it to say that scholars interested in this relationship focus on the question of the balance of power between politicians and the members of the officer corps. Based primarily on the Western European perspective, there is an evident normative bias for civilian dominance over the officer corps, or what Samuel Huntington called objective

33 For a discussion of the civil-military problematique, see Peter Feaver (1996).
civilian control (1957, 80-83). The obverse of objective civilian control is subjective civilian control and is theorized to obtain when societal elites court the military in an effort to press their interests over the dominant elite in government (Huntington 1957, 83-85). From the perspective of this study, civil-military relations matter in two key ways. First and foremost, a politicized military is a marker fragmented state power among elites and very likely an under-institutionalized government.

Second and more substantively, from the perspective of defense development, I argue that the degree to which the interests of politicians and officers converge on issues of defense development, the more cohesive the state the more power it will command for defense development. Paradoxically, I expect that the less professional an officer corps is (in the sense that Huntington used the term professional), the more the officer corps will be interested in defense development. For example, in the cases of Brazil and India, one can see clear contrasts in the interests of politicians and officers. In the case of Brazil under the Estado Novo, Getulio Vargas and the officer corps shared a long term developmental vision that included the state being a key agent of industrialization. This vision included the creation of a strong state capable of coordinating the efforts state scientific bureaucracies and private capital. Following the establishment of the military dictatorship in 1964, a shared vision remained between generals cum politicians and the officer corps. Thus, it was during these periods that the military played a key role in state-led development, although the Brazilian military was exemplary of Stepan’s “new professionalism” (1971, 1973).

In stark contrast to the case of Brazil, the balance of power between the civilian and military leadership in India has always characterized by objective civilian control,
albeit of a very strong variety (Cohen 1971, 170-177; Wilkinson 2015, 86-123). What this means is that there has been a tacit agreement since the early 1960s to allow the military a relatively high degree of autonomy in tactical matters, or to use Huntington’s terminology, the strategic use of organized violence. This is particularly evident in certain border territories of strategic significance, such as Kashmir, where because of ongoing conflicts with either Pakistan or China, the military is allowed to impose martial law conditions on the population (Wilkinson 2015, 155-156). In exchange for this tactical autonomy, the politicians reserve for themselves authority over all political decisions including defense procurement/development policy and strategic decision-making. With respect to the strategic domain, in a Clauswitzian sense, because strategic decision-making involves high level political goals, Indian politicians since Nehru have reserved them to themselves.\textsuperscript{34} This is most evident in the realm of nuclear weapons policy, where even though the military would deliver a nuclear payload, no strong command and control authority to take such action has or does currently exist in India. With regard to defense procurement/development policy, these decisions have long been made in an ad hoc fashion (Smith 1994). When money has been available for domestic development, politicians pursued autarky with alacrity.\textsuperscript{35} However, when money became tight or projects ran overtime and budget, the military was allowed to purchase weapons abroad in order to fulfill their needs. This reality ultimately suited the interests of the thoroughly professional military, which was interested in acquiring the latest in sophisticated technology.

\textsuperscript{34} For Clauswitz’s conception of war, see Howard and Paret 1984, 75-89. The effective idea is that war is the application of violence to get another to do what they would not otherwise do.
\textsuperscript{35} For instance, see Cohen and Dasgupta’s discussion of the rise in defense spending in India that has come along with its growing affluence at the end of the 1990s and into the 2000s (2010, 16-20).
The third and final domain of states’ authority structure used to measure power for defense development is state-society linkages. Now, this dimension of state power was already touched upon in the preceding discussion of strategic enclaves. However, it bears repeating because state-society linkages loom large in development outcomes. From a developmental perspective, what one wants to know is how closely the state is able to work with capital and/or labor. In large measure, what makes it possible for the state to work with either group are the class commitments inherent in elites’ ideology. In those cases, in which political power is highly concentrated at the apex of society and wielded by capital, landlords, or both, political leaders may well elect to work with these groups. Although, from the perspective of development, the inclusion of landlords into a ruling alliance is likely to dilute the focus of government on industrialization (Kohli 2004, 369). When government ideology is supportive of a close alliance with capital, the flip-side of this alliance is labor repression. For the process of industrialization requires the state to discipline labor and exclude its demands from the political process (Kohli 2004, 22). On the other hand, if government ideology supports labor to any extent, this should lead to a more fragmented development policy. Simply put, if labor is the beneficiary of guaranteed tenure or redistribution, these and other labor demands will limit the pace and scope of industrialization.

To conclude this section on state power it is important to emphasize, the two key claims I make. First, a state’s power for development is dependent on the amount of purposive power it can generate. Those states that can generate more purposive power for defense development are expected to have better developmental outcomes; that is to say a positive relationship between state power and development outcomes is
hypothesized. Second, I argue that rather than using the worn strong/weak state framework to assess state power, Kohli’s typology of patterns of political authority, which I term state authority structure, can be used to measure a state’s power across three domains: elite ideology; state organization; and state society linkages. Additionally, referring back to Table 2.1, Kohli contends that state power varies both across time and space. This is a theme I turn to in the next section of this chapter.

2.1.2 Explaining Variation in State Authority Structures
In borrowing a metaphor from Schumpeter, Kohli readily acknowledges that the architectonic structure of state authority is a coin that does not readily melt (Kohli 2004, 19). This is so for a host of reasons, however, two reasons are more important than others are. On the one hand, dominant elites pay the costs of creating new institutions and build them so they reflect their own interests because they have the power to do so. On the other hand, even actors whose interests are not well reflected by given institutions may support them in general because their norms, expectations, and interests tend to converge around these institutions. These two explanations illustrate why the institutions that have been defined as the determinants of state power in the preceding section have proven so durable. Given the fact that state power has been identified as an intervening variable, this raises the following question: What causes state power to vary over time and space?

I make two arguments with respect to what causes state power to vary over time and space, both rooted in a non-linear theory of change borrowed from Hendrik Spruyt (1994). Drawing on a metaphor from the study of evolutionary biology, Spruyt argues

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On the logic of conflict that can occur between groups opposed to institutions, see Jack L. Knight (1992).
that the origin and dominance of the state as form political organization was the result of two processes.\textsuperscript{37} First, a process of political speciation caused by a dramatic environmental change (the rise of international trade) created three new types of political organization: the state; city-states; and trading confederations. Second, a process of political selection took place in which the most efficient form of political organization, relative to synchronic alternatives, survived. In Spruyts study, the modern nation-state.

Though under dramatically different environmental conditions than those present at the time the first states began to emerge, I make two very similar arguments to explain variations in state power. First, consistent with Spruyt’s political speciation argument, I argue that contingent events in the international system can have significant domestic organizational consequences, which can serve to produce variation in state power. Variation in state power is the result of the social and political coalitions that emerge during and after the critical juncture caused by a contingent event and how these dominant elites choose to institutionalize their power. Four events in the international system are theorized as having the potential to dramatically alter the internal organization of a state, including the following: military intervention; foreign meddling; international economic shocks; and competition among states in the international system (Gourevitch 1978, 882-883, 912). In this dissertation, my primary focus is on the domestic consequences of international economic shocks, just as Spruyt notes of the seminal works of Barrington Moore (1966), Theda Skocpol (1979), and Peter Gourevitch (1986).

Second, following Spruyt’s political selection argument, I argue that the relative efficacy of the state to pursue national goals in a new external environment determines

\textsuperscript{37} Spruyt draws on the work of evolutionary biologist Stephen Jay Gould (1980, 1989) to develop this argument.
the potential for changes in state authority structures once established. Those states not capable of generating sufficient power to attain national goals are likely to suffer growing pains or bouts of institutional reform, possibly even the creation of new patterns of state authority. Institutional reform is made possible as a function of systems-level incentives and by pressure from below. By contrast, those states that prove capable of generating sufficient power to accomplish national objectives are likely to endure, even if they are inefficient relative to synchronic alternatives. I elaborate further to clarify the logic of these arguments in what follows.

Contingent Events as a Source of Institution Formation and Internal Balancing

Consistent with the neorealist logic of emulation, I argue that contingent events are the independent variable driving institution building; or rather, they are opportunities for institutional genesis. Moreover, I argue that through demonstration effects, institution builders in developing countries are likely to follow the leader in their aims, because they are socialized into a world of established states. That is to say, the patterns of state authority attempted by state-builders and their aims are shaped by the demonstrated efficacy of proven strategies of system-leading states, or great powers. However, I differ from Resende-Santos (2007) in two key ways. First, I do not expect that adverse shifts in the balance of threat are necessary and sufficient to induce military emulation. Second, I do not expect that emulation will produce efficient institutionalized responses to structural incentives. I expand on both of these points in what follows.

With regard first to the sources of contingent events capable of stimulating military emulation, I argue that adverse shifts in the balance of threat can include both military and economic events. The standard politico-military shock is sufficiently well illustrated by Resende-Santos (2007). The logic runs that large increases in levels of
external vulnerability from either regional or extra-regional powers is sufficient to change either the elites in power or the preferences of elites that remain in power to make them willing to pay the significant costs associated with large-scale institutional development. The rise of imperial Japan is a clear example of the neorealist logic of emulation, paradigmatic even (Taliaferro 2009, 194-195; Samuels 1994). I fully concur with this logic. However, when looking at the case of Brazil, which has faced no serious military shocks, such as defeat in war, the question becomes are there other contingent events of sufficient magnitude that could induce elites to build strategic enclaves?

In addition to large shifts in politico-military strategic circumstances, I argue that large shocks in the international economy can induce internal balancing as well. Specifically, I argue that economic crises that are big enough to cause a change in the social and political coalition in power or the preferences of those elites in power to change are also powerful enough to result in changed patterns of state authority and thus changes in state power. As in the case of Brazil, the economic shocks radiating from New York and engulfing the globe in the 1930s were exactly the sort of economic crisis that can bring new leaders to the fore with considerably different preferences than the leaders they displaced. This shock was a critical juncture in Brazil, leading to a moment of national political consolidation that saw political, economic, and military emulation.

The case of India bears out the point that dramatic changes in the international economy can stimulate military emulation as well. Specifically, in addition to the political agitation aimed at winning independence, the process of decolonization was a central part of the reason why Indian gained independence from Britain in 1947. The British government came to the realization that formal empire no longer paid, in fact
empire cost quite a bit of treasure to maintain. Rather, free trade of the sort advocated by the U.S. in the Cold War era was much cheaper than empire, making the economic gains greater. Independence from Britain ushered in a period of Indian national political consolidation, in which the patterns of state authority changed to a degree from those imposed by the Raj. In addition, the threat posed by Pakistan and the desire to be a first-rate world power were catalysts for defense development in India.

It is important to be clear how rapid changes in the international economy can stimulate military emulation. This can happen in at least three ways. First, an economic shock that causes a revolutionary regime to come to power in country A, could very well increase elite perceptions of external vulnerability in country B, sufficiently for elites in B to pursue emulation (Walt 1996, 32-33). Second, if the international economy changes dramatically enough to cause the fall of a government, the elites representing the new dominant political coalition that emerges may very well have a different understanding of the country’s external vulnerability than did erstwhile political elites. In which case, if the perception of external vulnerability increases, one would expect emulation. Third, even if changes in the international economy do not cause the downfall of a regime, it could still serve to shift the preferences of elites in power, such that military emulation and defense industrialization become important for reasons of economic stimulus, to ensure foreign policy autonomy, and earn international power and prestige. In any case, what is important to note for present purposes, is that changes in elite perceptions of external vulnerability resulting from changes in the international economy can very well serve as a catalyst for military emulation.
Two key additional factors need to be taken account of, which could blunt the impulse for military emulation. First, a key mitigating factor in the scope, scale, and pace of emulation will result from what Resende-Santos has called external balancing opportunities (2007, 86-92). In the realm of military emulation, the availability of foreign sources of weapons systems or training may well dampen the pace and scale of emulation. Notably, empirical proof of the mitigating impact of external balancing opportunities on the pace of internal balancing is conspicuously obvious in the case of Brazil, which Resende-Santos studied. Specifically, he notes that Brazil did not pursue internal balancing more vigorously or completely from the late-1800s through the 1920s because it had ample ability to hedge the Argentine threat with external balancing (Resende-Santos 2007, 280). Until the very late-1800s, Brazil was able to ally with Chile to balance Argentina. Following Chile’s collapse as a great Southern Cone power, Brazil could ally with the United States to hedge the Argentine threat. It is important to note that such a strategy was wholly consistent with the preferences of Brazilian regional elites, who dominated the hyper-federalist national government at the time.

Strengthening the military, the only truly national institution and the only one capable of threatening regional interests, was entirely antithetical to the interests of power brokers in Minas Gerais, Rio Grande do Sul, and São Paulo (Flynn 1978, 28-32).

One could also make the same case about independent India between 1947 and 1962, the key phase of strategic enclave construction. From 1947 through the 1950s,

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38 As for the timing of Chile’s decline as a great power in the Southern Cone, Resende-Santos states that this occurred by the turn of the century (1900), because the Chilean economy could not keep pace in its arms race with the wealthier Argentina (Resende-Santos 2007, 280). Thus, I use 1902, the date of the Argentine-Chilean Accords as a spot estimate of when Chile was no longer a regional contender for power in the Southern Cone (Resende-Santos 2007, 280).
India had access to British weapons platforms on easy terms. Upon receiving independence, the Government of India inherited a large sterling balance from Britain as compensation for the Indian contribution to the Second World War. Policymakers used this sterling balance to buy many things from Britain following the war, including copious amounts of combat aircraft and equipment to support this fleet. Despite Nehru’s wish to keep defense spending down so as not to interfere with national economic development goals, the sterling balance allowed Nehru to buy a considerable amount of hardware from Britain without affecting the money spent on development. However, the ready availability of this weaponry also likely blunted the impetus to build robust developmental military institutions, capable of one day achieving Nehru’s professed goal of autarkic defense production capacity.

A second key mitigating factor in preventing the creation of robust, developmental enclaves was the possible political coalitions that could emerge from contingent events. Such rare events serve to do two things. First, contingent events can shift the balance of political power such that new elites with ostensibly different preferences rise to control the apparatus of state. Second, they may change the preferences of elites who remain in power. In either case, the elites in power and their preferences are not totally de novo, nor are they necessarily chosen to maximize utility in either a purely rationalist or functionalist way. Rather a new coalition and the preferences of dominant elites find expression through a process of political bargaining in which these elites frequently make institutional choices in a satisficing way. All of this is to say that institutional arrangements may be optimal or objectively efficient, though they are just as likely not going to be objectively efficient. This reality goes a long way in
explaining why countries in similar environments or even different ones, have varying success in pursuing national goals.

To summarize, I argue that institutional origins are explained by rare, contingent events, or changes in the overall social milieu in which societies exist. These shocks have induced developing countries to emulate the proven economic, political, and military strategies of system-leading states. However, the large-scale institutional responses to changes in the overall social milieu do not produce uniform or efficient institutional responses. Because of the political compromises that must be struck between political actors to allow new institutions to emerge, systemic imperatives that become clear following events such as international economic shocks or war are not directly translated into action. To put this another way, as neoclassical realists have, there is no direct transmission belt between system structure and state behavior, it is filtered through policymakers who must make decisions as we all must; under conditions of imperfect information, with high stakes, and in frequently short time frames (Taliaferro 2009, 213-214).

Institutional Stasis or Change?
As is true of industrialization generally, defense industrialization is not a one-shot deal. Rather, it is a long-term process requiring the state to extract, mobilize, and employ societal resources over extended periods. Thus, if one wishes to understand the political determinants of successful defense development, one needs to explain not only the institutional origins of defense development, but also subsequent institutional stasis or change. Drawing once more on the punctuated equilibrium model Spruyt articulates, I argue that institutional stasis or change is a function of how much power the state can generate to accomplish national goals in a new environment (Spruyt 1994, 28). Drawing
on Spruyt’s metaphor from evolutionary biology, selection occurs after institutions are developed and causes ineffective institutions to fall by the wayside, leaving only effective ones. To be sure, in a world in which state death has become increasingly unthinkable, I am not arguing that predation will cull weak states from the herd. The empirical reality of a world with many weak, failed, and failing states makes this clear.

Rather, I argue that institutional stasis or change is dependent on the stability of the political coalition that gave rise to a strategic enclave in the first place. This argument is based on the premise that strategic enclaves were born in moments of national political consolidation. The goal of these moments of national political consolidation was to create a Westphalian-type state, capable of realizing national political goals over the objections of both international and domestic actors. Following a contingent event, both systemic and domestic forces determine the efficacy of the political coalition in power in achieving national political goals (Spruyt 1994, 28).

At the systems-level, external balancing opportunities once again loom large. The reality is that several changes have occurred in the international system at mid-century that significantly bolstered the ability of domestic political coalitions to endure, regardless of their own limitations. Notably, the creation of the Bretton Woods System made it possible for regimes to access resources that had never been available in history. Notwithstanding its role in limiting the policy autonomy of developing countries, the IMF made loans to developing countries that helped stave off collapse. Additionally, petro-dollars and FDI had a similar effect. In both cases, Latin American countries serve at once as prime examples of international financial assistance staving off regime collapse, as well as cautionary tales of sovereignty constrained.
In the realm of defense industrialization, the Cold War was a major boon to regimes as well. The Cold War had two specific impacts on defense development. First, in seeking to court or enlist developing countries in their global struggle, the Soviet Union and the United States both sold weapons to LDCs. Additionally, following their economic recovery, European countries elected to revive their defense industries leading to an increasingly commercial logic in the international market for weapons systems. Thus, the availability of weapons systems may well have blunted the impetus for creating more robust strategic enclaves.

Again, the Indian case is a good example of a country whose access to weapons systems served to forestall institutional reform in its strategic enclaves. Though the defense trade between Britain, India, and the U.S. would end following the 1965 Indo-Pak War, just before the start of the Sino-Indian War, Moscow and New Delhi began a long and fruitful exchange relationship denominated in rupees. This was very important for Indian policymakers, because they lacked hard currency, thus trade denominated in rupees allowed them to gain access to technology that was not on offer from the West. This trade also extended into the defense market as well and India was consistently able to buy Russian made weapons systems and spare parts. Thus, I will argue at greater length later in this dissertation, that the availability of weapons systems on terms favorable to the Indians blunted the impetus for institutional reforms in their strategic enclaves, even following the 1962 war.

At the domestic level of analysis, regime survival is determined by the ability of the regime in power to make good on the promises to its domestic constituencies. In Brazil, the developmental coalition that remained in power following the end of the
Estado Novo had proven inept in making good on its developmental goals, which ushered in a military dictatorship in 1964. Then again, in 1985, the military returned to the barracks because its legitimacy was severely undermined by the high-levels of repression meted out to the public. Ultimately, the military had been unable to make good on long-standing promises of development and security, with the former goal undercutting the latter.

In India by contrast, secular democracy proved to be an incredibly effective and stable platform for government. However, the democratically elected government of India proved to be only a modestly effective agent of economic development, though it was very successful at providing a minimum level of social welfare goods to its most important constituents, thus enabling it to survive several economic and military shocks. Yet, because of the India state’s political efficacy, no change occurred in the institutional arrangements of Indian strategic enclaves despite several lack-luster performances against its remarkably weaker neighbor, Pakistan. Not to mention the spectacular and humiliating defeat at the hands of China in 1962.

To summarize, I argue that institutional stasis or change is a function of the stability of elites in power and their preferences. When a regime is unable to meet the needs of its constituency, it is prone to collapse, ushering in new elites with different preferences. Stasis or change in the cohesion of strategic enclaves is dependent on the preferences of the elites in control of the new regime. To the extent that regimes do not change and preferences remain stable, I expect no institutional change or reform to occur in strategic enclaves.
2.1.3 Summarizing the Argument
To summarize the argument presented in this section. I argue that the coherence and efficacy of defense industrial policy is dependent on state power. This is a positive relationship. Consistent with scholars in the fields of international relations and comparative politics I believe that state power is an explicitly political variable and propose to measure it along three primary dimensions: elite ideology; state organization; and state-society linkages.

Additionally, I argue that state power varies over time and space as a function of environmental conditions. In particular, for late-, late-developing countries, shocks emanating from the international political economy are key catalysts for shifts in state power. These shocks thus constitute the independent variable causing a specific pattern of state authority. Subsequent changes in the patterns of state authority are a function of how well a state is able to achieve national goals. States that prove too impotent to achieve national objectives are subject to reform, while states that prove capable in achieving national objectives are not likely to experience any changes to its state authority structure. The argument detailed in this chapter is represented in Figure 2.1, below.

![Figure 2.1: A Neoclassical Realist Theory of Defense Development](image-url)
2.2 Testing the Argument
Though many scholars harbor at least some ambition to create predictive theories, the benchmark of success for any theory is its explanatory power. That said, assessing the explanatory power of a theory is always difficult for social scientists. It is not as if one can set up an experiment on a lab bench and carefully control all of the conditions the subjects are exposed to. Rather, the gold standard in the social sciences is to create a falsifiable hypothesis to be tested in as rigorous a research design as possible. While the research design was discussed in Chapter 1, what needs to be spelled out here, for purposes of falsification, are those instances when evidence does and does not support my theory.

Evidentiary support for the theory of defense development I have elaborated above is straightforward. Given the positive relationship I posit between state power and development, when states wield more power rather than less, I expect better development outcomes to obtain. To put a finer point on this, when the constitutive elements of state power (elite ideology, state organization, and state-society linkages) are found to be highly cohesive I expect to observe better development outcomes. If on the other hand, a weak or fragmented state authority structure is observed along with better defense development outcomes, this would severely diminish the explanatory power of my theory.

2.3 Contributions and Inherent Limitations
It is important to be clear and upfront as to what the contributions, as well as the inherent limitations of the model of defense development I have built are. The key contribution of my theory of defense development on the periphery is to specify the political determinants of this process which have long escaped sustained attention in the scholarly
literature. As demonstrated in Chapter 1, to date the scholarship on defense industrialization has not taken seriously the deeply political nature of defense development. Many scholars have focused on the structure of the international market to explain development outcomes, others on domestic institutions, and a very small number on security threats. The neoclassical realist approach offered here integrates systemic variables and domestic level variables to create a parsimonious and powerful explanatory political theory of defense development on the periphery.

What are the inherent limitations of this model? First, some may question the generalizability of the model to cases beyond Brazil and India. I agree that a theory based on two cases should give some cause for concern over how well a theory travels from case to case. Ultimately, it is up to the reader to decide whether my theory strikes the correct balance between historic accuracy and abstract generalizability. Second, some may object to the fact that my theory places too much emphasis on political factors and not enough emphasis on other factors in the admittedly multi-causal process of defense development. It is important to be clear, I am not arguing that the structure of the global arms transfer and production system plays no role in defense development. Nor am I denying the importance of institutions in the process of sectoral development, even in the defense sectors of the economy. What I am positing is that the amount of purposive power a state can generate goes a long way in explain state agency vis-à-vis international structures and that politics create the need for institutions, whose concrete forms are the result of political bargaining not rational planning or structural-functional responses.
Chapter 3
Baselines of State Power and Aeronautics Industrialization in Brazil and India

The core empirical claim made in this dissertation is that variations in state power explain divergent defense development outcomes in developing countries. In this section, I begin my empirical assessment of the relationship between state power and defense development in Brazil and India. I make the following argument: Neither the Brazilian nor the colonial Indian state had the power to be an effective agent of aeronautics sector development prior to the moment of national political consolidation, because both were fragmented multiclass states. Such aeronautics sector development as is observed prior to independence in India was a function of the imposition of development by foreign powers to promote their strategic aims.

Notably, though the scope of my project begins with my first critical juncture, the moment of national political consolidation (1930-1945 in Brazil and 1947 to 1962 in India), the central focus of this chapter is on state power and aeronautic sector development in the period just before the critical juncture in each case. I measure state power and levels of defense industrialization in Brazil from 1889 to 1930 and in India from the late 1880s until independence in 1947. There are two solid methodological reasons for such a beginning.

First, establishing baseline levels of state power prior to the critical juncture of interest in Brazil and India serves as an Archimedean point for the remainder of the project. Less artfully put, it allows me to assess the causal relationship between state power and defense industrialization outcomes prior to the independent, or treatment variable, being applied in both cases. From the vantage of within-case analysis, such a
vantage point is important because it helps establish that in fact change over time takes place. With this end in mind, it is possible to foreshadow a bit the content of the two cases discussed in this chapter. In both the cases of Brazil and India, external threats provided the impetus for defense industrialization. In the case of the former, hegemonic competition between a militarily superior Argentina and a significantly weaker Brazil, coupled with the unreliability of access to war materiel from great powers was the key catalyst for the process of military emulation. Yet, there was little impetus for emulation in the field of military aviation, an innovation still unfolding in developed countries and only taken up by Argentina in the mid-1920s. This fact notwithstanding, looking at the Brazilian state’s power for broader defense development during the Old Republic leads one to conclude that the state would have lacked the power for aeronautics sector development even if it had an incentive to do so.

In the case of India, the catalyst for aeronautics sector development was the threat posed to British interests east of the Suez by the Axis Powers. With the outbreak of WWII in Europe and large-scale Japanese success in annexing large portions of British, Chinese, French, and Russian territory, Britain sought to develop the Indian aeronautics sector as part of a broader push for defense development in the hopes of making India the arsenal of the British Empire east of the Suez. To be clear, this was not a process of emulation, but rather an act of imposition by a colonial power upon those they governed, engendering much resistance from the Indian National Congress in the process. What is interesting with regard to the Indian case is that a relatively high level of aeronautics sector development took place during the Second World War, yet this did not occur because the colonial government of India had tremendous power for such a project; it did
not. The colonial government of India, or the Raj, was a fragmented-multiclass state, poorly suited to the task of state-directed development. Rather, the transfer of British and American capital more than compensated for the weakness of the Indian state as an agent of development.

The second key reason to begin the empirical section of this work prior to the critical juncture of interest is for purposes of cross-case analysis. As noted in the introduction, not all of the causal factors that lead to divergent outcomes of interest arise during a critical juncture; these critical antecedents arise before moments of extraordinary agency and serve to influence the value the dependent variable takes. In this case, the shifting structure of state authority (the mediating variable) and the level of defense development (the dependent variable) prior to the first critical juncture have important significance for the divergent development trajectories of the aeronautics sectors observed in the course of this work.

As will be discussed in what is to come, the critical antecedent condition in both cases is the level of political modernization prior to the critical juncture. In Brazil, despite the rhetorical flourish of the Old Republic, this was a government whose level of political modernization was relatively low. There were no real parties to speak of, rather the pattern of patrimonial politics established well before the start of the Old Republic continued after the coup in 1889 as it always had. Ultimately, the precarious balancing act that bound regions together in a hyper-federal republic proved unequal to the task of insulating the country from the shocks of the 1929 New York Stock Exchange collapse and the subsequent global recession. In the Indian case, political modernization was conducted under the tutelage of the Raj. In arguing for decades for increasing levels of
home rule and eventually independence, a broad-based national coalition was built under the aegis of the Indian National Congress, which following independence would become the premier political party for decades after the fall of the Raj. This well-institutionalized political party and its competitors proved important in creating a mature and stable government able to withstand wars and economic shocks.

This chapter is organized around two primary sections, each one dedicated to one of the cases in this study. In Section 3.1, I will develop three themes regarding the Old Republic. First, I will address the impetus for defense industrialization, that is the geostrategic context of the country, including its unsatisfactory history of defense dependence. Second, I will discuss the power the state possessed to act as an agent of defense development during this period by focusing on ideology, state organization, and state-society linkages, such as they existed at the time. Finally, I will consider the level and pattern of defense development during the Old Republic. Section 3.2, which is dedicated to the Indian case, will proceed in a nearly identical fashion to Section 3.1, in which I discuss the impetus for the Raj to undertake defense industrialization, the power the Raj commanded for defense development, and the pattern and level of defense development obtaining under the Raj. In section 3.3, which concludes this chapter, I seek to summarize the findings of this chapter and provide some comparative perspective on each of the two cases examined in this chapter.

3.1 The Old Republic, State Power, and Aeronautics Sector Development
For Brazilians, the father of modern aeronautics and aviation is Alberto Santos-Dumont. The son of a coffee baron from São Paulo, Santos-Dumont began his pioneering work with hot air balloons, moving on to dirigibles, and is argued to have created the first modern airplane to fly, the 14-bis. So revered is Santos-Dumont in Brazil, that he is
honored in Brasilia’s Pantheon of Fatherland and Freedom alongside other national heroes such as Dom Pedro I, Marshall Deodoro da Fonseca, and the Duke of Caxias. Yet, it is not without a bit of irony that Santos-Dumont is so honored. One the one hand, he lived much of his life and did all of his pioneering work in France. On the other hand, there was almost no aeronautic sector development to speak of in Brazil, with or without state support.

The goal of this section, as is true of the chapter in general, is to establish a baseline for state power, aeronautic sectoral development, and the relationship between these two variables. I make two arguments in what follows. First, I argue that even though there was a structural incentive for military emulation because of regional rivalry with Argentina, there was no structural imperative for Brazil to emulate in the realm of military aviation, as Argentina would not begin such a process until the mid-1920s. Second, I argue that even if a structural imperative for emulation in military aviation did exist, given the relative dearth of state power for broader defense development during the Old Republic, it is unlikely the state would have been an effective agent of aeronautics sector development. I conclude this section with a very brief survey of the level of defense industrialization during the Old Republic, such as it existed, and the contribution of the state to this level of development.

3.1.1 The Strategic Backdrop of the Old Republic
In his work on military emulation in the Southern Cone, Resende Santos argues that external balancing opportunities with Chile and the United States limited the pace and scope of emulation in Brazil (2007, 279-283). That is to say, from a structural vantage, Brazil’s level of external vulnerability was not as great as that of Argentina or Chile, thus limiting the impetus for emulation. In contrast to Resende Santos, I argue that the
perceived level of Brazilian external vulnerability was quite high by the foreign policy establishment in Rio de Janeiro, which included civilian politicians, the foreign policy establishment, and the military owing to regional rivalry with Argentina and the frustrating experiences Brazil had obtaining weapons from abroad, a key component of external balancing. Indeed, the level of external threat was perceived to be sufficiently high that Brazilian policymakers ultimately concluded that defense development was a national imperative. However, there was no structural imperative to emulate the still nascent strategic innovation, military aviation, as Argentina did not begin to do so until the mid-1920s.

As has been well-documented, the source of external threat for Brazil during the Old Republic was centered on Argentina. The source of tension between Argentina and Brazil was influence over the La Plata River Basin. As a country of continental dimensions, it is worth noting that Brazil shares borders with every country in South America, with the exception of Chile. During the Old Republic, Brazil suffered from poorly defined boundaries with all the countries in the La Plata Basin; this includes of course Argentina, Bolivia, Uruguay, and Paraguay. Through the skillful diplomacy of the Baron Rio Branco and recourse to international arbitration, most of these disputes were settled in Brazil’s favor, including the Missones territory, the control over which was contested by Argentina and Brazil (Hilton 1985, 28-31; Burns 1993, 276-285). While the success of Brazilian diplomacy served to add greatly to Brazilian territory in the early part of the twentieth century, it was not without a price. That price was the perception amongst South American countries and Argentina in particular, that Brazil was an

39 For a synthetic overview, see Resende-Santos 2007, Chapters 5 and 6.
expansionist power, bent on continental conquest (Hilton 1985, 28; McCann 2004, 251-252). This perception of Brazil on the part of South American countries was a key catalyst for the historic rivalry between Argentina and Brazil.

Argentina was unique among the countries in the La Plata Basin insofar as most of these countries lacked the wherewithal to challenge perceived Brazilian expansionism. In contrast to all other countries in Spanish America, political power in Argentina was centralized under the imperial and often autocratic rule of its first president, Julio Roca in 1880. This political centralization allowed the Argentine state to pursue first a massive arms buildup and then a process of military emulation based on the model of the German army (Resende-Santos 2007, 185-186). Both of these actions were financed by profits earned in the Argentine export-led economy.40

The Argentine defense buildup and efforts at military emulation were well-known by foreign policy elites in Brazil, who measured their national security with reference to their rival’s military power. According to Hilton, by 1922 Brazilian elites found that:

The Argentine army consisted of a total of ten active and reserve divisions, whereas the Brazilian army had only two active and one reserve divisions. Argentina, the Brazilian military experts calculated, could mobilize 379,000 men and have them in the field in weeks before Brazil could mobilize 136,000 troops (Hilton 1980, 346).

Worse still, from the vantage of the Brazilian military, not only was the Argentine force superior in number, but in terms of its weapons as well. With respect to comparisons between the weapons of the Argentine and Brazilian militaries, Hilton states:

The Argentine forces, moreover, would have the benefit of 522 rapid-fire and 510 slow-fire cannon; Brazil had 176 and 156, respectively. The disparity in naval power was almost as marked…Whereas the Brazilian fleet, constructed before the war [WWI], consisted of thirty ageing ships with a total tonnage of less than

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40 Speaking to the Argentine economy, Resende-Santos notes that between 1870 and 1914, the average annual growth rate of the economy was estimated to be 5 percent (2007, 185).
65,000, Argentina, according to a 1928 study, had thirty-two vessels with a tonnage of nearly 114,000 even before Buenos Aires announced a fleet renewal program. In both speed and volume of fire, Argentina’s 140 guns were far superior to Brazil’s 84. In addition to an inadequate fleet, Brazil had no naval bases north of Bahia or south of Santa Catarina (Hilton 1980, 346-347).

The point to be made here is that from the vantage of Rio de Janeiro, the Argentine military was clearly stronger than the Brazilian military in all respects. Underscoring Argentine strength versus Brazilian weakness were the poor performances of the Brazilian military in internal operations such as the Canudos Affair and the Contestado conflict.  

Moreover, international observers were equally dismal in their assessment of Brazil’s ability to balance against the Argentine threat. The leadership of the French Military Mission, which began in 1919, was shocked at the poor condition of the Brazilian military institution, from logistics, to armaments, to the quality of its rank and file troops (Hilton 1980, 347-348). The French confidence in the quality of the Brazilian officer corps was similarly negative. In fact, the quality of the Brazilian officer corps in terms of leading men in the field was so poor, field exercises led by the French were severely impeded by Brazilian officers lacked even basic land navigation skills (Resende-Santos 2007, 271). Both British and American military observers ranked the military efficacy of the Brazilian military at a level similar to the French assessment (Resende-Santos 2007, 285-286). In fact, one British officer went so far as to label the military of the Old Republic as a quantité néglige (Resende-Santos 2007, 291).

It was not simply the military threat posed by Argentina that so concerned the Brazilian foreign policy establishment. The diplomatic thrust of Argentine foreign policy

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was believed to be aimed at isolating Brazil in South America (Hilton 1985, 29-31). A key component of this diplomatic strategy was an effort to build and strengthen already extensive ties between Buenos Aires and the other Spanish-speaking countries in the La Plata Basin. In fact, at least one high ranking Brazilian official described Argentine foreign policy during the course of the Old Republic as economic imperialism (Hilton 1985, 30). To be clear, Brazilian policymakers believed that Argentina was making a bid for continental hegemony that would isolate Brazil in South America.

Set against this threat, Brazilian policymakers believed they had few allies upon whom they could count on to hedge against the threat from Buenos Aires. In South America, it was believed that the combination of Spanish colonial heritage, a common language, and strong economic ties between Argentina and the other countries in the La Plata Basin meant Brazil had no regional allies (Hilton 1980, 348). At the broader international level, though not without some concern with regard to economic imperialism, it was believed that the United States was the only country that could be enlisted to deter its regional rival (Hilton 1980, 359-360). This belief was founded on three propositions. First, it was believed that Washington could be enlisted to deter Buenos Aires because both the Brazil and the United States were the only non-Spanish-speaking countries in the hemisphere and thus shared similar interests with Rio de Janeiro in the South America (Hilton 1980, 359). Second, the economic linkages between Brazil, a commodity exporter, and the United States, a commodity importer, could provide a strong basis for foreign policy approximation (Mares and Trinkunas 2016, 28). Finally, Rio de Janeiro shared with Washington concerns about European encroachment into the
Western Hemisphere and Brazil was the only country in South America to support the Monroe Doctrine (Mares and Trinkunas 2016, 28).

Stoking Brazilian concerns further regarding the opportunities for external balancing were its experiences as an arms importer. As Hilton notes, Brazilian policymakers were quickly made aware of the dangers of defense dependence, noting three specific concerns that were heightened during the Old Republic (Hilton 1982, 633-637). The first of these lessons Brazil was to learn was that military hardware is expensive generally, but especially in terms of foreign exchange. With respect to hard currency, during the early 1900s especially, there was a shortage of foreign exchange in Brazil with which to buy weapons. It is important to remember that at this time, the Brazilian economic profile was that of an agro-exporter undergoing the first phases of import substitution, which relied heavily on imported inputs in the manufacturing process. Worse still, the money spent on military modernization angered foreign creditors, who preferred to be paid back instead of limited government revenue being spent on new weapons for the Brazilian military. Eventually, during World War I the Brazilian government was forced to “…resort to a new funding loan, the minister of finance was forced to promise the House of Rothschild that “every nerve will be strained in every department so as to bring about the strictest economy and retrenchments”” (Hilton 1982: 635). This is to say, that in order to get a loan from the Rothschilds to get badly needed weapons during World War I, Brazil was forced to promise to impose austerity measures to raise the money. The situation did not improve with the arrival of the 1920s either. The reality is that Brazilian financial situation became worse and even
the modest efforts at military industrialization, such as building a new factory for gunpowder was simply beyond the financial capacity of the Brazilian government.

A second key lesson learned by the Brazilian government regarding defense dependence during this period was that weapons merchants were not above embellishing their claims to win customers. In point of fact, it appears that weapons manufacturers pulled what might be called a bait and switch scam in several cases. Typical of these sorts of claims was an incident in which 750,000 rounds of Mauser ammunition were purchased by the Ministry of War and they proved unusable (Hilton 1982: 636). In another case, “…in 1911 tests conducted on 145,000 recently purchased Mauser rifles showed the barrels to be structurally weak, which led to two years’ delay in securing and adapting new barrels from Germany” (Hilton 1982: 636). Moreover, in some cases, the weapons purchased from European suppliers simply could not function in the Brazilian climate, one example of this was that some gunpowder imported from Europe simply did not function (Hilton 1982: 636).

Perhaps the single most important drawback of defense dependency for Brazil was that weapons availability was dependent on the interests of the supplier country. While during the Cold War this was to come to mean that the trade in heavy conventional weapons systems generally followed the flag and was used as political leverage, in this era weapons availability was contingent on the actual needs of the countries in which the manufacturers were headquartered. So, in the period before World War I, Brazil found it very difficult to get weapons. As has been noted:

…when war broke out in Europe and the British blockade disrupted the contracts with Krupp and other German firms to which Rio de Janeiro had paid large sums in advance. Unable to acquire weaponry in Europe, Brazil gave contracts to suppliers in the United States, but when the latter mobilized for war in 1917,
Washington informed Rio de Janeiro that its arms would have to be reserved for United States troops. Brazilian authorities ran into the same problem with a naval purchasing program that had to be shelved because no Western country would sell vessels (Hilton 1982: 637).

The point to be made here is that Brazil’s access to foreign weapons was dependent on the vicissitudes of international politics. If war came with Argentina, as had been forecast during the Old Republic, Brazil might find itself wholly unable to procure weapons at all.

It was set against this strategic backdrop that a major policy decision was taken with long-term consequences for broader defense industrialization and aeronautics sector development. The strategic circumstances of the Old Republic dictated that defense industrialization was necessary for national security. The fact of the matter is that given the problems with acquiring weapons and supplies from abroad after 1900 and particularly after the First World War, the issue of autonomy in defense production became an important dimension of foreign policy for both ministers of war and their presidents. As Hilton notes:

The minister of war in 1903, for instance, urged the development of munitions production because it would make the armed forces “entirely independent” from overseas markets and eliminate “obstacles and difficulties” in obtaining supplies. [President] Pena told Congress the same thing in 1908, and General Fonseca, as minister of war and then as president (1910-14), repeatedly stressed the importance of expanding domestic military manufactures in order to “free ourselves from foreign markets” and “thus achieve the independence we need in a matter related to so intimately to our security.” Wartime leaders saw in the European conflict stark proof of the need for greater military-industrial autonomy…The lessons of the war were not lost on later leaders. Military industries had to be organized, said President Delfim Moreira in 1919, “whatever the sacrifices required.” Military commanders in the 1920s understandably pressed for greater military industrial autonomy, and their pleas found strong resonance in executive circles (Hilton 1982: 638).
Regardless of dominance of domestic regional interests in this hyper-federal republic, among the Brazilian foreign policy establishment, including civilian politicians, there was a growing awareness that military industrialization was becoming a national imperative.

While elite perceptions of external vulnerability were a key catalyst for defense development during the Old Republic, conspicuous by its absence was a structural imperative for emulating the great powers in the realm of military aviation. This was so mainly for reasons of historical timing. The strategic use of aircraft in war was an innovation in military statecraft that was only beginning at the start of the Old Republic and there were no clear models to emulate. Britain was the first country to establish an independent air force in 1918, but France and Germany would not have independent air forces until the eve of the Second World War. For its part, the United States would not create an independent air force until after the WWII. Additionally, the strategic value of air power was debated with three doctrines evolving in the United States, Italy, and Russia (MacIsaac 1984, 629). Argentina only took its first steps towards building military air power in the mid-1920s with the creation of army and navy air wings. Brazil contracted a very small French Aviation Mission in 1919 along with the military mission, more of which will be said in due course. Put simply, military aviation was an innovation in warfare that was slowly unfolding in developed countries, where there was no single model that diffused. It can hardly be expected that countries on the periphery to adopt innovations of unknown value, particularly while they are still evolving.

To summarize the discussion to this point, three key claims have been made. First, Brazilian elites perceived a high level of external vulnerability during the Old

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42 On the slow evolution of air warfare, see MacIsaac 1984.
Republic. Second, the external threat that was the cause for concern was regional rivalry with Argentina over political and economic influence in the La Plata River Basin, a threat that the foreign policy establishment believed Brazil was inadequately prepared to defend against. Third, Brazil had limited external balancing options. Neither Latin American countries nor European great powers provided attractive balancing options; only the United States seemed a potential partner to balance against Argentina. Moreover, the acquisition of arms from abroad was a frustrating experience, leading Brazilian leaders to come to see defense industrialization as a national security imperative. Yet, because military aviation was an innovation still unfolding, one which Argentina would only tentatively move to adopt in the mid-1920s, there was no structural imperative for Brazil to emulate institutions associated with military aviation, including an aeronautics industrial base.

3.1.2 State Power for Defense Development During the Old Republic
To be sure, given that it was too early in history for there to be a structural stimulus for aeronautics sector development, one cannot hope to discuss state power for such an endeavor. However, it is possible to establish a baseline for state power for broader defense development during the Old Republic to get an idea of how effective the Brazilian state could have been in promoting the development of an aeronautics sector. To this end, the central question framing this section is the following: Given high levels of perceived external vulnerability, what power did the Brazilian state have for defense development during the Old Republic? I argue that the fragmented-multiclass structure of the state significantly limited its ability to extract and mobilize societal resources for national defense. I make this argument by paying attention to the two relevant core aspects of state power during the Old Republic: ideology and state organization.
Ideology in the Old Republic
The broad political contours of the Brazilian state during the Old Republic are well known. Following the downfall of the Brazilian Empire in 1889 and a brief period of military rule, a liberal oligarchic regime emerged in the 1890s that proved relatively stable until the late-1920s. Conventional wisdom suggests that the state was a feeble developmental actor because commercial industrialization and the expansion of the central state’s authority was at odds with the interests of the hegemonic agro-exporting class (Kohli 2004, 139). Steven Topik (1987) and Kohli (2004) have illustrated that while this view is largely correct, the Old Republican state was a more capable agent of commercial development than conventional wisdom suggests. Notably, the central state set tariffs, pursued modest expansion of the railways beyond centers of economic import, and subsidized European immigration to satiate growing demand for labor, among other actions. When it comes to defense industrialization, I agree with Topik and Kohli that the state did undertake some consequential actions to promote the growth of a national defense industrial base. However, the power of the old republican state for defense development was quite low because the state had neither the desire nor institutional capacity for such an endeavor.

The political system of the Old Republic is well characterized by two descriptive phrases: patrimonial politics and radically decentralized. Regarding the appellation, patrimonial politics, this refers to the system by which national leaders were chosen and placed in office. Famously called the politics of the governors system, or **café com leite** politics, the governors of the three key states, São Paulo, Minas Gerais, and Rio Grande do Sul, selected a consensus choice for president of the republic (Flynn 1978, 34-35).

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43 For a similar overview, see Flynn 1978, Chapter 3.
Then, through the institution of *coronelismo*, local notables used inducements, force, and fraud to deliver the vote for the consensus presidential candidate (Flynn 1978, 36-40). In this way, an air of legitimacy was manufactured for the national Brazilian government.

As for the radically decentralized nature of the Old Republic, Kohli highlights two key reasons for the diffusion of power away from the capital of Rio de Janeiro to the states. First, there were no national political organizations, namely political parties, to aggregate and articulate interests that were national in scope (Kohli 2004, 138). The only possible institution that could wield power at the national level other than regional elites, was the national military, which was too fragmented and factionalized to take a leading role in state-building (Kohli 2004, 138). Second, in the absence of national political parties or a strong, unified military, political power diffused from the federal government to the most powerful states (Kohli 2004, 138). São Paulo and Minas Gerais were the first and second most powerful states, respectively, the former because of the dynamism of its coffee exports and the latter because of the success of export economy centered on cattle and associated products. Though Rio Grande do Sul was by no means as economically dynamic as either São Paulo or Minas Gerais, it was politically mobilized and threats to leave the republic were taken seriously, according it a modest role in national politics.

The constitution of 1891 fully reflected the relative power of the states versus the federal government. Kohli points out that:

The constitution of 1891 gave enormous powers to the regional states, including the power to tax exports, raise loans abroad, and raise local armies…At the same time the central state was relatively weak. Not only was there no centralized army, but the central state had almost no political and bureaucratic capacity to collect direct taxes. In 1928, for example, only 3 percent of the national budget originated in income tax, whereas 42 percent of it was derived from taxing imports (Kohli 2004, 138-139).
What is relevant for present purposes in the text reproduced above is that the separation of powers between the states and the central government severely handicapped efforts at state-led development. Simply put, the inability to pursue direct taxation diminished the power of the state to extract societal resources for national ends. Rather, the revenue the central government could raise, that from export taxes, was subject to the vagaries the Brazil’s performance in the context of the global economy. When Brazilian imports and exports performed well, the government had money to pursue its goals. Yet, when the economy floundered, the resources available to the government rapidly diminished.

Not only did the structural issues noted above limit state power, regime ideology also limited the power of the old republican state for defense development in two key ways. First, national policymakers, both civilian and military alike, held views very similar to regional elites regarding the role of the state in the economy, even when it came to defense development. As is well known, the dominant economic ideology of the era in Brazil was laissez-faire capitalism, in which markets decided economic outcomes, not states (Kohli 2004, 140). Looking at national policymakers that were concerned with defense development, what is clear is that there was consensus on a limited role for the state in such an endeavor, leaving the burden on the private sector. Hilton observes that high profile and influential individuals such as Hermes da Fonseca, João Calógeras, and Alexandrino Alencar were all on record favoring the nationalization of defense production, but not the direct entry of the state into producing weapons systems (Hilton 1982, 646). Ultimately, the ideology of national policymakers regarding the role of the state in defense development, including the officer corps, is best observed in remarks
made to the *Clube Militar* in 1916, by Captain Egydio Castro e Silva, paraphrasing the captain, Hilton notes the following:

…nationalize defense production, yes, he said, in the sense of reducing dependence on foreign markets, but leave as much possible to the private sector, where a valuable pool of specialized labor would be formed and the bureaucratic inertia of public enterprise could be avoided. Ideally, he declared, the army’s role would be limited to that of technical supervision. As long as private capital displayed “impetitude or fear,” however, he thought the state should take the initiative (Hilton 1982, 643-644).

The point to be made regarding Hilton’s remarks is that there was elite consensus that the state should have a limited role in defense production, so long as private capital was willing to undertake the initiative. Ultimately, a more expansive role for the state in defense development would “…have to await increased centralization of political authority, the onset of true industrialization, and the recruitment of broader sectors of the political and industrial elites to the cause of military autonomy, developments that would occur under the stimulus of depression and war during the Vargas era” (Hilton 1982, 646).

State Organization
In addition to ideological factors, state power for defense development was also limited by the organization of the state itself. Consistent with the organizing ideology of the regime, neither the military nor the federal bureaucracy were strong, developmental institutions, nor did either endeavor to craft any type of long-term industrial policy. Rather, both state institutions served primarily as a tool to shore up political support for the regime itself through patronage. For its part, the civilian bureaucracy expanded greatly during the Old Republic along two tracks observed by Kohli (2004, 141-142). On the one hand, the vast majority of the federal bureaucracy was comprised of low-level functionaries and blue collar workers, whose livelihoods were dependent on political
connections. On the other hand, at the apex of the federal bureaucracy, there was a distinct trend toward professionalization with high-level bureaucrats appointed not only because of their political connections, but because of their professional expertise and competence in a given domain. For instance, Topik notes that when it came to the top management spots for the railroad following nationalization or posts in the economic bureaucracy, seasoned professionals were appointed rather than political allies (1987, 109-111). This trend toward professionalization occurred because of increasing demands from the export oligarchy on the federal state to manage and stabilize Brazil’s economy, which was subject to repeated shocks from the international economy. Citing Topik, Kohli notes that, “The highest echelons of administration were concerned with carrying out their duties professionally and efficiently. Reasons of state appealed to them as much as the desires of their civil protectors…In Rio bureaucrats came to recognize…a federal ethos…and to defend the national interest” (Kohli 2004, 142).

With respect to the military, this institution was heavily politicized and fragmented, thus limiting the power it could wield either to further centralize political power at the national level, or for defense development (Kohli 2004, 140-141). To appreciate the limited power of the military, it is important to understand the relationship between the military and the Brazilian society that it was part of. Simplifying greatly, the relationship between the civil authority in Brazil and the military is best understood as a paradigmatic example of Huntington’s pattern of subjective civilian control. That is to say, absent viable national political institutions, civilian factions contending for power at

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44 As noted, this quote comes from Topik (1987, 24).
45 For a more expansive discussion of the Brazilian officer corps and its fragmentation, see Robert Hayes (1976) and Smallman (2002, Chapter 1).
the national level sought to co-opt the military and the army in particular to gain political support and legitimacy. To this end, civilian elites used patronage including control over promotions and duty assignments to garner the loyalty of the military, this the only national institution that could possibly wield national political power. In fact, not only had the paulista elite co-opted the military to overthrow the Brazilian Empire in 1898, but civilian elites repeatedly used the military as in the Canudos Affair (1896-1897) and the Contestado Incident (1912-1916) to press political claims.\footnote{On the relationship between paulista elites and the military to end the Brazilian Empire, see Flynn (1978, 17-20) and McCann (2004, 1-14).} This politicization had the effect of exacerbating pre-existing personal rivalries among officers, as well as ideological and generational cleavages, further degrading the institutional cohesion of the officer corps. Interestingly, inter-service rivalry between the army and the navy was also exacerbated by the interference of politics, with the navy being strengthened in the early 1900s to hedge not only against the Argentine threat, but to balance the power of the army. In fact, Resende Santos goes so far as to make the case that precisely this pattern of civil-military relations was a key factor in limiting the success at military emulation during the Old Republic (2007, 275).

In contrast to the federal bureaucracy, efforts at emulation were made consciously in response to Brazil’s perceived high level of external vulnerability. Three efforts were made to professionalize the military during the Old Republic. The first was not an effort at emulation, though emulating foreign military systems was discussed, and it lasted from 1898 until 1902. The second effort to modernize, or professionalize the Brazilian military was an effort to emulate the German military system and occurred between 1906 and 1914. The third and final effort at professionalization sought to emulate the French
military system, lasting from 1919 until the mid-1940s. From the vantage of this project on defense development, the timing and specificities of these reform efforts are not of primary interest and have been covered in detail by Resende Santos (2007) and McCann (2004). What is of importance for this project are the aims of the efforts to emulate the German and French military systems.

Efforts at emulating the German military system between 1906 and 1914 focused on three key areas: armaments; officer formation; and universal military service (Resende-Santos 2007, 246). Resende Santos notes that Brazil was most focused on emulating the German military when it came to armaments (2007, 252-253). Though some German technicians were imported to support very limited efforts at defense development during the Old Republic, the primary emphasis was on the purchase of finished weapons from German firms including pistols, Mauser rifles, and Krupp artillery. So much was imported in the way of armaments from Germany that the Brazilian military was said to resemble a German arms display (Hilton 1982, 634). In addition to the acquisition of vast quantities of weapons, officer formation was another key dimension of emulating the German military. To this end, junior Brazilian officers were sent to Germany to train and drill. Upon their return, the officers sent abroad for training came to form the core of the military modernizers, known as the joven turcos (Young Turks). Though few in number, the joven turcos enjoyed the strong support from several influential senior members of the officer corps, including General Fonseca, a minister of war and president of the republic. Perhaps the single biggest contribution of this apolitical group of officers was the creation of the unofficial military publication, A Defesa Nacional (Resende-Santos 2007, 249-250). Finally, an effort was made to pass
legislation creating a universal service law that would improve the quality of the rank and file soldiers, most of whom were still taken from the lowest ranks of society (Resende-Santos 2007, 253-256). The goal of such a law was not only to improve the quality of the fighting force, but to help create a nation. Though such a law was eventually passed, it was passed with enough loopholes to undermine the aims of obligatory service.

There are two important points to be made about Brazilian efforts to emulate the German military system and the developmental power of the military. First and foremost, though great efforts were made to acquire German weapons, little effort was made to copy the German defense industrial base or to develop elements of strategic enclaves, such as a research and development organization within the military. Second, the jovem turcos sought to professionalize the officer corps, meaning creating a military specializing in the application of organized violence for political purposes. It was not geared toward creating officers with the specialized technical competencies required to perform even the most rudimentary oversight activities of a defense industrial base, let alone the ability to lend technical assistance to private defense firms. These sorts of competencies would come to be valued both during Vargas’ tenure in office and during the military dictatorship, not during the Old Republic.

Efforts to emulate the French military system between 1919 and the mid-1940s had a similar focus to that of the preceding reform spurt. A key difference between Brazil’s effort to emulate the German and French militaries was that no large push to acquire French weapons was made because they were frequently found to be of inferior quality to those produced in the United States and in the 1930s by Germany (McCann 2004, 251; Resende-Santos 2007, 267-268). Though it should be noted that the incipient
Brazilian army air arm, under the tutelage of the very small French Aviation Mission, came to acquire French aircraft, engines, and machine guns (Hilton 1982, 634). The primary focus of the French Military Mission (FMM) was centered on creating a professional officer corps (Resende-Santos 2007, 267). To this end, French defensive military doctrine was adopted and great efforts were made to reform the entire Brazilian military education system. Since even before the start of the Old Republic, the Brazilian military education system served to give officer recruits what amounted to a liberal arts education (McCann 2004, 12-13). The FMM sought to refocus officer training curriculum on practical military matters and in addition, holding regular drills with actual field maneuvers (McCann 2004, 253; Resende-Santos 2007, 271). Again, the important point to be made regarding the FMM is that, as was true of earlier efforts to emulate the German military, the goal was the creation of officers that were skilled in the use of organized political violence for political ends, not specialists in defense industrialization.

To summarize the discussion to this point on the relationship between state organization and power for defense development, two points should be made. First, both the federal bureaucracy and the military both sought reforms in response to external structural pressure. In the case of the federal bureaucracy, at the apex, top level bureaucrats became more professional in response to growing demands for the federal government to manage and stabilize a primary-commodity exporting national economy, which was repeatedly buffeted by external economic shocks. No formal plans at institutional renovation were created to professionalize the federal bureaucracy, it was

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47 The Brazilian army was the purchased these French aircraft, engines, and machine guns, with which they were dissatisfied (Hilton 1982, 634; Resende-Santos 2007, 268). The navy on the other hand obtained aircraft from the U.S., Britain, and Italy (Hilton 1982, 634).
done by selecting competent people to top spots. Second, in response to perceived high levels of external vulnerability several efforts were made to modernize and professionalize the Brazilian military. These reform efforts failed because a deep-rooted pattern of subjective civilian control prevented the emergence of a more coherent and better institutionalized military. Moreover, both the attempt to emulate the German military system and that of the French were aimed at de-politicizing the military, not creating skilled technicians in the military who could run munitions plants or arsenal facilities.

3.1.3 State Support for Defense Development and the Level of Development Achieved

In discussing state support for defense development and the level of defense development achieved during the Old Republic, two factors are important to bear in mind. First, though defense development was seen as a national imperative, national leaders were committed to a capitalist pattern of defense development leaving the widest possible margin for private capital to develop the Brazilian defense industrial base. The role afforded to the state was to provide technical assistance. Only if private capital proved unwilling to respond to domestic demand would the state step into the defense economy to undertake design, development, and production work. Second, the organization of the state itself limited the developmental power of the state to shape the development of the defense industrial base. In neither the case of the federal bureaucracy nor the military did there exist a cadre of skilled technicians that could perform even the minimal roles afforded the state in defense development. Nonetheless, the state did provide limited support for the development and modernization of a munitions plant, domestic gunpowder production, as well as the refurbishment and expansion of army and navy
arsenals. While these efforts proved lackluster, efforts at developing the indigenous industrial capacity to produce gunpowder domestically bore more fruit.

At the turn of the century, one of the primary goals of the federal government in the realm of defense development was to build out the production capacity of nationally owned munitions plants (Hilton 1982, 639). At this point in time, there existed three plants involved in the production of munitions in Brazil, one in a suburb of the city of Rio de Janeiro (Realengo) to produce finished cartridges, another in Estrela to produce gunpowder, and a defunct gunpowder plant in Mato Grasso (Hilton 1982, 639). The decision was made to focus on upgrading the cartridge factory at Realengo. To this end, a large amount of machinery was purchased from Germany, as well as the requisite technical assistance to get the machines up and running, yet the results of this effort to modernize the Realengo plant fell short of expectations (Hilton 1982, 639). Hilton notes that, “Production rose from half a million finished cartridges in 1900 to six million in 1914, but this was a far cry from the projected level of 45 million a year” (Hilton 1982, 639). The key difficulty in developing a truly autonomous capability to produce finished cartridges was a shortage of skilled Brazilian technicians to keep the plant operating after the Germans had setup the facility (Hilton 1982, 639). Interestingly, rather than focus on the formation of a group of individuals to operate the facility during the Old Republic, policymakers in Rio de Janeiro opted to import European technicians to oversee the management of the facility (Hilton 1982, 639).

Regarding the development of army arsenals, here too progress was very limited. As with the munitions plants, at the start of the 1900s there were three army arsenals, one
in Rio de Janeiro, another in Porto Alegre, and a third in Cuiabá. Of the developmental efforts made with the hopes of modernizing the army arsenal system, Hilton notes:

An early decision was taken to build a new Arsenal da Guerra in Rio de Janeiro (AGRJ), and Krupp received most of the contracts for machinery and equipment, which were delivered in 1900 along with the “entire metallic structure” of the new buildings. Over the next few years considerable expansion of the physical plant took place and machinery was installed, but the problem of skilled labor again impeded progress (Hilton 1982, 639).

Once again Brazil simply lacked a labor force skilled enough to operate the machinery and turn out weapons. It should be noted, as Hilton does, that though the performance of the AGRJ failed to meet expectations, it eventually developed the capacity to produce iron articles for the cavalry, which once were imported (Hilton 1982, 639).

Progress in modernizing the navy's arsenal system was almost entirely non-existent, even when compared with the meager progress made in developing the army arsenal. Interestingly, the navy was the very first target for modernization and defense industrial development following the establishment of the Old Republic in part because of the threat Argentina’s navy posed to Brazilian commerce in the South Atlantic. Additionally, it has been suggested that politicians sought to increase the size and power of the navy to help balance against the army as well. With the goal of modernization in mind, discussions regarding the expansion of the naval arsenal system began in 1890 and aimed “to replace the scattered and ramshackle installations known collectively as the Arsenal da Marinha do Rio de Janeiro” (Hilton 1982, 640). Yet, despite the fact that discussions took place to develop the industrial potential of the navy arsenal, both the country’s poor finances and differences of opinion among the policy principals involved in development planning delayed modernization efforts (Hilton 1982, 640). Improving the navy arsenal was not again taken up seriously until 1910, when a contract was
awarded to a French company to develop a new arsenal, which would eventually come to
be known as the Marinha da Ilha das Cobras (Hilton 1982, 640). This project was
abandoned however because of the First World War and persistent national financial
problems (Hilton 1982, 640). Two more efforts were made to develop the navy arsenal
following WWI, both involving British shipbuilders and the second involving American
firms as well, however neither of these two efforts would come to fruition because of the
costs associated with the project (Hilton 1982, 640). Ultimately, a contract to develop
Brazil’s naval arsenal was awarded to a firm from São Paulo in 1922, however the
Brazilian congress did not approve funding for the project until 1926 (Hilton 1982, 640).

The point to be made with regard to efforts to develop a modern naval arsenal is
much the same as that regarding the development of the army arsenal. That is to say, the
weak financial position of the Brazilian economy made modernizing and expanding the
capacity of the naval arsenal nearly impossible. Additionally, it should be noted that as
in the case of the army arsenal, policymakers in Rio de Janeiro sought to import the
capital, human and financial, required to develop national defense industries, rather than
developing the domestic capacity to do so.

An important part of the story of Brazilian defense industrialization during the
Old Republic is the reality that the broader civilian economy was not industrialized. This
meant quite simply that the requisite backward linkages crucial for defense industries,
such as a national steel industry, simply did not exist between 1889 and 1930. This is not
to say that the civilian economy did not produce anything of use to the military, because
during the Old Republic some industrialization did occur, yet it was primarily in light
consumer goods such as textiles, leather goods, and foodstuffs, which the military did
purchase domestically. In the absence of backward linkages to a metallurgical industry, items like machinery and metallic structures had to be imported. Thus, some attention was paid to the development of supporting industries during the Old Republic. However, Brazil did not actively seek to develop heavy industries that could contribute to national defense until the Vargas era.

To summarize the discussion of state support for defense development and the levels of defense development achieved, two basic points can be made. First, the state supported both the import of finished weapons systems and to a much smaller extent the import of the human and financial capital required to facilitate domestic defense development. Second, such efforts at defense development as were made by the state to promote defense development were hampered by several factors, some beyond the control of the government such as international politics and the economic shocks that repeatedly buffeted the Brazilian economy. Yet, other factors hampering the process of defense development were the product of the state, namely its commitment to laissez-faire economic policy, a non-existent sense of nationalism, and the poor organization of the state. Given these political factors, it is hardly surprising that the old republican state was a poor agent of defense development.

3.1.4 Summarizing the Early Brazilian Experience with Defense Development
In concluding this portion of Chapter 3, there are several important factors to bear in mind. First among these are the realities of the strategic environment which Brazilian policymakers were forced to confront during the Old Republic. To be direct, as outlined in Section 3.1.1, there were strong structural incentives for emulation, though not necessarily in the aeronautics sector. Regional rivalry with a militarily superior and apparently expansionist Argentina was a key source of structural pressure for deep
military emulation, including both the modernization and professionalization of the entire Brazilian military system. This structural pressure extended into the domain of defense development primarily because defense dependence had proven frustrating to Brazilian policy principals and left the country dependent on the interests of great powers to furnish the military with the war materiel necessary to hedge against the Argentine threat. Despite this strong and persistent structural pressure for emulation, such defense development as did occur was very limited and had lackluster results.

The second factor to bear in mind, the power of the state for defense development, explains both the limited scope of state-led defense development and the poor results. Regarding the first domain of state power, the dominant laissez-faire economic ideology put the onus for defense development on the private sector, reserving for the state a very limited role in the provision of technical assistance. Only when the private sector failed to respond to market incentives for defense development would the state enter the design, development, and production of weapons. Additionally, because of the near total lack of nationalist sentiment among the political elite, the stark federal-regional tension could not be overcome to extract and mobilize societal resources for national defense development.

Not only did the ideology of the state limit its power for defense development, so too did the organization of the state itself. As noted in Section 3.1.2.2, neither the federal bureaucracy nor the military had the capacity to formulate coherent and long-term defense industrial policy, it also lacked the ability to perform the basic roles envisioned for the state in defense development. Simply put, neither of the old republican state’s key institutions had the personnel with the technical competence to perform any of the roles afforded the state in the process of defense development. With specific regard to the
military, though modernization and professionalization efforts were made along the lines of both the German and French military systems, both reform efforts were aimed at creating professional soldiers that specialized in the organized use of violence for political ends, not military developmentalism.

Finally, given the limited power of the old republican state for defense development, neither the scope of government support nor the level of development achieved were impressive. With respect to the scope of defense development undertaken during the Old Republic, it was focused primarily on the modernization of existing state-owned facilities, including the munitions industry, as well as the army and navy arsenals. No serious efforts were undertaken by the state to promote the development of heavy weapons such as tanks which had proven their value during the First World War. In fact, it is worth noting that given the serious organizational problems of the military during the Old Republic and its limited industrial base, the Brazilian army actually disbanded its sole unit equipped with tanks. Regarding the level of defense development achieved, the most notable success was the development of a gunpowder factory at Piquete, which produced less powerful single-base powder. Precious little in the way of success was had in developing the army and navy arsenals and production at the munitions plant at Realengo were only modestly more successful, falling well short of the forecast capability.

3.2 State Power and Aeronautics Sector Development Under the Raj
The Second World War was a major catalyst for the creation of a defense industrial base in India, including the aeronautics sector. Prior to the acceptance of and implementation of the Chattfield Committee Report in 1938/39, the aeronautics sector was virtually non-existent in India, with almost all of the airplanes used in military and civilian roles
imported from Britain (Wainwright 1994, 14). However, by the end of World War II, largely thanks to British financial and American human capital, India had acquired a significant domestic capacity in the aeronautics sector, including the assembly of airplanes from imported kits and the complete overhaul and maintenance of aircraft. These two competencies are generally regarded as the first steps up the ladder in the aviation product cycle. However, as will be argued below, this level of development in the aeronautics sector occurred because of British money and American technology, not because of the power or strength of the colonial government of India. In fact, the colonial regime was a fragmented-multiclass state incapable of extracting or mobilizing the requisite resources for such development to occur.

3.2.1 The Strategic Backdrop of the Raj

The strategic conditions that produced Indian defense development and that of the aeronautics sector are straightforward and well-known, thus only a cursory discussion is offered here. Since Queen Victoria declared India a formal colony of Britain following the Mutiny of 1857, India served two primary roles in the defense of the British Empire. First and foremost, the Indian Army was assigned an internal police role to ensure the political subordination of the colony to London, such that it could be economically exploited (Wainwright 1994, 13). To this end, India served as the largest garrison in the British Empire and very limited defense industrialization was undertaken to support this role. The ordinance factories established prior to the 1930s produced mainly uniforms, saddles, small arms and ammunition (Wainwright 1994, 13). Its second role was in defense of the Northwestern Frontier Area (NWFA), from Russian colonial expansion.

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48 Wainwright observes that 165 of the aircraft imported into India, 109 were from Britain (Wainwright 1994, 14).
and raids from Afghan tribes, which constituted the historical overland invasion route to India (Wainwright 1994, 13). It was actually for the purpose of defending and pacifying the NWFA that the Indian Air Force (IAF) was created (Omissi 1990, 47).

This limited role for India in imperial defense was not well received by many in London. In fact, there were those, including the celebrated strategist Basil Liddel-Hart, who pressed for the modernization of the Indian military and the employment of the army and air force to garrison the British Empire, in particular the Middle East (Barua 1997, 246-247). To this end, several reform initiatives were drawn up and proposed, but none gained much traction. New Delhi successfully fended off these calls for greater Indian participation in defending the British Empire through fiscal and security arguments (Barua 1997, 244). On the one hand, policymakers in India highlighted the fact that the Indian Army, including the British troops garrisoned in India, was entirely funded by taxes collected by the Raj government. Were Whitehall to require the Indian military to defend imperial interests beyond the Subcontinent, it would be exceedingly difficult to fund such expeditions, thus funding would have to come from London. London was only too reluctant to provide this funding. As the situation stood, the 1920s and 1930s were very difficult economic times for Britain and the government was seeking to cut costs anyway possible. In fact, by forcing the Raj to foot the bill for the British troops serving in India, the British Army was able to remain larger than perhaps otherwise possible (Barua 1997, 247). The second argument made by members of the Raj was that force modernization of the Indian Army could sufficiently empower it to pursue a successful mutiny, as it attempted in 1857.
The threat of war in Europe and Asia radically altered the role of India in the scheme of imperial defense. To use political science vernacular, the threat of a two-front war created an environment of high perceived external vulnerability. As for external threats, three were forecast by the responsible parties in London. First, despite the military emasculation of Germany following the Great War, under the Nazis a vast war machine was built that threatened to conquer all of Europe. The particular danger to Britain and its empire from Germany was that of isolation of the metropole from its colonies. The thinking ran that if Germany were to pursue a successful campaign of U-boat warfare in the North Atlantic, London would be cut-off from its colonies. The second threat to Britain came from Italy. Should Britain have to combat the German navy in the North Atlantic, Italy could close off the Mediterranean and thus the Suez Canal, the quickest route between London and its empire in Asia, thereby allowing Germany and Italy to attack these colonies with near impunity. Finally, even though it was hostile to British intentions in Asia, Japan was not seen as an immediate threat so long as it remained mired in war on the Chinese mainland. As the threat of war in Europe became a reality in 1939 and Asia in 1941, both the German and Japanese threats came to fruition, with Germany conquering much of Europe and trying to isolate the British Home Island. For their part, the Japanese quickly conquered British possessions in South East Asia, right up to the border between Indian and Burma (present-day Myanmar) by 1942.

Set against these threats, there were few opportunities for the British to hedge against the growing threats to empire. The Anglo-French relationship had been strained for a variety of reasons during the interwar period and prior to the German annexation of
France in 1940, the French government was busy mobilizing for its own defense. The Commonwealth Countries could not be enlisted in support of London’s objectives as domestic crises were affecting these countries and the political control Britain once held over members of the Commonwealth had long since waned (Wainwright 1994, 12). Finally, the United States could not be counted upon either to support Britain (Wainwright 1994, 12). On the one hand, American foreign policy was strongly isolationist and directed at remaining aloof from power politics the world over. On the other hand, anti-colonialism was another plank in American foreign policy, making the United States particularly unwilling to help Britain defend its empire.

It was in this context of high perceived levels of external vulnerability that India’s role in imperial defense changed radically. As Wainwright observes, the strategic value of India for Britain as World War II loomed was the former’s workforce (1994, 13-14). This was so in two regards. First, echoing defense planners in London during the interwar years, Whitehall came to see India’s large population as a vast reserve force to supplement the British Army in Europe, Africa, and Asia (Wainwright 1994, 13). Second, India also had a relatively large and technically skilled workforce that could be used to create an arsenal for the British Empire east of the Suez and perhaps even supply the home island (Wainwright 1994, 13). It was precisely this resource, manpower, that the Chattfield Commission sought to make use of in defense of empire. To paraphrase Wainwright, Lord Chattfield sought to make India into an arsenal of empire (Wainwright 1994, 19-24).

3.2.2 State Power for Aeronautics Sector Development Under the Raj

As World War II exploded across Europe at the end of the 1930s, the colonial government of India was faced with a severe internal security crisis. Though the causes
of the Quit India Movement have deeper roots, the catalyst for this civil disobedience campaign was the unilateral declaration by Viceroy Linlithgow in 1939 that India would support Britain against the Axis Powers. From the vantage of Indian nationalists, involvement in the Second World War represented further unacceptable exploitation of Indian blood and treasure to serve the interests of the British Empire. The security crisis provoked by the Quit India Movement became severe enough that many of the nationalist movement’s most prominent leaders, such as Gandhi and Nehru were imprisoned for the remainder of the war. Additionally, the Indian Army and Air Force were both called out to put down protests (Omissi 1990, 47). This anecdote is worth mentioning here because it is symptomatic of the fragmented-multiclass nature of the colonial state of India. In what follows, I make use of the analytic construct, state authority structure to measure the power of the Indian state for aeronautics sector development prior to independence in 1947.

The Ideology of the Raj: The Role of the State in the Economy and Nationalism
The British took over India as a formal colony from the East India Company following the Mutiny of 1857 with two goals. First, Britain sought to maintain and expand its global power in an age of imperial expansion on the part of European powers (Kohli 2004, 229). Second, it sought to ensure the continued stream of profit accruing to British merchants and industrialists (Kohli 2004, 229). To facilitate these twin goals, the British embarked upon a near century-long state-building project that was incremental in nature, taking cues from changing political circumstances in India (Kohli 2004, 228). The key ideas which animated this project and limited the developmental potential of the colonial government in the broader commercial and defense economies, the aeronautics sector included, were ideas of liberal governance and laissez-faire capitalism (Kohli 2004, 231).
The latter idea limited the scope of legitimate government authority over the economy and the former allowed for elite-mass cleavages to develop over time that would contribute to the British decision to quit India.

Regarding the idea of laissez-faire capitalism, this dominant ideology reflected the widespread and accepted ideology in Britain at the time. By 1869, the Corn Laws had been repealed in Britain thanks to the economic and thus political ascendance of industrialists (Kohli 2004, 231). Consistent with this ideology, the British crown set up a government in India which was to be both limited in the scope of its authority and highly efficient (Kohli 2004, 231). Specifically, the British established a hybrid legal system that fused English common law with local Indian precedent by 1861 for the protection of private property (Kohli 2004, 231). Second, building on the professional and meritocratic civil service established by the East India Company prior to 1857, the British created the Indian Civil Service for the daily administration of Raj business, including policing and tax collection functions (Kohli 2004, 237-240). Finally, the British crown oversaw the reconstruction of a powerful centralized and apolitical military to secure internal order primarily, with the goal of ensuring that a mutiny such as that which occurred in 1857 never happened again (Kohli 2004, 235-236).

This limited colonial state had a relatively limited capacity for economic intervention by design. The key goal shared widely by the British elite that governed India from afar was a commitment to maintaining an open trading economy based on the principle of comparative advantage. Thus, it was unthinkable for the government to take an active role in the development of the Indian economy, let alone the development of a sector that would have been import competing as in the case of textiles or aeronautics.
During the Raj, the political alliance upon which the state was based shifted and as a result Kohli argues that the period of state-building between 1857 and 1905 can be split in two (2004, 230). From the establishment of the Raj in 1858 until approximately 1905, the key junior partner in the governing alliance with the British were the traditional and landed elites, many of whom ruled the more than 500 principalities, collectively called the “princely states” (Kohli 2004, 231-232). In exchange for a royalty paid to the Raj, the elites managed the affairs in their fiefdoms by and large as they saw fit. Yet, mindful of the limits to which these elites could be squeezed for revenue to support and finance the Raj, made clear in the events leading to the Mutiny of 1857, the ability of the central government to extract resources for anything beyond a laissez-faire state was severely constrained (Kohli 2004, 232). The importance of the these traditional elites in the ruling alliance would diminish as agrarian incomes stagnated and new sources of revenue became available to the British from import and export duties (Kohli 2004, 233). Nevertheless, this group remained incorporated in the ruling alliance (Kohli 2004, 233-234).

The second group to join the ruling alliance with the British and the traditional elites were the Indian nationalists. The key wedge issue that allowed this group to exercise political influence, sometimes more effectively than others, was the liberal ideology of the Raj. As the Indian National Congress49 (INC) developed beginning in the late-1880s, it came to be a well-institutionalized and democratically organized political movement capable of mobilizing and agitating for independence on an all Indian basis with increasing efficacy. Having been educated in London and in British institutions in

49 There were actually many Indian nationalist movements, for an overview, see Wolpert 2009, 258-273.
India, the elites that led the INC including Gandhi and Nehru did well to highlight for the British the chasm between their espoused political ideology of liberalism and the frequently despotic fashion in which India was governed. The efficacy of INC agitation for independence and its criticism of British despotic governance were key factors in the creation of elected legislative assemblies in provinces and the Central Legislative Assembly. Interestingly, while the Raj did not allow for the progressive “Indianization” of the Indian Army, the growth in the political power of the nationalist movement can be seen in the establishment of the Indian Air Force, which proudly boasts that it is the only service branch to be staffed from inception by both Indian officers and airmen alike (Chaturvedi 1978, 4).

The important point to be made about the Indian nationalist movement from the vantage of this dissertation is that the growth of its political power further limited the developmental potential of the Raj. The Indian nationalist movement generally and the INC specifically were a strong oppositional force to the colonial government and not a force that could be readily leveraged by the British to overcome domestic political hurdles to extraction or mobilization (Kohli 2004, 246-247). In fact, even as Europe erupted into war and on the eve of Japanese conquest in Southeast Asia, Nehru made clear that he believed India had no natural strategic enemy on which Indian blood and treasure should be spent (Kavic 1967, 23).

To summarize this discussion of ideology as it relates to state-led industrialization, particularly with regard to the aeronautics sector, one can say the ideology of the Raj decisively limited the developmental role of the state. First, there was intra-elite consensus among the British who ruled India prior to August 1947 that the
state had no role or business being involved in industrial development. This was doubly so in the defense sector, which could have provided Indians with the war materiel for a successful mutiny. Second, the political alliance upon which the Raj was based severely limited the amount of revenue the government could raise to run the government, let alone provide the resources for state-led development.

State Organization and Developmental Power
Consistent with the twin goals and ideology of the Raj, the “steel frame” of the colonial state in India, the civil service and military, were key limiting factors in the developmental power of the Raj. Though both the ICS and military were highly competent and thoroughly professional, neither possessed the competencies required for active state-led development in the civilian or defense sectors. Ironically, it was the definition of a professional civil bureaucracy and military that limited the developmental potential of the state.

Much has been written of the quality and professionalism of the ICS. Kohli notes that even those scholars that are avowed nationalists are amazed at the sheer efficiency and capability of the ICS and its officers (Kohli 2004, 237). There are several factors that explain the high quality and capacity of the ICS. First, entrance into the ICS was through an exam-based merit system (Kohli 2004, 238). For much of the near 100-year duration of the Raj, the Britishers who entered the ICS were men educated at Oxford and Cambridge, in London. Later, even as the “indianization” of the civil service occurred, in part owing to nationalist pressures, arrangements were made so that the civil service exam was routinely offered in New Delhi as well as London. Additionally, just as the Britishers who entered into the ICS were some of the best educated men in England, the Indians who entered the ICS were similarly well-educated. These Indians were educated
not just at elite universities in Britain, but in British-built institutions of higher learning in India. Thus, by means of an exam and a high quality education, all those British and Indian alike, who became ICS officers had a similar set of competencies.

The second key factor explaining the high quality of the ICS was its strong esprit de corps (Kohli 2004, 238). Not only was recruitment to the ICS limited effectively to highly educated individuals with demonstrated competencies via a rigorous exam, training and promotions helped foster the development of a strong set of internal norms among ICS officers. With regard to training, it was largely guided by senior staff officers on the job that facilitated a passing down of norms and values of public spiritedness and rectitude. Additionally, junior ICS officers were further socialized and internalized the norms of the ICS by means of a tightly controlled and centralized promotions process. Just as in militaries, those who do not pass muster do not get promoted, while those who do move up eventually influence the future of the organization.

The third and final reason of importance regarding the competence and professionalism of the ICS was its relative isolation from society (Kohli 2004, 238). The process of entry and promotion helped create an organization with great prestige set apart from society and limited the political influence interest groups in society could have over policy and the day to day business of state. That isn’t to say that corruption did not exist in the ICS; it did. But the core of the ICS at the apex of the state prevented corruption from becoming widespread and pervasive.

From the standpoint of the developmental efficacy of the ICS, its Achilles heel lay in the definition of professionalism (Kohli 2004, 238). ICS officers were highly skilled generalists. That is to say, they were trained and promoted based on their general ability
to manage any administrative problems that arose. To be sure, these were not the skilled technocrats found in developmental states. Again, the difference was in the training. Whereas the ICS were skilled generalists capable of highly efficient administration in a laissez faire capitalist state, technocrats had a highly specific skill set and competence in a given field of expertise, such as the aeronautics, rail, or banking sectors of an economy. Such skills were simply not valued nor rewarded in the British civil service or the ICS.

The gulf between the skills required of a developmental bureaucracy and those possessed by the ICS can be seen in efforts at wartime mobilization in India. Following the entry of the United States into the Second World War, some three years after the Chatfield Committee Report had been drafted, approved, and was being implemented, little of value had been accomplished in terms of civilian or defense industrialization. When the American Grady Commission arrived to assess the progress of wartime mobilization in India, the report issued by this committee noted that whereas fordist assembly was required to make India an arsenal for Britain and the Allies, what passed as factories were in reality jobbing shops (Wainwright 1994, 26-27). The ICS simply lacked the requisite capabilities to engage in the sort of widespread industrialization envisioned by the Chattfield Committee Report. That is to say, the ICS lacked the knowledge of how to setup, run, and manage modern factories.

For its part, the Indian military was in little better position to be an agent of development and for the same reason as the ICS; the definition of professionalism. When the British crown took over governance of India one of its key goals was to prevent another mutiny, such as that which took place in 1857. To that end, the British made several changes to the Indian military built by the East Indian Company, in the end
creating a large and apolitical military. Building upon the work of Stephen Cohen (1971), one of the foremost authorities on the Indian military, Kohli points to five key changes the British made to the military to assure not only its efficacy, but its loyalty too (Kohli 2004, 235). First, the British changed the recruitment pattern to reflect the martial race theory. Second, the number of British officers was increased relative to the number of sepoys. Third, ethnically homogenous units became the norm across the Indian Army and regiments were maintained in their regions of origins, though separate from the civilian population. Fourth, officer training for Indians was initially limited and centralized at Sandhurst. Though later, as the British opened military academies in India, officers were trained domestically too. Finally, command of the military was centralized in New Delhi.

Professionalism in the Indian military, or its apolitical nature was its Achilles heel as was true of the ICS. Whereas the new professionalism described by Alfred Stepan and typified by the Brazilian military was developmental in nature, the apolitical professionalism of the Indian military was the paradigmatic example of Huntington’s professional military. To be more precise, the reforms introduced by the British to create a loyal military ensured that those who served in it were specialists in organized violence, controlled by civilians. The concern of the officers and men in the service of the Raj was not national development, but military efficacy. Notwithstanding complaints by some in Whitehall about the backwardness of the Indian military because of its poor showing in Mesopotamia during the Great War, the Indian soldiers and those who commanded them

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50 The “martial classes” was a system of racial recruiting designed by the British after the 1857 mutiny to ensure the political loyalty of the military and was legitimated by the idea that some groups in India were simply better suited for military service than others. See Wilkinson (2015, 42-52). See also Cohen (1971, 45-56)
proved to be highly effective during the Second World War when pitted against the German war machine in North Africa, among other theaters (Barua 1997, 256-258). Additionally, in their primary role, that of ensuring domestic peace in India, Kohli notes that the threat of armed intervention by the military was usually sufficient to preclude its use (Kohli 2004, 235).

For their part, the Indian Air Force (IAF) was similarly limited in its potential to act as an agent for the development of the aeronautics sector. Established by the Skeen Committee in 1925, the IAF’s history is somewhat different than that of the Indian Army (Lal 1986,11). From the start, it was manned almost entirely by Indian officers and airmen (Chaturvedi 1978, 3-4). The officers were trained at the Royal Air Force (RAF) flying school at Cranwell and saw service immediately in the NWFA flying air substitution missions. That is to say, the IAF was charged with patrolling the NWFA to police tribal insurgents instead of ground troops (Chaturvedi 1978, 3-4). Airmen were recruited to perform the requisite maintenance and upkeep in IAF aircraft from railroad factories, as there was no aeronautics sector to speak of. These airmen were subjected to harsh military discipline and were required to maintain near 100% combat readiness of IAF aircraft (Chaturvedi 1978, 3). The rigorous training and isolation from Indian society surely served to help maintain the apolitical professionalism of the IAF as it did in the army (Chaturvedi 1978, 6). Proof the IAF’s apolitical professionalism can be seen by virtue of the fact that the Raj relied not only on the army to help disperse protestors associated with the Quit India movement, but the IAF as well.

Subsequently as the Second World War erupted and the Japanese threat loomed ever larger on the horizon, the IAF was dramatically and rapidly expanded from two to
ten squadrons. Recruitment was dramatically expanded with the creation of the Indian Volunteer Air Force Reserve (IVAFR). The IVFAR sought to recruit all people in India, expats and Indians, with a civilian pilot’s license. Yet the rigors and the brisk operational tempo of wartime flying helped prevent the politicization of the IAF. Rather members of the IAF were pressed into new missions including the full gamut of air operations (reconnaissance, close air support, and interdiction) apart from air superiority, which the IAF was ill-equipped for against the Japanese.

The key point to be made here with respect to the IAF is that their professionalism was traditional. IAF officers and airmen were concerned of necessity with the effective application of organized violence and the requisite maintenance of their aircraft. IAF recruits were not selected because of their skills as aeronautical engineers, but because they could fly, fight, and perform maintenance. Throughout the course of the Second World War, the IAF performed so well in its various missions that in addition to various personal and unit commendations, it also came to be referred to as the Royal Indian Air Force; a title given only by the British crown. The IAF would continue to be referred to as the RIAF until shortly after independence.

One further point should be made with regard to the impact of apolitical professionalism on the Indian military and the IAF. Specifically, the officers that were educated, trained, and served the British in the Indian military developed a preference for top of the line, cutting-edge military hardware, or a British mentality in the words of Patrick Blackett. Though no precise explanation of this mindset has been suggested, one can posit two plausible hypotheses. First, the Indian military created by the British was a

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great power military fielded by a British colony. Thus, trained and indoctrinated in a
technology-centric method of warfare, the Indian officers preferred capital-intensive
rather than labor-intensive warfare, necessitating world class weapons. Second, one
could posit a relative deprivation hypothesis. That is to say, having been deprived of
modern weapons for nearly the entirety of crown rule for fear of mutiny, officers of the
Indian military and IAF specifically became covetous of weapons technology
continuously denied them by their colonial master.

The discussion of the limited potential for the pillars of the colonial state, the ICS
and the military, to play a developmental role can be summarized as follows. Though
both the ICS and military were highly professional, public-spirited, and competent state
institutions, their developmental potential was limited given how the competencies of
these institutions was defined. As was discussed, professional civil servants were
talented generalists not the technocrats found in developmental states with industry
specific knowledge. Thus, when required to engage in civil and defense industrialization
to contribute to the war effort during WWII, they were ill-suited to setup or run factories.
For their part, the military, including the IAF, was professional insofar as it was
apolitical, specializing in the organized application of violence only. Such specialization
was to the exclusion of other competencies such as engineering skills or other technical
education commensurate with defense or aeronautical development. Thus, ironically it
was the very high level of professionalism in the political context of British India that
precluded key state institutions from playing a role in the mobilization for WWII.

State-Society Linkages
The virtual non-existence of state-society linkages between either the state and capital or
the state and labor also served as a break on the developmental capacity of the state. The
relative absence of such linkages was in large part a function of ideology. Consistent with the laissez faire capitalism practiced in India, it would have been inconceivable for the Raj to forge links with capitalists to facilitate development in any sector, let alone an import competing sector such as aeronautics. It is important to bear in mind that at this time, virtually all aircraft flown by civilians and the military in India were imported, primarily from Britain. Moreover, the sort of labor discipline found in communist or fascist governments was at odds with both the liberal ideology of the British and Indian nationalists. This isn’t to say that leftist labor organization didn’t happen. Rather, these were minor features in an otherwise non-existent relationship between the state and society.

3.2.3 State Support for Aeronautic Sector Development
A. Martin Wainwright (1994) argues that British money and American know how bequeathed to India a robust defense industrial base capable of meeting Indian defense needs following the Second World War and independence. As noted above, the catalyst for defense industrialization in India was the Axis threat. On the one hand Britain agreed to finance the creation of an Indian defense industrial base in order to defend the eastern empire, which by 1942 had become seriously threatened by Japan, bringing the war directly to India’s western border. On the other hand, the United States sent the technology and manpower to develop India’s defense industry in support of its war against the Japanese in the Pacific. Though the lion’s share of effort in terms of defense industrialization was focused on the needs of the Indian army, a substantial effort was made to develop the aeronautics sector as well. So consequential and successful was this effort at developing an aeronautics sector that in the early years of independence, American intelligence estimates of India’s aeronautics sector were rather optimistic,
making the point that, “if materials, supporting contractors, and technically skilled labor were available, the Hindustan Aircraft factory would have the capacity to produce 500 combat aircraft per year” (Wainwright 1994, 51). The goal of this section is to illustrate how British and American contributions to the Indian aeronautics sector supported development prior to independence.

As alluded to in Section 3.2.1, as the clouds of war gathered in Europe in the late 1930s, the British invited the first lord of the admiralty, Lord Chattfield, to design a plan for defense industrialization in India. The goal of such an effort was to leverage seemingly endless Indian manpower to transform India into the arsenal of empire in the east. The Chattfield committee plan was the result of this effort and it outlined an ambitious program of industrialization centered on the defense industries, as well as the crucial supporting industries such as the steel industry. A crucial point here to be made is that the British Indian government could scarcely pay for the administration of the colonial government and the maintenance of the peacetime Indian military on domestically generated revenue, let alone the ambitious plans laid out by Chattfield. This was a point that both the viceroy, Lord Linlithgow, and the senior most leader of the Indian military, General Aulinchek, made in objection to the British government’s plans (Wainwright 2004, 17-18). The outbreak of the war made financial considerations of the utmost importance to resolve between London and New Delhi.

The necessities of imperial defense forced a financial settlement between the British Treasury and the Raj government in New Delhi. Wainwright summarizes the terms of this financial settlement as follows:

Under the settlement India bore responsibility for payment of (1) a fixed sum representing the cost of the army in India under peacetime conditions (Rs 367.7
(2) a supplement to allow for inflation; (3) the cost of military measures undertaken by India solely in its own national interests; (4) Rs. 10 million toward the initial maintenance cost of Indian forces overseas. The one remaining issue was the disposal of stores transported to India during the war. The British government anticipated that difficulties might arise in distinguishing between those items used in the imperial war effort and those used purely for the immediate defense of India. It therefore agreed to cover the entire cost of stores brought into India during the war, provided that negotiations about the cost of surplus supplies would take place after the end of hostilities (Wainwright 1994, 19-20).

This financial agreement mollified the colonial government and facilitated the execution of the Chattfield plan in India.

While this agreement made possible the Chattfield program, it also encumbered Britain with nearly the entire cost of the Indian contribution to the war effort, a debt which became quite considerable. The Chattfield plan had originally committed £34 million for India, of which £4.66 million was dedicated to the air force, yet under the financial settlement reached between London and New Delhi greatly expanded the scope of British financial responsibility (Barua 1997, 246). Specifically, “The British government was now committed to the Chattfield program as well as any expenses of strategic concern to Whitehall incurred by the government of India” (Wainwright 1994, 20). As defense expenditures rose precipitously during the Second World War the result of the financial settlement had the effect that, “The [British] Treasury paid for India’s contribution to the war effort by transferring sterling from its account in the Bank of England to the government of India’s account in the London branch of the bank of India” (Wainwright 1994, 20). As a result, whereas Britain had long been a creditor of the Indian government, now it rapidly accumulated a large sterling debt to India, which would have to be paid after the war and independence.
The details of how the United States came to provide the technology and managerial skills for Indian defense industrialization are somewhat complicated and relates to the unfolding of events in the Second World War. To simplify, the fast pace of events in the European and Pacific theaters of the war forced the British to agree to the American-led defense industrialization on the Subcontinent. The original plans for Indian defense development envisioned that WWII would proceed as had the Great War. That is to say, the power best able to mobilize its economy for war would ultimately be the victor. Based on this assumption, Britain sought to mobilize not only the home economy, but that of its colonies and the dominions as well. Both Churchill and Lord Linlithgow believed that even if British industry were crippled, Britain could be supplied by the defense industries of its colonies and dominions. In the extreme, the colonies and dominions could carry on the war against the Axis powers even if the home island could not. Yet, the swift annexation of France in 1940 by the Nazis and the collapse of the eastern empire at the hands of the Japanese by 1942 robbed the Chattfield program of valuable British inputs for defense development in India. The capital equipment and the personnel skilled in its use could not be spared by the home island for defense industrialization in India.

Thus the realities of war forced the Americans to help develop the Indian arsenal, transforming it from an arsenal of the British Empire into one of the Western Alliance (Wainwright 1994, 24-29). American involvement in Indian defense development in general had two key facets. First, was the creation of Lend-Lease Aid from the U.S. directly to India, which is not of particular interest for the present project save for the fact that Britain incurred further financial responsibilities for Indian defense industrialization
as a result of the decisions of the Lend-Lease Committee (Wainwright 1994, 28). The second key aspect of American involvement in defense industrialization in India was the provision of capital equipment and technical competence to India from the United States. Such support was forthcoming because of the findings of the Grady Commission. Specifically, the Grady Commission report was highly critical of British efforts at wartime mobilization in India (Wainwright 1994, 26-28). With specific regard to efforts made at conversion of civilian industries for wartime production, the report noted that the government had scarcely organized more than “jobbing shops,” instead of well-organized and managed modern factories. Though the British were somewhat critical of the findings of the Grady Commission, its conclusions were accepted and American assistance was lent to the defense development of India. The key implication of this facet of American support for defense industrialization in India was that it limited the role the British would play in subsequent efforts at mobilizing industry for the war.

As far as development of the Indian aeronautics sector is concerned, American assistance had its roots in the realities of the war as well. Prior to the Second World War, nearly every single aircraft flown in India was imported mostly from Britain, but France as well. It was during this period that New Delhi made a $10 million loan to a nascent industrial venture in Bangalore to help develop the Indian aeronautics industry (Wainwright 1994, 50). Wainwright notes of Hindustan Aircraft Company that it was, “a combined enterprise by Walchand Hirachand of Bombay, a company that had previously been interested in the assembly of motor vehicles, and the Mysore government” (Wainwright 1994, 50). However, “it was the intervention of an American businessman, D. Pawley, who first encouraged the venture to fill the gap left by the Japanese closure of
his aircraft factory in Loiwing, China, before the Pacific war began” (Wainwright 1994, 50). Prior to the war, Pawley’s Chinese factory had supplied the Kuomintang with aircraft and he the intention that the Hindustan Aircraft Company would do the same (Wainwright 1994, 50).

The possibility that the Hindustan Aircraft Company in Bangalore could be a valuable tool in the Western Alliance’s Pacific arsenal became a reality in 1942. In particular, the successful production and test flight of the Curtiss-Hawk P36 single-seat fighter monoplane highlighted the value of the incipient Indian aeronautics sector. As a result of the successful flight of the P36 prototype, “the United States army air force named the Hindustan Aircraft Company’s aircraft factory as its major maintenance base in the Far East for the overhaul of heavy and light bombers (Wainwright 1994, 50-51). The Indian government subsequently nationalized the firm and its management was overseen by the U.S. military throughout the war (Wainwright 1994, 51). Following the war, the Raj government maintained control of Hindustan aircraft company (Wainwright 1994, 51). The important point to be made here is that the wartime experience of the Hindustan Aircraft Company in overhauling U.S. aircraft was crucial to its evolution, as it gave employees of the firm firsthand knowledge of how to manage an aeronautics firm and the capital stock to do so.

The technical competencies and physical plant acquired by the Hindustan Aircraft Company gained during the war made it the backbone of the Indian aviation industry. Speaking to this point, Wainwright notes that following the war:

The fleet of the newly formed Air India was based entirely on surplus Dakotas, originally intended for use as transport planes. Hindustan Aircraft acquired the sole responsibility for refitting these planes for civilian use. Its tasks involved the overhaul not only of the Dakota’s bodies and engines but also of their radios and
guidance systems. The American firm, Douglas, authorized the factory as its service center in early 1947. The government of India added a full engineering and design department in spring 1947, and the Royal Indian Air Force (RIAF) delivered some Tempest fighters for overhaul. India became an aircraft manufacturer on a regular basis when full-time production began on the Percival Prentice trainer aircraft on 30 April 1949. The factory’s machine shop manufactured all the parts for the Percival Prentice, except its engine (Wainwright 1994, 51).

It was on the strength of these accomplishments that American intelligence analysis, noted earlier, were so optimistic about the future of the Indian aeronautics sector.

Additionally, it should be noted that following the war, the government also had Hindustan Aircraft Company produce railroad cars to help retain its skilled workforce, helping insulate it from declining defense production.

3.2.4 Summarizing the early Indian Experience with Aeronautics Sector Development

In concluding this section of Chapter 3, which has focused on India, it is useful to reiterate several points made in this section. First, the strategic context of India changed dramatically in response to new threats arising to the British Empire, which were the catalyst for Indian defense and aeronautics sector development. Specifically, whereas the primary mission of the Indian military had historically been to ensure law and order, thereby facilitating commerce, threats to the British Empire made incorporation of Indian resources an important component of imperial defense. In fact, because of its skilled workforce and large population eligible for military service, planners in Whitehall sought to use India as an arsenal to defend Britain’s eastern empire. Defense industrialization plans called for the mobilization and expansion of Indian industry, including crucially the aeronautics sector.

The second key point to emphasize is that the colonial government of India, the Raj, had little power to act as an agent of defense development. The organizing ideology
of the Raj administration was that of political and economic liberalism, leaving the state a relatively limited role in economy. Additionally, while the Raj government could count on an apolitical military to provide law and order, the unilateral declaration of war against the Axis by Viceroy Linlithgow and the failure of the Cripps Mission served to put further strain on an estranged relationship between the colonial administration and the Indian nationalist movement, and the Bengal famine that was believed to have resulted from wartime mobilization meant the Raj government could not hope to use some form of state-sponsored nationalism to rally political support for the war effort. Moreover, consistent with the organizing ideology and goals of the British, neither the civilian bureaucracy nor the military possessed the requisite knowledge to manage factories. In the case of both institutions, they had been constructed along the lines of British ideas regarding professionalism, yielding highly skilled administrators in the bureaucracy and an officer corps which was skilled in the application of organized violence.

The third important point to reiterate is that the substantial level of defense development achieved during the Second World War was the result of British and American capital investments. For their part, because of the financial settlement made between London and New Delhi to gain the support of the government in the latter for the Chattfield program, the British were financially responsible for nearly the entirety of the military industrialization effort. With regard to American support, this came in two forms. On the one hand, the U.S. supplied capital equipment for expansion of defense industries, including the aeronautics sector. On the other hand, American management of defense production during the war transformed factories from “jobbing shops” into relatively modern factories. With specific regard to the aeronautics sector, the Hindustan
Aircraft Company was a venture that was encouraged to pursue aircraft production by an American, gained equipment and experience for the production of aircraft in its role as the overhaul and maintenance facility for the U.S. Army Air Corps’ heavy and light bomber forces in Asia. In no small measure, American support was perhaps the key factor in the creation of a viable aeronautics industry following the war.

Given the preceding summary of the data presented in this chapter, what can one say with respect to the argument that levels of state power determine levels of defense development achieved? Simply put, following the Second World War, there existed an aeronautics industrial base with great potential. This was not the result of the strength of the colonial state in India, but the intervention of the metropolitan power ruling India and the United States. Given the fact that India had no aeronautics sector prior to the Second World War, the low level of state power of the Raj government would have prevented it from being an effective agent of defense development. Nonetheless, the reality is that India was not an independent power prior to August 1947 and the convergence of British and American interests during the war made possible such a development.

3.3 Comparative Insights and Theory Testing
I conclude this chapter, by summarizing the data presented in two key ways. First, I seek to summarize the baselines of state power for defense development in Brazil and India, for the purpose of within and cross-case analysis in later chapters. This presentation of stylized facts regarding the Brazilian and Indian cases serves additionally to highlight critical antecedents that are the starting points for observed divergence presented in subsequent chapters. Second, I provide a limited assessment of the relative theoretical utility of the novel hypothesis offered in this dissertation.
3.3.1 Baselines of State Power for Defense Development

What were the relative levels of state power for defense development in Brazil and India prior to the moment of national political consolidation? Regarding the Brazilian case, the discussion in Section 3.1 of this chapter, highlights the fact that the capacity of the state for defense development was extremely limited. This was so because the level of external vulnerability was not sufficiently high to induce deep organizational changes in the structure of state authority in Brazil. With respect to external vulnerability during the Old Republic, consistent with Resende-Santos’s findings, while there was a high level of perceived external threat, Brazilian policymakers also had solid external balancing opportunities. On the one hand, Brazilian elites were very concerned by the possibility of war with a militarily stronger Argentina. On the other hand, implicit alliances with Chile and then the U.S. served to blunt the impulse for emulation. In addition to these alliance partners, weapons and the associated production technology, and military training were all available from France and Germany. As for emulation in the realm of military airpower, no strong incentives were found. Airpower was a sufficiently novel innovation in warfare that no real model for emulation existed and Argentina only began building an air force toward the end of the period under consideration.

The consequence of these limited structural incentives for emulation was limited state power for defense development, defined in terms of the state authority structure of the Old Republic. First, ideology severely limited the power of the state for defense development. On the one hand, the dominant laissez-faire economic ideology of the political class from 1889-1930 strictly curtailed the scope of state intervention in the economy, even in the defense sectors, leaving development in the hands of private capital. The only time the state would intervene to facilitate defense development was to
provide technical assistance. On the other hand, there was little in the way of nationalist sentiment that could be utilized to extract and mobilize resources for defense development.

Second, the key institutions of the state lacked the sort of technocrat experience required to pursue defense development. Specifically, in neither the federal bureaucracy nor in the officer corps did there exist a cadre of individuals that had the requisite education and experience to create coherent and long-term defense industrial policy or to provide technical assistance to private industry, should it be required. Moreover, such attempts at emulation as were observed, namely efforts to import elements of the German and French military systems, were geared toward creating a more professional officer corps, meaning specialists in the use of violence for political ends, not technical specialists. These two factors, ideology and state organization, discussed in Section 3.1.3, led to the lackluster results observed in Brazilian efforts to modernize the army and navy arsenals, as well as the effort to create a munitions plant during the Old Republic.

Turning to the Indian case, discussed in section 3.3, here too I observed limited domestic capacity for defense development, yet substantial aeronautics sector development did occur. The driving force for defense development was WWII. Specifically, confronted with the rise of the Axis powers, Britain was confronted with high levels of external vulnerability. Regarding external threats, London feared the consequences for empire if Nazi Germany and fascist Italy cutoff the home island from its far eastern reaches. Additionally, the lightning quick advances of imperial Japan resulted in the loss of British territory and brought the war in the Pacific to India’s eastern border. Set against these threats, Britain had limited opportunities for external balancing
among the industrialized nations; France fell quickly to Germany, the Commonwealth system was strained and these countries were grappling with economic turmoil, and U.S. foreign policy was strictly isolationist and had an anti-imperial bent prior to December 1941. Owing to its large military age population and relatively high skilled workforce, India offered the only possible avenue for external balancing against the Axis. Thus, Whitehall sought to make India the arsenal of the empire east of the Suez Canal.

Notwithstanding the structural imperative of external vulnerability in the late 1930s and 1940s, India was relatively fallow ground for British internal balancing. This was so because the power of the Raj for defense development was extremely limited. The key ideological factors limiting the Raj’s power for defense development were its economic ideology and the conflict between London’s imperial interests and those of nationalist elites. As for economic ideology, up until the eve of the Second World War, the British Colonial government in India pursued a strictly hands off approach to the Indian economy, consistent with the doctrine of laissez faire dominant at the time in London. Additionally, Lord Linlithgow’s failure to seek the consent of the Indian people before declaring war against the Axis powers infuriated the INC, making it difficult to extract and mobilize Indian resources for the war effort.

Consistent with the aims of the London, the Raj also lacked the institutional wherewithal to support defense development. The ICS was surely a consummately professional organization, however ICS officers were trained as generalists, making them well suited to tackle administration, not industrial development. For its part, the Indian military, including the air force were also highly skilled specialists, though in the use of violence for the political ends of the Raj. Thus, in both the case of the ICS and the
military, there was no group of individuals with the skills to undertake state-led defense development.

Such defense development as did occur in India during WWII took place despite the Raj’s weakness for such an endeavor. Because of shared strategic concerns, the British contributed the financial capital and the Americans the human capital to make defense development in India a reality. Looking at the aeronautics enclave specifically, the British paid for and the Americans created an aeronautics industrial base that made India a fourth-tier producer of aircraft upon independence. Moreover, the sterling credits accrued by India would be an important external balancing opportunity for India after independence.

In addition to establishing baselines of state power for defense development, the material in this chapter tells the reader something about future outcomes as well. Implicit in these accounts of the Brazilian and Indian cases are the critical antecedents, which help explain the outcomes in terms of state power following the critical juncture, discussed in the next chapter. Specifically, it is important to call attention to the institutionalization of the political system during the period considered in this chapter. In Brazil, the political system was highly fragmented along state lines, meaning that national political parties represented parochial state, rather than national interests. In seeking to create a truly national state after 1930, Getúlio Vargas would have to contend with these regional forces and enlisted the military to impose his vision of a modern Brazil, in part accounting for the authoritarian character of the Estado Novo. In India, under the tutelage of British imperialism, a cadre of nation-builders emerged in the INC that valued and had become habituated to democratic process, in part explaining the creation of a
democratic India following independence. As will be discussed in Chapter 4, these regimes would come to possess very different levels of power for state-led defense development.

3.3.2 Theory Testing
How does the neoclassical realist theory of defense development set forth in Chapter 2 do in explaining these divergent outcomes? In short, the alternative theory of defense development proposed in Chapter 2 does very well to explain the divergent outcomes observed in the Brazilian and Indian cases. The key point to focus on is that military emulation is by definition not possible in a non-sovereign state, such as India was during this time period. Defense development during the Second World War in India is an example of defense development by imposition and in pursuit of broader strategic goals by a colonial power. Nonetheless, bearing in mind the fact that the colonial administration in India had relatively high degrees of autonomy from London, the Indian case almost resembles a case in which a state has solid external balancing options. That is to say, despite its colonial status, the India case prior to independence mimics some of the features of West German or Japanese re-armament during the Cold War. In both of these cases, the respective governments were heavily politically dependent on the United States and benefited tremendously from the contribution of American inputs to their war industries following WWII.

Regarding existing theories of defense development, there is little evidence to confirm or falsify any of these theories, except perhaps the neorealist theory of defense development. This evidence comes from the Brazilian case. The neorealist theory of defense development suggests that as threats increase the rationality of defense industrial policy will increase. Yet, looking at the case of Brazil this was manifestly not the case.
As was noted, the relationship between Argentina and Brazil included several cycles of arms racing and policymakers in Rio de Janeiro thought on more than one occasion that war with Argentina was not only likely, but imminent. This would have been the ideal situation to find evidence confirming the neorealist theory of defense development laid out by Hoyt, yet quite the opposite is found. The rationality of Brazilian defense industrial policy during the Old Republic, such as it existed, was tempered by concrete ideas about the role of the state in the economy, a lack of skilled personnel to engage in a process of defense industrialization, and the vagaries of domestic politics. Though a need was seen to develop domestic defense industries in Brazil, one could hardly say that the policies pursued to that end were rational.
Chapter 4: The Origins of Aeronautics Enclaves

The core proposition of this study is that levels of external vulnerability and state power at the start of the path dependent process of defense industrialization are key determinants of the success of that process. Specifically, external vulnerability is theorized to drive increases in state power, making the state a more effective agent of defense industrialization. To this end, in this chapter I seek to highlight the impact of differing levels of external vulnerability and state power at the first of two strategic junctures in the cases of Brazil and India recognized as the impetus for emulation, specifically defense development, and the origins of the aeronautics sectors in both countries.

The divergent development trajectories of the Brazilian and Indian aeronautics sectors can be traced to the mid-twentieth century. In Brazil, military threats were seen at both the regional level in Argentina and Paraguay, as well as at the broader international level in imperial Japan, Nazi Germany, and Mussolini’s Italy. Making each of these threats more menacing was the fact that Brazil’s only opportunity for external balancing either against regional or extra-regional threats was limited to the United States, which had proven itself an unreliable partner in balancing regional threats. The United States was not only seen as an unreliable alliance partner; it was seen as the foremost threat in terms of another source of external vulnerability: economic imperialism. In particular, the asymmetric economic relationship between Brazil and the United States led nationally minded Brazilians including Vargas and important members of the officer corps to worry about the potential of American business interests to gain political influence in Brazil as had the British during the Old Republic. Thus, during the Estado
Novo and the nominally democratic period that followed, state support was used to foster the development of strategic industries, the steel and petroleum industries are two frequently cited examples, as well as the domestic aeronautics industry.

In stark contrast to Brazilian elites, Indian elites believed that India existed in a relatively benign strategic environment, retarding the modernization of the aeronautics industrial base inherited from the Raj. With regard to external threats, despite the fact that Pakistan and India went to war in October 1947, Indian elites perceived no existential threats to Indian survival; India was without question the regional hegemon in South Asia. Thus, Nehru crafted a grand strategy designed to keep India aloof from the emerging Cold War, as significant arms procurement and defense industrialization were thought to be a drain on the process of economic development. Additionally, Indian elites attempted to balance the economic power of both the Eastern and Western Blocs through the creation of a nonaligned movement of newly independent colonies, stressing the importance of support from the developed countries to developing countries to help make all prosperous. Ultimately, between the late 1940s and early 1960s, the importance of defense industrialization, as well as the modernization and expansion of the existing aeronautics industrial base became priorities first because of the fact that Pakistan had acquired modern American military aircraft. And second, because Indian elites came to the realization that to effectively lead a nonalignment movement, a defense industry was necessary to supply military aid to African and Asian countries, lest they turn to either the Soviet Union or the United States.

This chapter will be structured, as was the preceding chapter, around the Brazilian and Indian cases. The discussion of each will be comprised of the following three focal
points. First, elite assessments of external vulnerabilities will be discussed. Second, the impact of external vulnerabilities on state power following the moment of national consolidation, my first strategic juncture, will be discussed. Third, state support for the aeronautics sector will be discussed. The chapter will conclude with an analysis of the empirical evidence presented in both cases.

4.1 The *Estado Novo* and the Brazilian Aeronautics Sector
The *Estado Novo*, the moment a truly national government emerged, was a political response to two key crises the Brazilian political elites confronted in the 1930s. The first of these crises was the collapse of the Brazilian economy in the wake of the global recession following the U.S. stock market crash in 1929. The ineffectual response of the hyper-federal Old Republic to the collapse of the Brazilian economy led to the overthrow of this regime in the Revolution of 1930. Far from a social revolution, the Revolution of 1930 ushered in a period of political turmoil that saw Getúlio Vargas adroitly leverage personal alliances, institutional reform, and the support of the military to create a powerful national state capable of articulating and pursuing national interests. In crushing political opponents, expanding and professionalizing the bureaucracy, and the creation of corporatist labor relations, Vargas and the supporters of this new state sought to create the political stability and state support believed necessary to facilitate rapid industrialization with strong state support. Rapid industrialization was believed to insulate the Brazilian economy from future economic shocks.

The second crisis confronting the Brazilian political elite during the 1930s was strategic. While Vargas and the military were centralizing power in Rio de Janeiro as

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52 In summarizing the collapse of the Old Republic and the process of consolidating a modern national state, I drew heavily on Flynn (1978, Chapter 4) and Skidmore (2007, 3-9).
opposed to the capitals of states such as, São Paulo and Minas Gerais, international
political conditions were substantially deteriorating at the regional and extra-regional
levels. During the São Paulo Civil War (1932), the Chaco War between Bolivia and
Paraguay broke out and given Paraguay’s historically close relationship with Argentina, a
Paraguayan victory threatened to shift the regional balance of power decidedly in
Argentina’s favor. At the broader international level, the rise of revisionist powers in
Asia and Europe during the 1930s and their search abroad for natural resources to fuel
their economies concerned Brazil’s civilian and military elites. While concerns about the
regional balance of power in South America and attempts to develop Brazil’s arms
industry in response were nothing new, the rise of resource hungry revisionist powers
was new and sharpened the push for defense development. In the absence of well-
organized political parties, political support for Vargas and the Estado Novo was
critically dependent on the dispositivo militar, or military support. Appreciating their
political leverage, Generals Góes Monteiro and Eurico Dutra leveraged their political
power to extract a promise from Vargas to begin military industrialization; a promise
Vargas made good on.

To be clear, given the extreme underdevelopment of heavy industries and lacking
a solid science and technology base, the prospects for military industrialization in the
1930s was low. This was a reality that Vargas, Monteiro, and Dutra all recognized.
Thus, to defend Brazilian national interests, two measures were taken. First, Brazilian
foreign policy sought to approximate that of the United States to balance against regional
and extra-regional threats. Second, the state was used to foster the development of heavy
industry, as well as a science and technology base, so that over the long-term a Brazilian
defense industry could be built. As McCann suggests and others have noted, this was the first recognition the relationship between defense and development that would inform the doctrine of the *Escola Superior de Guerra* in the 1950s (Hilton 1973; Flynn 1978, 88; McCann 2004, 354).

In practice, this incipient defense and development doctrine resulted in the Vargas government targeting specific strategic sectors for development, including the aeronautics sector. In terms of the development of the *Industria Aeronautica Brasileira* (IAB), no large scale or direct intervention on the part of the government was used to support this nascent sector between 1930 and 1962. Rather, several institutions were created based on foreign models, which would provide key demand- and supply-side support for the development of the aeronautics sector from the 1970s and through the early 1990s. These institutions formed the core of the aeronautics enclave and includes the Ministry of Aeronautics, the *Força Aerea Brasiliera*, the *Instituto Aeronautica Tecnico*, and the *Centro Tecnico, Aeronautica*.

In what follows, the key goal is to establish a link between levels of external vulnerability and emulation in Brazil in the period from 1930 to 1945. It is during this period that the institutional foundations of the IAB were created. To this end, elite perceptions of external vulnerability will be discussed, followed by a discussion of the shifting state authority structure between 1930 and 1945, as it relates to the aeronautics sector, and finally state support for the aeronautics sector from 1945 through the early 1960s will be discussed.

4.1.1 External Vulnerability: National Security and the Development Imperative

Between the Revolution of 1930 and the end of the *Estado Novo* in 1945, Brazilian foreign policy principals and the military perceived external threats to stemmed from two
key sources: regional rivals and revisionist extra-regional countries. First, as always, within South America, there was the threat of war with Argentina or the threat that a war among the smaller countries might lead to a confrontation between Argentina and Brazil. Indeed, at the same time as Brazil was confronting a protracted civil war in São Paulo, two wars erupted on Brazil’s borders, causing great alarm for Brazilian policymakers. Fought between 1932 and 1935, the Chaco War was the foremost threat in the minds of Brazilian civilian and military elites because a Paraguayan victory threatened to shift the South American balance of power decidedly in the favor of Argentina (McCann 1983, 309-310; 2004, 349-352). The specifics of the Chaco War are beyond the scope of this project, yet a brief overview is important to illustrate the concern of policymakers in Rio de Janeiro. The Chaco War was a conflict centering on disputed national boundaries between Bolivia and Paraguay in a region both believed to possess oil. While the Paraguayan War (1864-1870) is said to be the bloodiest in South American history, the Chaco War is said to have been the bloodiest of the twentieth century. Not only had long-simmering tensions between Bolivia and Paraguay erupted into an open war, Peru and Columbia also engaged in limited fighting between 1932 and 1933. Situated as these conflicts were on Brazil’s western border, they endangered the Amazonian frontier towns of Corumbá, as well as Tabatinga and Benjamin Constant (McCann 2004, 349). Despite the fact that the Paulista civil war was over, these conflicts worried “…the Vargas government enough to keep 60,000 soldiers on active duty, even though the federal budget that year called for a reduction to 54,500” and, “By March of 1934 the general staff had submitted to Vargas a plan for a provisional reorganization of the army that envisioned a force of 74,000 soldiers” (McCann 2004, 349). Despite its concerns
regarding the Chaco War, because Brazil was mired in a war against one of its own states, a policy of neutrality in the matter of the war between Bolivia and Paraguay was pursued. The real import of this war from the perspective of Rio de Janeiro was its potential impact on Brazilian interests in South America and the regional balance of power.

With specific regard only to the threat posed to Brazil by Paraguay, Vargas, Oswaldo Aranha, and the Brazilian general staff were concerned about a militarily strong Paraguay. Put directly, the Chaco War gave rise to a Paraguayan army of some 70,000 men, which if victorious would have little to occupy their time because of the poor state of the Paraguayan economy (McCann 2004, 349). Vargas and his ministers were worried that in victory, Paraguay may well seek to reclaim some of the territory it lost during the Paraguayan War, in the Brazilian state of Mato Grasso to be precise (McCann 1983, 308).

The other key concern for the Vargas government was the possibility of an Argentine-Paraguay axis, which was believed to be inimical to Brazilian interests in the region. McCann calls attention to the fact that in their analysis of the Chaco conflict, Brazilian intelligence officials were concerned about the fact that:

As of 1929, the great majority of the private properties in the Chaco were owned by Argentine citizens or enterprise, fully 10,500,000 hectares of the 22,000,000 hectares in dispute were in Argentine hands; of the 30,000 Paraguayans resident in the region, 18,000 worked for Argentine businesses, which held half of the million head of cattle being raised there; 198 miles of the Chaco’s 260 miles of railroad were Argentine…They asserted that Argentina considered Paraguay “an extension of its commercial markets and [that] its territory constitutes indirectly a tributary geographical element of its own political economy.” Moreover, they believed that Brazilian diplomacy was being outmaneuvered in the neighboring republics by the astute Argentine foreign minister, Carlos Saavedra Lamas (McCann 2004, 351).
The point to underscore here is that because of extensive financial Argentine interests in Paraguay, Brazilian officials inferred that an Argentine-Paraguayan axis made complete sense. It was also believed that this same axis would contribute to any threat posed to Mato Grasso by Paraguay (McCann 2004, 351). Worse still for Brazil was the fact that Brazil was still perceived to be militarily inferior to Argentina, its prime antagonist in South American power politics (Hilton 1975, 111).

In addition to the external vulnerabilities perceived by Brazilian foreign policy elites at the regional level, a 1934 review of the broader international strategic context was equally alarming in that it identified several extra-regional threats to Brazilian national security (McCann 2004, 352). The primary extra-regional threats identified included the blatant military expansionism of imperial Japan, Nazi Germany, and fascist Italy (Hilton 1975, 12-15; McCann 2004, 352-355). Policymakers in Rio de Janeiro understood the nature of these threats to be imperialistic in nature. That is to say these revisionist powers were seeking to expand their dominion either directly via military action or indirectly by means of mercantilist policies to increase their access to raw materials and foreign markets. In the case of each of these expansionist threats, analysts saw the potential for military confrontation with countries of far superior industrial might, which could not be matched by any single country in South America.

Interestingly, given the climate of extreme political instability and a history of subsidized European immigration to Brazil during the Old Republic, Brazilian policymakers also
feared German and Italian fifth columnists in states such as Santa Catarina and São Paulo respectively. 53

Set against these regional and extra-regional threats, Brazil had relatively limited options for external balancing against regional or extra-regional threats (Hilton 1975, 14-15; McCann 2004, 353-355). First, it should be noted that the structure of the global weapons market did not favor Brazilian defense industrialization. Given the backlash to the relatively unfettered access to weapons along commercial lines prior to the First World War, a considerable amount of political control was exercised over weapons manufacturers during the inter-war period. During this time, the most reliable access to weapons came from Germany, who needed export markets to help finance its crash military build-up that began in the 1920s. Brazil did purchase weapons from Germany during this period in part because they were on offer and in part because they were on offer on terms favorable to Brazil’s economic condition at this time, of which more will be said below.

As was true during the Old Republic, the primary opportunity seen by Brazilian elites for external balancing was the U.S. Yet an American-Brazilian alliance was problematic from the vantage of Rio de Janeiro for two reasons. The first of these problems stemmed from the fact that, the U.S. was named as an extra-regional and expansionist threat, much as were imperial Japan, Nazi Germany, and fascist Italy (McCann 2004, 353-354). Specifically, it was adduced that the threat posed by the United States was “…above all economic, not threatening directly our political

53 Interestingly, Hilton points out that Brazilian political elites were so concerned by Nazi overtures to Germans recently having immigrated to Brazil, that the FBI was actually enlisted to help provide intelligence on Nazi organization and mobilization of Germans living in Brazil.
independence, but tending to make us vassals. American expansionism, that is accomplished principally by means of exportation of capital and via commerce…” (Quoted in McCann 2004, 353-354). This point is particularly of interest here because it suggests that the nationally minded elites who came to power following the Revolution of 1930 were well aware of the pattern of dependent development which had begun to take root during the Old Republic.

However, finding themselves in a rather difficult strategic predicament, Brazilian foreign policy principles recommended a continued foreign policy of approximation with the United States.\textsuperscript{54} The fact of the matter was that as noted above, no country in South America had the requisite industrial capacity to deter or defeat threats from extra-regional powers. The idea of collective security of the South American continent was mentioned, which would entail the, “…development of military industries and a continental system of communications” (McCann 2004, 353). However, it was pointed out relatively quickly that such a grand South American alliance was not feasible given the long history of interstate rivalry that existed. Moreover, as was observed during the Old Republic, it was noted that Brazil, “…as the only Portuguese speaking country in the hemisphere, was isolated and so could only count on itself. Although the United States was similarly alone vis-à-vis the Spanish-speaking countries and although this Brazilian-American commonality as outsiders had led to a “more or less intimate cooperation” in the past,

\textsuperscript{54} As has been noted by several scholars, a foreign policy of approximation with the United States had been a key tenet of Brazilian foreign policy since the time of Baron Rio Branco in the early 1900s. The fact of the matter was that following the decline of the Chile as a military power in South America towards the end of the 19\textsuperscript{th} century, Brazil sought to free-ride on American power in South America as a way to balance against Argentina (Resende-Santos 2007, 279-283).
expanded United States influence would not be “without grave inconveniences”” (McCann 2004, 353).

No doubt, the fear of approximation with the United States would be problematic because such a foreign policy would only bring the security assistance Brazil was seeking so long as American and Brazilian interests were understood by policymakers in both countries to be consonant. Additionally, in seeking friendship with the United States, Brazil would have to walk a fine line between cooperation and dependence. In practice, what Brazil would have to do is both align its interests with those of the United States to form a tacit alliance and pursue internal balancing to ensure that it would not become a vassal state of the United States. Concerned as it was about becoming a vassal of the United States, Brazil had to undertake a concerted effort at industrialization as rapidly as possible.

Furthermore, the U.S. appeared to be an unreliable partner in a tacit alliance. Specifically, in addition to the French Military Mission Brazil contracted to modernize its army, a contract for naval weapons systems was signed with the U.S. in the 1930s. However, whereas Brazil sought American investments in its naval industrial base, the U.S. did not make the desired investment. Rather, Franklin Roosevelt decided that warships ordered by Brazil would be built in American navy yards, rather than making a direct investment in a Brazilian naval industry (McCann 2004, 361). Seen from the vantage of Washington, the terms of the deal for navy ships were meant not only to bolster firms involved in the American naval industry, it was also meant to check the political ambitions of Brazil in South America. At nearly the same time, Argentina used its political leverage in the United States to disrupt plans for the delivery of arms to
Brazil, thus ensuring Brazil could not put these weapons to use against Paraguay (Hilton 1975, 182). The Vargas government chaffed both at the seemingly imperial pretensions of the United States to play power broker among South American countries and the fact that it had not the means to secure what were considered vital national interests.

Given the problems with an American-Brazilian alliance, even a tacit one, Brazilian policymakers actively courted economic relations with Germany.\(^{55}\) Prior to WWII, widespread political support existed between civilians and the officer corps for a Brazilian-German alliance and the economic interests of these two countries were near perfectly aligned. As previously noted, Germany’s rapidly growing commercial and military industrial bases required evermore raw materials for its factories. Whereas Germany had been able to maintain its balance of payments prior to escalating hostilities in Europe through trade surpluses with developed countries, this became increasingly difficult as the march to war in Europe continued.

From the Brazilian perspective, German assistance offered an opportunity to diversify its export recipients away from Great Britain and the United States (Hilton 1975, 32). From Germany, Brazil could also acquire machine parts for factories and other important finished goods. Perhaps most importantly, trade with Germany put no additional strain on Brazil’s balance of payments, because trade between these two countries was carried out on virtually a barter basis. Beyond ideological affinities between Brazilian integralistas and the Nazis, important members of the Brazilian officer corps supported trade relations with Germany because it facilitated the import of weapons the military badly needed to shore up its defenses against Argentina. This Brazilian-

\(^{55}\) For this historical background concerning the relationship between Brazil and Germany in this paragraph and the following, I draw from Hilton 1975, Chapters 2 and 3.
German trade relationship caused serious concern in Washington, yet despite threats of trade retaliation by Washington, little was done to address the relationship between Brazil and Germany.

With an eye towards the push factors for emulation, this sketch of Brazil’s external vulnerability, suggests two things. First and foremost, relevant policy principles in Brazil following the Revolution of 1930 did in fact believe that Brazil occupied a precarious strategic position in South America. This threat came from both regional and extra-regional powers. Second, a British blockade put an end to German weapons shipments to Brazil, once more reinforcing a key lesson learned during the Old Republic: weapons are available only when the vicissitudes of great power politics allow for it.

To summarize, Brazilian policy principles including Vargas, his minister of foreign affairs Oswaldo Aranha, and the officer corps found Brazil’s strategic position in the 1930s untenable. Both regional and extra-regional threats combined to threaten vital national interests. Worse still, there was a dearth of suitable candidates to form alliances with to balance against these external threats. The candidate most suitable, the United States, was also a threat to the long-term political independence of Brazil. Given this situation, Vargas and the military concluded that the only way Brazil could improve its strategic position was to pursue state-led industrialization, in order that at some point in the future, Brazilian firms could take a lead role in furnishing the weapons and technologies to guard against both military and economic threats to Brazil’s political independence. The broad political framework in which state-led industrialization proceeded is discussed in the following section.
4.1.2 State Power and the Estado Novo

The political foundation of the Estado Novo was the alliance between nationally minded elites led by Getúlio Vargas and the military (Flynn 1978, 85). Between the Revolution of 1930 and the declaration of the Estado Novo in 1937, the key political cleavage that existed was between the political core and periphery in the country (Flynn 1978, 61-62). While regional elites in Minas Gerais and Rio Grande do Sul supported the coup in 1930, they did not support the centralization of power in a strong, national state centered in Rio de Janeiro. Rather elites in these states, as well as São Paulo, preferred a return to the status quo prior to the revolution, in which a hyper-federal political system structured Brazilian national politics, leaving the federal government little autonomy. While several incipient candidates for national political parties did exist, Vargas chose to ally with the only legitimately national institution, the military.\(^{56}\) The Brazilian military loomed large during the process of national political consolidation. In dealing with states’ challenges to centralized and national political authority centered in Rio de Janeiro, the military was called out to put down the São Paulo Civil War and Rio Grande do Sul’s attempt at secession. Moreover, the military was instrumental in crushing a working-class rebellion in the form of the Brazilian Communist Party, as well as the Integralist Movement.

Despite their differences, the key area of agreement that allowed the alliance between Vargas and the military to endure was the shared vision of the state as a key agent in the development of strategic industries (Flynn 1978, 88; McCann 2004, 355). Indeed, Vargas is remembered as being a vociferous proponent of Brazilian industrialization, particularly in the steel and petroleum industries. Just as Vargas

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\(^{56}\) For a discussion on these nascent political parties, see Flynn (1978, 69-84). See also Skidmore (2007, 12-21).
supported the development of these industries, he was also a key proponent of the development of the Brazilian aeronautics sector (McCann 2004, 357-360). For Brazil, a country of continental breadth, wholly lacking in adequate transportation infrastructure, airplanes were vital to the effort to help integrate remote regions of the country into the broader tapestry of national life (McCann 2004, 358). In addition, from a military perspective, aircraft could be used to great effect for reconnaissance and attack missions. Thus, just as the armored car and the naval vessel were seen as vital instruments of statecraft, so too was the airplane in Brazil.

To this end, between 1930 and 1945, when the military deposed Vargas, ending the *Estado Novo*, a number of institutions were created that formed the core of the aeronautics enclave, the broader institutional arrangement determining the success of state-led aeronautics sector development, beginning in the 1970s. The most famous of these institutions created to support the development of the IAB include the Ministry of Aeronautics, the *Força Aérea Brasileira, the Instituto Tecnológico de Aeronáutica*, and the *Centro Tecnológico de Aeronáutica*, the origins of these institutions are discussed below.

Elite Ideology: Development as Defense
The developmental ideology associated with the Vargas regime lasting from 1930 until 1945 had clear national security underpinnings. On the one hand, industrialization was crucial for the development of a defense industrial base over the long run, which would enhance Brazilian national security by freeing it from dependence on developed countries for weapons. On the other hand, Vargas and his supporters hoped that the emergence of a nationally oriented capitalist class would shift the balance of political power in Brazil away from regional elites whose parochial interests during the Old Republic threatened to
destroy a unified Brazil and as such was a perpetual fear until the declaration of the
Estado Novo in 1937. Vargas, his civilian backers, and the officer corps all shared these
goals (Hilton 1973, 72-73; Flynn 1978, 86-89; McCann 2004, 355-357). To this end and
given Brazil’s underdeveloped economy, the Vargas during the Estado Novo focused
state support for industrialization on the creation research institutions and direct support
for strategic industries. Set against this backdrop the logic of state-support for the
development of the IAB comes into focus.

When considering the levels of economic development of Brazil in the 1930s,
using scarce resources to support the development of an aeronautics sector seems a bit
odd. Speaking specifically to the enormity of the challenges of industrialization in Brazil
at the time, McCann observes that, “There was so much to be done that it was nearly
overwhelming. How could sophisticated development occur in a country where the bull
cart and mule train were still common means of transport—the army remained
preoccupied with horse and mule raising until the eve of World War II—and wood was a
major source of energy? The goal of steel and arms production involved a leap of
centuries, from animals and wood to gasoline-powered internal combustion engine and
hydroelectric power” (McCann 2004, 356). Notwithstanding the underdeveloped state, if
not outright backward, condition of the Brazilian economy, the development of an
aeronautics sector became a national priority because Vargas and his supporters saw
military aviation as an important component to Brazilian national security even in the
early 1930s (McCann 2004, 357-360).

At least among a small segment of the Brazilian population, aviation had been a
long-standing fascination and Getúlio Vargas was a member of this group. Yet, Vargas is
not remembered as a champion of both the IAB because of his fascination for aviation.

From nearly the start of the 1930s, aviation and military aviation in particular were seen as having great strategic import for Brazil (McCann 1973, 213-215). Here, it is important to recall that the conjunction of Brazilian geography and a lack of transportation infrastructure were key factors in limiting the reach of the authority of the government in Rio de Janeiro. Looking first to the dimensions of Brazil, it is a country of continental proportions, of which Hilton observed:

The great bulk of the approximately 35 million inhabitants in 1930 were concentrated in urban clusters along an irregular coastline that would connect Maine to California [2,700 air miles], which meant that the country’s huge interior was largely uninhabited. Indeed, there was less than one inhabitant per square mile in the great Amazon basin and adjacent areas (Hilton 1975, 3).

Brazilians believed the country’s interior held enormous wealth particularly in the remote and largely unexplored Amazon basin and little means existed to exploit or defend this territory for one simple reason: much of this territory was inaccessible. At the start of the 1930s, “The country’s transportation network was markedly inadequate for its size, a fact constantly lamented by the geopolitically conscious military planners. At the time of the Revolution of 1930, Brazil had a total of 76,000 miles of roads, mostly unpaved. Railway mileage in 1934 was less than 21,000. Communications with the hinterlands were adequately developed only in the Southeast, and thus the North and drought-ridden Northeast could be reached from the nation’s political and industrial center only by ship or airplane” (Hilton 1975, 3-4).

The relatively underexplored and inaccessible nature of the great Amazon basin was both a strategic blessing and challenge for policymakers in Rio de Janeiro. On the one hand, much as the dense rainforest that covered much of Brazil’s interior made it
inaccessible to Brazilians for exploitation, it also acted as a formidable buffer for Brazil’s political and industrial centers against would be invaders from the west, situated as they were along the Atlantic coast. Yet, such a vast territory could not be monitored with the extant resources, technology, and infrastructure readily available to Brazilians of the era on the other hand. This meant that Brazilian territorial sovereignty could be violated and its natural resources plundered without anyone necessarily being the wiser in Rio de Janeiro. Given these circumstances, Vargas was, “…convinced that aviation would be the most rapid and effective means to tie the farthest reaches of Brazil’s roadless expanse to the nation-state” (McCann 2004, 358).

Beyond concerns regarding the extension of the authority of the central government into the Brazilian hinterlands, the São Paulo civil war demonstrated the importance of aviation to military operations. As has been discussed elsewhere, the paulista state military was a better-equipped and trained fighting force than that possessed by the national government (Flynn 1978, 65-64). In addition to the good fortune resulting from poor coordination between forces from Minas Gerais and Rio Grande do Sul, the quality of the national army’s air arm helped shorten the siege of São Paulo (Flynn 1978, 64; McCann 2004, 327-328). In fact, despite the reality that the Brazilian economy was in the throes of a severe recession only exacerbated by the paulista conflict, the Vargas regime approved the purchase of approximately 150 aircraft from the U.S. during the conflict (McCann 2004, 357). McCann notes that the São Paulo civil war “turned Brazil into an aviation-conscious society” (2004, 358).

Impressed by the strategic importance of aviation for national security, the aeronautics sector became a target for state developmental support. However, there were
limits to what support the state was willing to give to industry during this period. While Vargas and his supporters, both civilian and military alike, favored strong government support for strategic economic sectors, the Brazilian economy still sat firmly within a capitalist mold. That is to say, while the political elite of Brazil believed the government should strongly support development, it should not undertake production directly unless the private initiative had failed; then and only then would the government undertake production directly. This is a radically different position on government involvement in the broader economy than had been the case in 1930. Notably though, this position on state support for military industrialization was nearly the same as that established during the Old Republic. It is precisely this type of government intervention and no more that occurred in the aeronautics sector during the *Estado Novo*.

Specifically, as will be discussed below, the Brazilian government undertook efforts to provide the private sector with both supply- and demand-side support. However, the government did not directly undertake industrial scale production of aircraft during the *Estado Novo*. To do so would have been a serious ideological contradiction, especially because there were several private firms that existed between 1930 and 1968, though none were successful.

State Organization
Concomitant with the gestalt shift from a laissez-faire to an interventionist economic ideology, at least in strategic economic sectors, were efforts to modernize and professionalize the Brazilian bureaucracy. Indeed, bureaucratic reform was a key feature of the Vargas regime between 1930 and 1945. The logic behind bureaucratic modernization and professionalization was straightforward: If the government was going to intervene in the economy to promote growth and development, it needed a bureaucracy
staffed by competent professionals capable of such work. To this end, Vargas supported
the creation of agencies such as the *Conselho Federal de Comércio Exterior*, the Civil
Service Council, the *Instituto Nacional de Estatística*, as well as the signature act of
institutional creation the *Departamento Administrativo do Serviço Public*, better known
by its acronym, DASP (Hilton 1975, 22-26; Flynn 1978, 104-106; Kohli 2004, 160)).

The success of efforts to modernize and professionalize the bureaucracy varied
considerably as a result of a number of factors including the availability of skilled
professionals, institutional frictions, personality conflicts, and the impact of institutional
reform on vested interests, and the fact that the bureaucracy was stilled routinely used as
a source of patronage (Kohli 2004,160).

The institutional origins of the Brazil aeronautics enclave that served as the
institutional foundation of the aeronautics industrial base were located in this same drive
for professional competence. Regarding state organization and the aeronautics enclave,
two functionally defined categories of organizations existed: demand and supply side
institutions. The only instance of institutional genesis that does not fit neatly within these
two broad categories is the founding of the Ministry of Aeronautics, which came to be the
key regulatory agency for aeronautics sector development. The following discussion
focuses first on the creation of the Ministry of Aeronautics, followed by the demand side
institutions, and then supply side institutions.

The need for centralized control of all forms of aviation in Brazil rested on two
key arguments. The first argument in support of the creation of an aviation ministry was
that individual, or fragmented management of three types of aviation was a waste of

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57 Institutes such as these came later to be known as “bolsões de eficiência,” or “pockets of efficiency”
(Geddes 1994, 61; Evans 1995, 60-61).
scarce Brazilian resources (Forjaz 2005, 284). Wholly consistent with the modernizing logic of the Vargas regime, proponents of the creation of a ministry argued that if the management of commercial, army, and navy aviation were all centralized in one agency, resources could be conserved. It was the perspective of Brazilian policymakers that unlike the United States, which had five types of aviation, with five different headquarters, this was and would be a huge waste of time, energy, and resources in Brazil. Rather, Vargas and others favored a streamlined government approach, based on French institutions, vested with the regulatory authority to control all aspects of aviation.

The second key argument made in support of the creation of the ministry was from the military, whose concern was on the revolutionary importance of an air force in the context of modern war. Notably, Forjaz points out that, “It is no coincidence that the creation of the Ministry of Aeronautics occurred during the Second World War, when military and civilian elites preoccupation with Brazilian vulnerability swelled” (Forjaz 2005, 284). I call attention to this argument because, not only had the use of air power in the São Paulo Civil War impressed Brazilian policymakers, so too had the great devastation wrought by Japanese aircraft on Pearl Harbor in December of 1941 (Forjaz 2005, 284).

These two arguments provided the political pretext for the creation of two central institutions in the aeronautics enclave. First, Vargas issued an executive decree disbanding the army and navy aviation corps in favor of a single air force; the Força Aérea Brasileira. In one fell swoop, this executive order fused two long-standing arms of the primary national military; no mean feat. The second step was the creation of the Ministry of Aeronautics (MAER) itself. Institutionally, the construction of MAER was
little harder for Vargas than issuing an executive order. What was challenging, evincing a small measure of Vargas’s legendary political acumen, was the selection of the very first director of MAER.\(^{58}\)

At the time, there was a limited pool of Brazilians to choose between for this position and among this small talent pool, most had gained their experience and expertise while serving in the army or the navy. Problematically, if Vargas were to appoint a person seen as an army or a navy man, it would smack of blatant favoritism toward one service or the other, perhaps putting at stake his military support and making this new institution a site of inter-service rivalry. Instead, Vargas selected a close personal confidant and friend, Joaquim Pedro Salgado Filho. As Maria Cecilia Spina Forjaz observes, the selection of Salgado “…Served to engage the military and obtain political control of the new institution” (2005, 286). While the creation of MAER went against the wishes of both the army and the navy, the selection of a close personal friend and confidant was wholly in keeping with Vargas’s approach to maintaining the political support of vital sectors of politically active Brazilians; in this case the army and the navy at least in the short run (McCann 1973, 226; Forjaz 2005, 2860).

Consistent with the goal of creating MAER in early 1941, it had several missions, including the following:

- It was to be the central command authority for all aeronautics activity in the country, in both the military and civilian domains.
- It was to streamline the management of civilian, army, and navy aviation.
- Integrate the infrastructure of commercial and civilian aviation.
- Foster the emergence of a Brazilian aeronautics industrial base.

\(^{58}\) For a description of Vargas’s political acumen, see Flynn (1978, 96-104) and Skidmore (2007, 21-33).
Create research institutions for the development of technology applicable to the aeronautics sector (Forjaz 2005, 286).

Taken in their entirety, the missions set forth for the Ministry vested it with a regulatory responsibility for the aeronautics sector in Brazil. As will be detailed in the next chapter, this regulatory authority proved crucial to the development of the aeronautics industrial base in the future.

On the demand side of the equation, the two watershed moments of institutional genesis were the creation of the Correio Aéreo Militar (CAM) and the Força Aérea Brasiliara (FAB). The CAM, or Military Air Mail, was created in early 1932 just before the outbreak of the São Paulo civil war. The creation of the CAM had two key goals. The first of these goals was to better prepare military pilots for service. Importantly, “Prior to the 1932 conflict the training regimen of pilots at the flight school at Rio de Janeiro’s Campo dos Afonsos held them within six miles of the field. To break free of the distance limitation and to gain practical experience of flying conditions, a group of pilots including Major Eduardo Gomes and First Lieutenants Antonio de Lemos Cunha and Casimiro Montenegro Filho suggested to the minister of war that they form a military airmail service…” (McCann 2004, 358). It is of some interest to observe that both Gomes and Filho each became important figures in Brazil. Gomes went on to be minister of aeronautics, as well as a presidential candidate. For his part, Filho was the driving force in the creation of the Centro Tecnológico de Aeronáutica and Embraer.

The second reason why the creation of the CAM was important for the development of the aeronautics sector in the 1930s was that it justified expenditures on aircraft. As McCann observes:
This idea [the CAM] provided the army and navy with a civilian justification for the costly imported aircraft, to gain valuable flight experience, and a way to extend the military and the central government into the still shadowy interior. It allowed sharing equipment and infrastructure costs with the Ministry of Transportation and Public Works. And it was a productive manner to “channel” the energy and enthusiasm of the pilots and ground crews into useful and welcome service to society (McCann 2004, 358).

To be sure, the CAM was an important step towards institutions that would support demand from a still nonexistent Brazilian aircraft industry.

The second institution created that would be a major source of demand for the IAB in the future was the Força Aérea Brasileira (FAB) itself. Though the FAB and Ministry of Aeronautics were created at the same time, a brief consideration of the implications of the FABs creation are important. Prior to the creation of the FAB, military aviation had existed in the army and navy separately. Thus, military aviation such as it existed at the time, was one more among the several combat arms of each service, no different from say the cavalry or coastal artillery. However, during the interwar period both tactical and strategic air doctrines began to slowly emerge in the Europe and the United States. Specifically, experienced military aviators with combat experience such as William Mitchell in the United States and Gulio Douhet in Italy, along with others, began arguing for the creation of separate air forces (MacIsaac 1986, 629-636). In some cases, such as Britain and France, truly independent air forces would emerge in Europe prior to the Second World War and after the war in the United States. The creation of such forces in Europe in particular had an important demonstration effect on Brazilian aviators, who began arguing for creation of a separate air force as well (Forjaz 2005, 285). Just as was the case with the Ministry of Aeronautics, the terrible effectiveness of air power at Pearl Harbor in 1941 would be an important catalyst for the
formation of the FAB. This then was the key impetus for emulation in the Brazilian military system.

The creation of the FAB as its own unique service, at least nominally coequal with the army and the navy meant that it had increased leverage in the acquisition of equipment, notably airplanes. When conceptualized as one among many combat arms, without its own distinct logic apart from the broader army or navy mission, aircraft acquisition is but one demand among many that may be viewed as more pressing. Certainly, an army commander can be expected to privilege the acquisition of artillery, the king of the battle field, over the acquisition of combat aircraft.

On the supply side of the aeronautics enclave a long-term approach was taken. Ken Conca has pointed to two defining features of Brazilian policy in the aeronautics sector: human resource development and its long time horizon (Conca 1997, 40). This approach to the development of the aeronautics sector was out of necessity. Vargas and the senior most members of the officer corps, influential generals like Góes Monteiro and Dutra were well aware that Brazil lacked both the infrastructure for commercial and military industrialization, but also the human capital and technology. Speaking specifically to these sorts of problems, McCann notes:

The majority of Brazilians were illiterate, and the tiny educated elite did not have the problem-solving or organizational mentality required to take the country into the modern age. Higher education under the empire had been medical, law, and engineering faculties; the first university, that of Rio de Janeiro, dated from 1920. By 1937 and the Estado Novo there would be only a total of four universities. Those institutions were not engaged in preparing a modernizing cadre…The universities, their faculties, and students were disengaged from the ideas, goals, and regimentation of the military, and neither seemed to understand the other, with dangerous future results. So instead of universities leading Brazil into the modern age, that role was left to the politicians and the military (McCann 2004, 356).
Given this Brazilian reality and the highly technical nature of the aeronautics sector, the decision was made to create the Instituto Tecnológico de Aeronáutica (ITA) and the Centro Tecnológico de Aeronáutica (CTA) to address these supply side problems.

The core mission of the ITA was to develop a pool of highly skilled engineers capable of working in an aeronautics industry. When it first opened its doors to students in 1950 it was only an undergraduate institution, however in the 1960s it began granting graduate degrees; master’s degrees in 1961 and doctorates in 1968 (Conca 1997, 41). It is interesting to note that those responsible for the creation of the ITA deliberately sought to copy the model of the Massachusetts Institute of Technology’s (MIT) aeronautical engineering program (Conca 1997, 41; Forjaz 2005, 288). To this end the, “ITA represented the introduction of the North American university system in Brazil, including semesters, annual curriculum revision, curricular control at the university level, and independence from the Ministry of Education. ITA’s first four rectors included three professors from MIT and one from the University of Maryland” (Conca 1997, 41).

In assessing the importance of the ITA to the development of the IAB, I join with others who judge this institution to have been of inestimable value. Conca specifically notes that, “ITA’s historical influence within the aeronautics industry cannot be overstated. In 1990, when the state aeronautics firm Embraer was at its peak level of employment, ITA graduates represented 40 percent of the firm’s 1,200 engineers, more than half of its fifty managers, and five of its six directors” (Conca 1997, 41). Franko-Jones adds that between 1950 and 1992 ITA graduated over 72,200 engineers and awarded over 300 postgraduate degrees (Franko-Jones 1992, 72).
Located in São José dos Campos (São Paulo), the remit of the CTA upon its founding in 1954 was to develop a Brazilian research and development capacity. To be more specific, Franko-Jones notes that, “The institutional goals of the CTA are to train aeronautical engineers, to perform research and to foster the growth of supplier firms by transferring new products and processes to the private sector” (Frank-Jones 1992, 72). To accomplish these goals, the ITA was incorporated under the umbrella of the CTA and retained the sole responsibility for training engineers. As the name suggests, the Instituto de Pesquisa e Desenvolvimento (Institute of Research and Development, IPD) and its five subordinate divisions, was responsible for research and development in the areas of systems integration and product development (Franko-Jones 1992, 73). The Institute of Industrial Coordination and Promotion (IFI) at its founding was responsible for facilitating coordination between the CTA and the private sector, with an eye toward supporting private sector firms development within the domestic market (Franko-Jones 1992, 73).

To summarize, by 1954, the regulatory, demand side, and the supply side capacity for the Brazilian government to intervene in the aeronautics sector was largely developed. MAER furnished the regulatory capacity to the enclave and coordinated the constellation of actors that comprised it. The CAM and the FAB constituted the demand side of the enclave, both necessitating the expenditure on aircraft. On the supply side, the CTA was formed, which Franko-Jones characterizes as a triad of state support for industry that included education, R&D, and coordination with the private sector (Franko-Jones 1992, 72-73). Conspicuously absent from this supply side arrangement to support the development of the aeronautics sector was the existence of state involvement in
manufacturing, which would not occur until 1969. This is wholly consistent with the ideology of the both Vargas and the military, that the state should support private industry, not replace it.

State-Society Linkages
Much as institutional reform and genesis were one of the hallmarks of the *Estado Novo*, so too were institutionalized relationships between the state and society. The relationship between state and society can be broken down along two dimensions. The first dimension is the relationship between the state and capital. Though Vargas had long paid attention to the demands of capital, the avenue for these demands became somewhat institutionalized under the *Estado Novo* insofar as in many cases key members of the private sector were brought into the policymaking process (Kohli 2004, 159). This allowed clear and direct articulation of industrial needs to the policy principals. Though the aeronautics industry was considered strategically important and a fascination with aviation existed among Brazilians, during the first Vargas era, as will be discussed in the section to follow, there was no industrial scale aeronautics sector of which to speak.

The second dimension of state society relations during the Vargas era was the corporatization of labor. Vargas brought labor under the dominion of the state through a process of corporatization to advance the interests of domestic capital and thus industrialize the Brazilian economy (Flynn 1978, 100-103; Kohli 2004, 159; Skidmore 2007, 39-41). Disciplining labor involved outlawing specific labor organizations and a special government tax on wages providing funds to state-sponsored unions. State-sponsored unions could not strike; rather binding arbitration, frequently weighted in favor of the employer, was the sole recourse labor had to settle disputes. Moreover, capitalists easily circumvented the labor laws enacted by Vargas out of a genuine, albeit
paternalistic concern for the working classes. Regarding state-industry relationships in the aeronautics sector, there is little evidence in the historical record to suggest that at this stage in the development of the sector, state-labor relations had much impact on sectoral development. What few planes were assembled in Brazil during the Estado Novo required well-educated professionals, not the low-skill labor of an assembly line.

4.1.3 State Support for the Aeronautics Sector
The reality is that while there was great interest in the development of a Brazilian aeronautics sector, there was relatively little direct state support for the sector. While the economic ideology of the era had shifted from economic liberalism to an interventionist and nationalist economic position, the private sector was given ample space to develop under its own power. It is important to bear in mind that in rejecting laissez-faire ideology, Brazilian elites were not rejecting capitalism, just international capitalism. Bearing this in mind, one can distinguish between two periods of government support for the aeronautics sector (Bernardes 2000, 148-149).

The first period of state support for IAB development was between the 1930s and 1940s. To be sure, this period has been overshadowed by the meteoric rise of Embraer in 1969, however no less than five other aeronautics firms were established in Brazil, prior to the 1960s. In fact, built in 1935 by the private Companhia Nacional de Navegação, the Paulistinha was the first airplane designed and built in Brazil. However, the major catalyst for an aeronautics sector prior to the 1960s was the Second World War. As in the broader commercial economy, the Second World War was a catalyst for import substitution industrialization in the aeronautics sector. Whereas before the war Brazilian

59 I draw heavily in this section on Bernardes (2000, 149-154).
demand for airplanes was amply meet by imports from Europe and the United States, the wartime footing of these economies meant that no exports were possible. Two additional private aeronautics ventures were launched during the war: Focke-Wulf Flugzeugbau GmbH and the Companhia Aeronáutica Paulista (CAP).

The work of Focke-Wulf is important to consider because it is reminiscent of the effort by the Brazilian government during the Old Republic to emulate modern military systems by hiring American and French military missions. Specifically, Focke-Wulf was invited by the army and navy to help in the construction of an aircraft maintenance facility for military aircraft that came to be known as Fábrica do Galeão. For its part, the Brazilian navy constructed the hangar bays in which overhauls and repairs were done. The Germans supplied the requisite equipment and tools, as well as workforce training. Roberto Bernardes notes that this training provided by the Germans was the “seed” of the skilled technical specialists that would be required to build, maintain, and upgrade Brazilian planes (2000, 150). Notably, some production ultimately took place in this facility and the planes were said to be of better quality than those produced by Henry Lange at the Companhia Nacional de Navegação (Bernardes 2000, 150). This relationship ended in 1939 as Europe edged closer to war.

While the German contribution to the Brazilian IAB was important, the contribution of CAP was important too. Founded in 1942 by Francisco Pignatari, CAP is notable among Brazilian aeronautics firms for two reasons. First, in seeking to collaborate with the Instituto de Pesquisas Tecnológicas of the Universidade de São Paulo, CAP became the first Brazilian firm to use outside R&D services to help design and manufacture an airplane (Bernardes 2000, 151). Second, CAP was the first Brazilian
aeronautics firm to export its products. While the CAP-4, or the *Paulistinha*, was sold domestically to the FAB and civilian aeroclubs, it was also exported to a diverse group of customers including, Argentina, Chile, Italy, Paraguay, Portugal, Uruguay, and the United States (Bernardes 2000, 151).

While there were a few other forays into the aeronautics sector, the *Companhia Nacional de Navegação*, the *Focke-Wulf* collaboration, and CAP are three of the most notable prior to World War II. Despite the initiative of the private sector and the work of foreign firms, the major problem for the development of the IAB was demand. The small Brazilian firms had done well to meet demand for small aircraft useful for light cargo, recreation, and agriculture. However, none of the Brazilian firms could meet the demand for larger planes. Moreover, Brazilian planes were not very competitive abroad. As Bernardes notes of the IAB at the end of the Second World War:

> The private and state owned companies that appeared at this time did not take advantage of two of the structural factors that favored the development of the sector, due to the limitations of the Brazilian market; as such, the Brazilian government was the only source of demand that could make a project of such a scope viable. Therefore, we could choose at least two salient elements of the first 20 years of the IAB: a) the lack of continuity, in other words, none of the factories or of the private and state initiatives which had appeared in the period survived until the founding of Embraer; b) the restricted nature of the technological development process of the sector. The national projects that were developed until then were dependent on the individual efforts, personified in the images of some names such as Muniz, Vandade, Niess, etc. In general terms, in the critical steps of the process of technology acquisition, the experience of the IAB was not structurally conducive to the dissemination of the necessary knowledge for dynamic indigenous technological development (Bernardes 2000, 154).

The point to be made here is that during the first 20 years of the IAB, neither sufficient demand nor technological support was forthcoming from the Brazilian state to facilitate sustained sectoral development. These problems in establishing a viable IAB were well recognized by the government and the institutions created during and shortly after the
Estado Novo reflect well the understanding of the problem among civilian and military elites alike.

The second stage in the development of the aeronautics sector began roughly in the 1950s and ended in 1968, just before the creation of Embraer. Three types of support for the sector distinguish this phase in the development of the IAB from that between 1930s and 1940s. First, with the requisite institutions in place on the supply side, the constituent components of the CTA began to operate. In the case of the ITA and the IPD, given the long time horizon for the development of human capital in these institutions, the immediate contributions of these institutions did not come to fruition until the late 1960s. In the case of the ITA, this was because the weakness and small scale of the IAB, such as it existed after the war, meant that many of the engineers who graduated would not be able to ply their trade for some time (Bernardes 2000, 155). Regarding the IPD (discussed below), it takes time to acquire the skill to perform the difficult task of systems integration, which in the vision of Richard Smith of MIT, the driving force behind the creation of the ITA and the CTA, was to be the core competency of the IAB (Bernardes 2000, 155).

Yet, to facilitate the acquisition of the broad range of skills required to design, manufacture, and overhaul aircraft, the FAB once more invited a team of Germans to Brazil. In the immediate postwar era, Europe was still smoldering from the recently ended war and the project of reconstruction was barely underway. For German aeronautical engineers, who were recognized the world over as a most talented, experienced group, the near-term employment prospects in Germany did not look to promising, and they sought out opportunities abroad. Given this set of circumstances,
Brazil sought to attract German talent as did other nations, perhaps most notably the U.S. in the field of aerospace (Bernardes 2000, 155). Specifically, Colonel Casimiro Montenegro now of the FAB, approached Heinrich Focke, formerly of *Focke-Wulf*, and invited him to CTA. Focke accepted the invitation to CTA, on the condition that he was provided with all the equipment he needed to keep working on his Heliconair project (Bernardes 2000, 155). Though this project was very ambitious, Montenegro and other influential officers agreed that this was an important opportunity to expand the capacity of the workforce and infrastructure of the IAB. Focke and his team of engineers arrived in 1951 to commence work.

The Heliconair was ultimately a failure of the weakness of the capacity of the national metallurgy industry and the inherent complexity of the project (Bernardes 2000, 156). Regarding the latter, the goal of the project was to create an aircraft with the cargo carrying capacity of an airplane, yet the vertical takeoff and landing capacity of a helicopter. From the vantage of today, recalling the long journey of the V-22 Osprey from conception, to trials, to production in the United States, one can appreciate the magnitude of the difficulties Focke grappled with in the 1950s. Despite the failure of this costly project, it was considered a valuable experience for the Brazilians working on the project and was a key event leading to the creation of the IPD in 1954 (Bernardes 2000, 156-157).

The second important way the state supported the creation of an IAB between 1950 and 1968, was through a policy of industrial restructuring. Specifically, the Brazilian government nationalized the most significant aeronautics firm of the 1950s,

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60 For an brief overview of the V-22 Osprey’s history, see Pappalardo (2012). For a longer treatment of this project, see Whittle (2014).
*Sociedade Construtora Aeronáutica Neiva* (Bernardes 2000, 157). *Neiva* was an important company in its own right because its plane the *Regente* was the first Brazilian plane made entirely out of metal and it built an advanced trainer aircraft, the *Universal* (Bernardes 2000, 157). As a result of the limited demand in the domestic market and an inability to compete internationally, *Neiva* was almost entirely dependent on the Ministry of Aeronautics to buy all of its production (Bernardes 2000, 157). The government nationalized the company in the hopes that it could help expand production and attract highly skilled workers (Bernardes 2000, 157). However, *Neiva* never meet these lofty goals and eventually became a subsidiary of Embraer in the 1980s, dedicated to the manufacture of Piper airplanes.

Finally, the last way that the state supported the development of the IAB during the 1950s and 1960s was through research conducted at IPD (Bernardes 2000, 157-158). Specifically, during the 1960s, a project labeled IPD-6504 began with the approval of Brigadier Eduardo Gomes, now the minister of aeronautics. Development of the IPD-6504 was carried out in the IPD’s *Departamento de Aeronaves* under the leadership of ITA graduate and future chairman of Embraer, Ozires Silva. Ultimately, IPD-6504 became the *Bandierante*, Embraer’s first product.

4.1.4 *Summarizing the Brazilian Experience Between 1930 and 1968*

The Vargas era was the crucial foundational era of the Brazilian aeronautics sector. The military and economic threats to Brazilian independence between 1930 and 1945 were important catalysts for the reorganization of the low-capacity Brazilian state of the Old Republic to the much more powerful state of the *Estado Novo* and the period of nominal democracy that followed. In reorganizing of the Brazilian state, Vargas and his associates sought to create a highly professionalized and modern state, emulating the
patterns of state organization for its military system found in the great powers of the era. In the civilian bureaucracy, as Peter Flynn has pointed out, the most innovative theories on bureaucratic structure were taken from abroad and applied to Brazil (1978, 105). With respect to the aeronautics sector, Vargas along with key army leaders such as Generals Gôes Monteiro and Eurico Dutra pushed for a reorganization of the state bureaucracy dealing with the aeronautics sector. This effort led to the creation of the FAB, the MAER, the ITA, and the CTA. While little direct government support went to fledgling aeronautics firms that emerged in the Vargas Era, the institutional reforms copied from France and the United States were the foundations for the aeronautics enclave that provided state support for future successful development of the IAB.

4.2 Independent India and the Indian Aeronautics Sector
The arrival of independence in August of 1947 marked the start of a period of national political consolidation, made very difficult by the enormity of the tasks undertaken within a framework of democratic politics. With specific regard to the economy, India was very badly underdeveloped in terms of both agriculture and industry, with many of its citizens illiterate and engaged in barely adequate subsistence agriculture. These poor masses presented an important problem for Indian political elites, nearly all of whom belonged to the Congress Party; these were the very people that the INC mobilized for the cause of national independence. Now that India was no longer under the yolk of the British Raj, Congress politicians had to make good on at least some of the promises made regarding improving the living conditions of average Indians. It was precisely these economic conditions and the related political promises that made economic development the number one policy priority for the Government of India.
From the perspective of national politics, Nehru and his top lieutenants confronted the challenge of establishing a constitution for a free India. The drafting of the Indian constitution brought to the fore a variety of contentious issues, the likes of which the Congress Party as a nationalist independence movement had yet to face. Among the very first problems Nehru had to address was the future status of the “princely states,” of which more than 500 existed in India under the British Raj (Guha 2008, 51-73). While most of these princely states joined the Indian Union prior to August of 1947, thanks in large part to the efforts of Lord Mountbatten and Vallabhari Jhaverbhai (VJ) Patel, several including Kashmir and Jannu, Anhandra Pradesh, and several Portuguese colonies remained independent islands on the Subcontinent (Guha 2008, 57-59). Through skillful diplomacy, force, and fraud most of these dominions came under the control of New Delhi (Guha 2008, 58). Another particularly pernicious problem was the division of power between the federal government and the states (Guha 2008, 122-123). Aside from deciding on a national language, perhaps most problematic was the issue of the equality for all citizens given the deep ethnic, religious, and caste cleavages in Indian society (Guha 2008, 123-133). Much to the credit of Nehru and his top INC lieutenants, these problems and others were all resolved more or less through a process of protracted negotiations and compromises between members of the Indian political class.

Partition of the Subcontinent also accompanied independence creating a majority Muslim state in Pakistan and a multi-ethnic state in India. Partition was to be a primary source of political unrest and violence in the early years of independence. An immediate consequence of partition was a huge two-way migration of Muslims heading from India.

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61 For a balanced assessment on the causes of partition, see Guha (2008, Chapter 2).
to Pakistan and Hindus heading in the opposite direction.\textsuperscript{62} This two-way migration was the scene of some of the most horrendous sectarian conflict ever witnessed in the Subcontinent. Moreover, in October 1948, Pakistan started a war with India over Kashmir. To this day, Kashmir remains divided along a cease-fire line, known as the line of control (LOC). It was precisely this conflict with Pakistan over Kashmir, which was the primary national security focus for India over the next several decades, a dispute that escalated into a nuclear standoff by the end of the 1990s.

Set against this broader backdrop, Indian political elites in the late 1940s and through the 1950s also had to confront the disposition of the role and status of the Indian military. For one thing, following independence, Nehru had to manage the reintegration of elements of the Indian National Army led by Shandra Bose until his death into Indian society (Cohen 1971, 157-161; Wilkinson 2015, 80-81).\textsuperscript{63} In aligning itself with the Axis during World War II as part of an effort to achieve independence from Britain, this group that broke with the INC and pursued violent resistance enjoyed great popularity among an influential segment of the Indian people. Moreover, the Indian Army was the single best-organized institution in the Indian government and Nehru among others feared an Army coup (Cohen 2004, 129-130; Wilkinson 2015, 96-97). To this end, the Congress-led government between 1947 and 1962 began a contradictory process of degrading the power of the Army to act against the government, while ensuring it could best any Pakistani challenge in Kashmir (Wilkinson 2015, 101-106). It was against the backdrop of these myriad thorny political issues that defense industrialization began in independent India.

\textsuperscript{62} See Guha (2008, Chapter 5) for a description of this process.
\textsuperscript{63} For a general overview of the Indian National Army, see Cohen (1971, 147-157).
With regard to the development of the aeronautics sector in particular, this section seeks to highlight the relationship between relatively low levels of external vulnerability, a politically weak military, and aeronautics sector development. That is to say, Nehru and a large group of other important Congress Party members held the military in particularly low esteem given its erstwhile role in maintaining British power and the fear of a military challenge to the consolidation of a democracy in India. Given these two fears, civilian politicians excluded the military entirely from any foreign policy or military decision-making policy process, including the processes of strategic planning and weapons systems procurement. As a result, even while the Indian Air Force expanded between 1947 and 1961, the capacity of the Indian aeronautics sector was little improved and according to some knowledgeable observers, it atrophied (Cohen 2001, 101).\footnote{Cohen highlights the fact that shortly after independence, India lent considerable support to other Asian countries, such as Malaysia and Singapore, to establish aircraft overhaul and maintenance capabilities, as well as the rudiments of state-owned airlines. However, at the same time, the Indian aeronautic industrial base was atrophying for lack of well-defined industrial policy and defense priorities.}

This section proceeds in a parallel fashion to the first on Brazil. First, India’s external vulnerabilities are considered from the perspective of the relevant policy principles, with a specific eye towards the sources of external vulnerability and the possibilities for alliances, or external balancing. Second, I discuss the power the state had for defense development, with the specific goal of illustrating how the Indian government was able to dominate the military in both the foreign policy and weapons procurement process, to the detriment of future efforts at defense industrialization. Third, I discuss the patterns of state intervention in the aeronautics sector.
4.2.1 External Vulnerability Following Independence

One of the most interesting aspects of Indian grand strategy between 1947 and 1962 is that foreign policy aspirations seem to have been entirely unencumbered by defense needs. The sources of threat to India during Nehru’s tenure as prime minister and minister of foreign affairs are well known. First, the partition of the Subcontinent into two states with irreconcilable differences resulted in the First Kashmir War (1947-1948), which erupted less than two months after independence. Yet, Nehru’s non-aligned foreign policy complicated both weapons purchases from abroad and the acquisition of defense production technology. In seeking to make India a third force in world politics, Nehru alienated policymakers in Western capitals, such as Britain and the U.S. While the logic of defense policies is discussed in the following section, the shift in Indian elites perceived external vulnerability is discussed below.

Independence without unity is the root cause of regional insecurity in South Asia. The creation of Pakistan, an independent Muslim country has proven to be a particularly thorny problem and over the longer-term, an increasingly dangerous enduring and nuclearized rivalry. However, from the vantage of the period from 1947 to 1962 and with the framework of the regional balance of power in mind, it is difficult to understand the threat posed by Pakistan to India. Following partition and independence in 1947, the balance of power clearly favored India. By most standard measures, including geography, population, economic potential, and political power, India was clearly superior on every measure compared to Pakistan. It is worth noting that almost the entire defense industrial base built by Britain in the Subcontinent during the Second World War was located deep inside India for strategic reasons and because factories are not easily moved, the newly independent India acquired nearly this entire infrastructure. Thus, the
question: Why did Pakistan come to represent a threat against which India has been willing for decades to expend scarce economic resources to balance against beginning in the late 1940s?

Shorn of historical nuance and complexity, the key political rift between these two countries is one of identity politics.65 Until almost the eve of independence, there was no real hostility between the future leaders of Pakistan and those of a free India. In fact, Muhammed Ali Jinnah of the Muslim League was an important member of the INC until independence appeared imminent. With independence imminent, Jinnah mobilized the Muslim League to agitate for a separate Muslim state because he and other League leaders feared that they might lose their power and prestige in a free and democratic India. The source of Pakistani hostility to India is found in the explicitly Muslim nationalism defined in diametric opposition to India that Jinnah and other League leaders used to mobilize Muslims (Smith 1994, 13). From the perspective of Pakistani elites, the very existence of India was an existential threat to Pakistan (Smith 1994, 13). The inequity and the failure of the Indian government to make good on some of the terms of the partition agreement, particularly those related to defense stores, gave tangible substance of the claims of Indian ill will toward Pakistan (Wainwright 1994, 78).

For Indian leaders such as Nehru, Pakistan was an extreme version of the regionalist tensions, which plagued India since time immemorial (Smith 1994, 12). By aggravating political cleavages, most importantly the Hindu-Muslim rift, Pakistan symbolically threatened the secular nationalism built by the Congress Party that saw the

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65 Cohen calls refers to the India-Pakistan rivalry in terms of a paired-minority conflict, which he defines as “…rooted in perceptions held by important groups on both sides—even those that are not a numerical minority and may even be a majority—that they are the threatened, weaker party, under attack from the other side” (Cohen 2001, 199).
Subcontinent as a single integrated unit harking back to the time of Akbar I (Tanham 1992, 10). Moreover, Indian leaders feared Pakistan had the capability to cause extreme internal disorder for the Government of India (Smith 1994, 12). This fear was rooted in the experience of partition, when millions began a forced migration from Pakistan to India and vice-a-verse, a process plagued by ethnic and religious atrocities on both sides (Smith 1994, 10-11; Guha 2007, 41-50). Moreover, the Government of India had the daunting task of resettling millions of refuges. This Indian perspective then is the key to understanding Indian attitudes toward Pakistan soon after independence and the implacably hostile relationship that continues to exist between the two countries.

The Kashmir War reinforced the thinking of elites in India and Pakistan. Though Kashmir and Jammu was an independent province onto itself, India and Pakistan coveted political control of this important buffer state because such control could allow for the staging of a surprise attack by either side. To that end, Pakistan armed and supported indigenous rebels in the region to conquer the country. These indigenous rebels enjoyed great success very quickly, nearly sacking the capital of Kashmir in a matter of weeks. They certainly would have sacked the capital, were it not for the aid of Indian government. However, Indian assistance had a high price; Nehru demanded Kashmir and Jammu accede to the Indian federation. In exchange for joining India, the Government of India quickly mobilized the army and made extensive use of airlifts to the redoubts held by Kashmiri forces. The fighting in Kashmir between Indian forces and the tribal

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66 Smith estimates the death toll of partition was as high as 500,000 people (Smith 1994, 10). By contrast, Guha gives estimates between 1 and 2 million (2007, 48). Though the populations of India and the United States differ greatly, the fact that an estimated 400,000 Americans died during World War II puts the death toll associated with partition in some context.

67 On the process of refugee resettlement see Guha (2007, Chapter 5).
insurgents backed by Pakistan quickly ground to a stalemate, though not because India lacked the capability to attain military victory. Rather, in seeking to prevent a wider-ranging conflict with Pakistan and at Lord Mountbatten’s suggestion, India elected not to press on fighting in Kashmir and referred the matter to the United Nations for settlement (Guha 2007, 87). Nevertheless, India was certainly successful in maintaining the freedom of a new Indian state.

From the perspective of this study, interested as it is in aeronautics sector development, it is important to make mention of Kashmir’s geography and its impact of the Indo-Pak rivalry. The key geographic reality for India regarding Kashmir was the fact that it lacked ready access to the region. Pakistan by contrast enjoyed the luxury of all-weather roads that it could use to ferry troops and supplies quickly into Kashmir.

Nearly the only means India had of deploying troops and supplies along the LOC should war break out as it almost did in 1950, was by airlift. (Cohen and Dasgupta 2010, 72). Critically, the success of airlift missions is crucially dependent on air superiority; cargo and transport planes make easy targets for fighter aircraft. Thus, in the context of the Indo-Pak rivalry, shifts in the balance of air power were of particular concern to Indian policymakers because such shifts could threaten Indian access to Kashmir.

The Kashmir War is an important part of Indian foreign policy history for several reasons. First, it highlighted for Nehru and other foreign policy principles that Pakistan did not want to risk an all-out war with India any more than India wished to provoke a total war, because it simply did not have the means, despite persistent saber rattling from Islamabad. Second, because India conditioned its aid to Kashmir and Jammu on the condition that it joined the Indian federation, Nehru put the credibility of the national
government on the line to protect the integrity of its territory for the first time against the forces of regionalism.\textsuperscript{68} Though the issue remains unsettled, the fact that the Indian Army and the IAF, such as they were following independence, were able to beat back the indigenous rebels bolstered the confidence of other Indian states that the central government had the ability to make good on some basic commitment.

Pakistan also represented an opportunity for superpower involvement in South Asia, a fear that came to fruition in the mid-1950s (Smith 1994,13-14).\textsuperscript{69} More likely than not in response to the expansion of the Indian military in the early 1950s, Pakistan acceded to the Southeast Asian Treaty Organization (SEATO) and the Central Treaty Organization (CENTO) in 1955. Among the privileges of membership in these organizations was access to American weapons systems. In making the point that the Pakistani Air Force (PAF) was a major beneficiary of these weapons transfers, Smith points out that “…Air Force strength was increased significantly with the acquisition of 120 F-86F fighters between 1956 and 1958, 26 Martin B-57B Canberra long-range bombers and later, in 1962, the Lockheed F-104 equipped with Sidewinder air-to-air missiles” (Smith 1994, 14). From the perspective of IAF officers, despite the quantitative superiority of the IAF over the PAF, Pakistani acquisition of first-rate American fighter jets such as the F-86 and F-104, represented a shift in the balance of air power that could limit Indian airlift missions into Kashmir. New Delhi perceived American military aid to

\textsuperscript{68} In addition, Nehru wouldn’t hesitate to use the military to, “…overwhelm the Nizam of Hyderabad’s forces the same year, and to overrun the weakly defended Portuguese colonies of Goa, Daman, and Diu in 1961” (Cohen 2001, 128).

\textsuperscript{69} For an overview of the differences between Indian and American leaders dating back even before independence, see Guha (2007, 162-168).
Pakistan as an American betrayal of Indian regional interests and contributed to the rift between the United States and India that spanned the Cold War.

With Pakistan’s emergence as India’s chief strategic rival in the post-independence era, Indian policymakers could take little comfort in their options for alliance partners. This was not for a lack of interest on the part of the West in courting India; rather it was a result of Nehru’s deliberate policy choices. From his vantage prior to independence, Nehru believed that because of the vast size of the Subcontinent and its serious underdevelopment, neither the European powers nor the superpowers could profit politically or economically from conquest of India (Kavic 1967, 25). Given this understanding of India’s geopolitical situation prior to independence, Nehru was inclined to follow a foreign policy emphasizing diplomatic statecraft, in order to keep India out of superpower politics (Cohen 2001, 37-40).

Notwithstanding developments in South Asia, Nehru and his advisors believed that the real threat to Indian security rested in alignment with either superpower (Smith 1994, 47). With some difficulty, Nehru pursued a policy with respect to the superpowers of nonalignment. On the one hand, while feeling some affinity for the United States because of its democratic regime and a shared colonial experience, Nehru believed that the United States had come to be a chief protagonist in the Cold War because of its capitalist economy (Ganguly 2013, 2; Guha 2007, 164-166). From Nehru’s perspective, the American struggle against global communism was an imperialist project, little different from that of the United Kingdom. On the other hand, because of his affinity for Fabian socialist ideology (acquired while studying in London), Nehru was enamored of the very rapid process of industrialization that had taken place in both the Soviet Union
and China, under the aegis of central economic planning. Indeed, central economic planning based on the Soviet experience became a key tenet of Indian development policy.

By choosing not to take sides in the Cold War, Nehru had two specific objectives. First and most simply, he hoped to avoid the massive expenditures on the men and material for war, which he and other members of Congress believed would divert scarce resources from their number one priority: rapid economic development (Smith 1994, 47). Second, Nehru hoped that in enjoying good relations with both the Soviet Union and the United States, he would be able to translate these relationships into the sort of massive economic and technical assistance required for the rapid industrialization of India. Ultimately, Nehru and his advisors believed that until the Indian economy was fully industrialized, it would be unable to play its predestined role as one of the world’s great powers (Tanham 1992, 60-62; Ganguly 2013, 1-2). Until India was an economic power, its foreign policy would abstain from the exercise of military power. Cohen and Dasgupta characterized this approach to foreign policy, or grand strategy, as one of strategic restraint (2010, xii). Ultimately, Indian efforts to negotiate a third way between the superpowers came to be the hallmark of Nehru’s nonaligned foreign policy and remained a guiding tenant of Indian grand strategy for decades to come.

India’s efforts to remain aloof from the Cold War was not a costless strategy. In fact, nonalignment served to narrow Indian options for external balancing. For starters, the outbreak of the First Kashmir War led to American and Australian arms embargos on the belligerents (Wainwright 1994, 94). Additionally, from the perspective of London, a British-Indian partnership or alliance would have been ideal to secure Britain’s colonial
interests in the East. In fact, for nearly two centuries, the Raj used India for just such a purpose (Wainwright 1994, 60-64). And, during the Second World War, even though London knew some sort of home rule would be granted to India following the war, great efforts were made to build out a defense industrial base in India, so that it could still function as the arsenal of the eastern empire following the war (Wainwright 1994, 60).

Yet, Indian elites demanded and achieved full independence, rather than remaining in the Commonwealth System. In view of Indian foreign policy aspirations, Nehru clearly could not have played handmaiden to the British repression of colonial possessions.

The divergence of British and Indian national interests meant that an alliance was simply not possible, yet there was the matter of outstanding sterling credits owed by London to New Delhi. It is important to be clear that while the British did sell a considerable number of weapons systems to the Government of India, this was for economic reasons. The British reasoned that while neither India nor Pakistan would be valuable alliance partners, their arms market was a prize unto itself (Wainwright 1994, 90-94). Moreover, while the Government of India would make good use of these credits to build up the Indian arsenal between 1947 and 1962, Britain proved an unreliable weapons supplier, in large measure because it could not meet the demands from either India or Pakistan. Specifically, Wainwright calls attention to this reality in highlighting an incident involving the sale of British aircraft to India, noting that:

…British industries were simply incapable of meeting South Asian requirements. Such shortages had the potential to become diplomatic crises. Probably the most significant of these related to the transfer of Spitfire trainer and tropicalized Tempest fighter-bomber aircraft. Part of the Indian mission’s list in November 1947 included a request for sixty of the spitfires and fifty-two tempests. The following month, however, the British Ministry of Defence discovered that none remained in Britain. Almost immediately, the sale of the Spitfires and Tempests to India became a diplomatic incident because the only supply of these aircraft
available to the Ministry of Defence was at the British air base in Mauripur in Pakistan. Pakistani authorities impounded the airplanes…(Wainwright 1994, 93).

Perhaps more galling than the issue of supply, was the fact that the British Ministry of Finance held up the sale of the fighters further over concern about payment (Wainwright 1994, 94).

Nehru’s nonaligned foreign policy alienated the United States as well. While the United States did provide India with massive amounts of economic aid, particularly in the 1950s and 1960s, it proved particularly reluctant to provide military assistance when requested. As was true during much of the Cold War, access to American weapons was a function of the political relationship between the United States and the recipient. From the Indian perspective, a tight political alliance with the United States was untenable because Nehru believed that American interests around the globe were imperial. From the vantage of Washington, Indian policymakers’ fondness for moralizing statements in public fora, such as those by Krishna Menon at the United Nations, were grating (Cohen 2001, 84, 86-87). In fact, India’s unwillingness to be the standard-bearer for the American policy of containment in South Asia made possible the alliance between Pakistan and the United States in the mid-1950s.

To summarize, though India’s geostrategic position in 1947 was relatively benign from the perspective of the balance of power in South Asia, this situation slowly changed. Because of the threat posed by Indian regional hegemony to its survival, Pakistan allied with the U.S. and received military aid that threatened Indian interests in South Asia. Additionally, India had few options for creating alliances that could alter the balance of power in its favor in South Asia. In fact, because of its neutral position in the Cold War, India alienated both Britain and the United States, leaving the Soviet Union as its only
option for an ally in the future when China emerged as a serious challenger to Indian security in the early 1960s. Thus, it was this conjunction of threats to Indian interests in South Asia and the unreliability of external sources of weapons that provided the impetus for the expansion and modernization of the defense industrial base India inherited from Britain.

4.2.2 Indian State Power for Defense Development
Nehru and his associates were cognizant of the precariousness of their situation when it came to weapons required to ensure Indian national security. On the one hand, India needed weapons to confront the threat from Pakistan. Yet, in order to get the high technology weapons and the associated production technology, a key tenet of Indian foreign policy, nonalignment would have to be forsaken. In light of this dilemma, Nehru commissioned the well-respected physicist Patrick Blackett to design a defense procurement policy to meet this challenge (Smith 1994, 48). The Blackett Plan called for a two-track weapons procurement policy. The first of these tracks was the purchase of foreign weapons from Western suppliers in limited amounts required for Indian national security needs and only of those weapons systems that the Indian defense industrial base could not readily produce. Competitive weapons under the Blackett Plan were those procured from abroad (Smith 1994, 50). So-called non-competitive weapons systems, which would be the focus of domestic production, included defense wares such as ammunition and army vehicles, as a means to develop a modern defense industrial base slowly and methodically (Smith 1994, 50). For reasons discussed below, though the Blackett Plan became government policy, implementation of that policy would fall far short of the requirements to make India self-sufficient in defense production.
Elite Ideology
The single most cohesive aspect of the Indian state authority structure with regard to national security was elite ideology. In particular, widespread consensus existed among the political elite on the wisdom of nonalignment and the negative relationship between defense spending and economic development. What is notable in the discussion to follow is that while elite consensus existed regarding the broad ideological framework of nonalignment, little consensus existed between civilian elites and the military regarding the type of military equipment required for national security. In this regard then, there is some fragmentation in Indian state authority structure on the dimension of elite ideology between 1947 and 1962.

Within the policy framework of nonalignment, Nehru and his top lieutenants in the INC argued that defense spending had a deleterious impact on economic development, the solution to India’s fundamental security problem. Wholly consistent with this belief was the decision to emphasize diplomatic as opposed to military statecraft, particularly with regard to both the Soviet Union and the United States. Yet, while managing Indian foreign affairs with either superpower or most South Asian neighbors was eminently possible, the unresolved border dispute with Pakistan made it impossible to eliminate military statecraft as a tool of Indian foreign policy. Given the necessity of maintaining and arming a military, Nehru sought out and adopted the advice of Sir Patrick Blackett on how India might equip its military efficiently, in order to direct scarce Indian resources towards economic development programs (Smith 1994, 47-48).

As Nehru’s special advisor on military affairs, Blackett’s task was to leverage technology to India’s advantage in the creation of a sustainable force structure for the Indian military. In an ideal world, a country’s force structure and the weapons systems
adopted would efficiently relate means to ends, or more simply they should reflect the exigencies of likely national security threats. Blackett’s specific role was to help Nehru integrate technology into weapons systems to get the most mileage out of each rupee spent, so as not to spend unnecessary resources thought better spent on economic development (Smith 1994, 48-49). Trained as a physicist in England prior to World War II, Blackett became a pivotal military advisor to the British in the pre-war years and during the war, he was pivotal in the field of cryptography and even developed a bombsight used on all Allied bombers during the war (Anderson 1999, 261). In addition, Blackett won a Nobel Prize for his work on cosmic rays. Without question and judging by credentials, Blackett was the right man for the job.

One of the key concerns Nehru set before Blackett was the “indianization” of the Indian military in terms of its high command, weapons production, and supply (Anderson 1999, 253). In view of this concern, Blackett presented Nehru with two policy options, which required:

…Nehru to explore two different kinds of strategy and thus two different military set-ups. For the ‘realistic’ strategy Blackett preferred, he told Nehru that Indianization could be completed in 18 months; this would prepare India for conflict with other similar powers in the region. For the unrealistic strategy, in which India would prepare for conflict with major world powers, Blackett predicted it would take many, many years. Nehru liked this approach, and wrote him soon afterwards to ask Blackett to advise him on military and scientific affairs (Anderson 1999, 253).

Given Nehru’s policy of nonalignment, there was no contradiction between the “realistic” and the “unrealistic” strategy. On the one hand, Nehru could indigenize the command structure of the military and its weapons production and supply in 18 months so that it could confront Pakistan, the adversary India was most likely to face. On the other hand, over the long-term, a strong, industrialized Indian economy was to be the foundation of a
defense industrial base capable of producing major weapons systems on par with developed countries. However, if India were to pursue the “unrealistic” strategy in the near term, it would remain dependent on great powers for weapons to deal with Pakistan and might infinitely delay the process of attaining the status and prestige afforded great powers.

Blackett’s recommendations for Indian defense came from his distinct and informed perspective on the problems facing developing countries. What Blackett observed in developing countries and India was a tension he believed to be inherent to the simultaneous efforts “…to build a scientific and technological community that applies its skills to socio-economic problems, as well as building up a modern military infrastructure” (Anderson 1999, 260). The conflict between these two processes was the competing claims of both objectives on foreign exchange earnings. In order to facilitate the creation of a science and technology community, extensive imports were required in terms of scientific equipment, human capital, and capital goods. At some point in the future, the scientific and technology community in a developing country held the promise of supporting industrialization, yielding a stronger and more diverse economy. By contrast, importing high technology weapons systems represented for Blackett government consumption, rather than a productive investment. Blackett absolutely understood that even developing countries needed militaries and weapons to deter or defeat threats to national interests. However, he argued that force structures and weapons systems should be proportionate to the threats a country was likely to encounter. In the case of India, weapons such as supersonic fighter jets were superfluous in interstate
conflict with Pakistan and of almost no practical value in a domestic military mission such as that in Hyderabad in 1948 (Anderson 1999, 260).

In effect, Nehru’s nonalignment doctrine and Blackett’s perspective as a military advisor viewed India’s defense problem in much the same way. Both Nehru and Blackett saw that the regional balance of power heavily favored India. Both agreed that the introduction of cutting-edge weapons would have a negative impact on India’s security in at least three ways. First, introducing highly sophisticated weapons into a conflict with Pakistan, which lacked the ability to produce and maintain these weapons, was considered unnecessary because superpowers were unlikely to get involved in a regional dispute (Smith 1994, 50). Second, in the near to medium term, India could neither produce nor maintain sophisticated weapons like supersonic combat airplanes and efforts to do just this might delay India’s future ability to do so (Smith 1994, 49-50). Moreover, introducing high technology weapons into service in the Indian military may very well create either a dependence on countries in either the Western or Eastern Blocs, thus limiting Indian political autonomy. Finally and related, buying weapons from either superpower bloc may not mean explicit abandonment of nonalignment, but it implicitly ended this policy (Smith 1994, 50). For all of these reasons, Nehru’s ideas on grand strategy and Blackett’s ideas on defense production were symbiotic.

It is important to note here that while the Blackett plan enjoyed much support, there were serious unresolved tensions between Blackett’s plan, Nehru’s vision for India’s future, political support for the Congress Party, and the preferences of the military. In fact, despite stringent mechanisms for financial oversight of defense spending and official policy pronouncements regarding nonalignment, Chris Smith
observed an Indian defense buildup. Though the Indian defense budget never rose above 2 percent of GDP between 1947 and 1962, massive weapons purchases from abroad, from England especially, took place (Smith 1994, 61-72). Of particular interest is the fact that the Air Force added well over 600 combat aircraft during this period (Smith 1994, 56-57). Smith notes that neither the level nor the types of weapons systems purchased are consistent with what one might expect had Nehru followed Blackett’s policy recommendations (1994, 61). Yet, it is wholly possible that this divergence between policy and reality reflect serious unresolved tensions.

Though Smith explores several potential explanations for the failure of the Blackett Plan, he ultimately settles on two factors: a permissive environment and a principal agent problem (Smith 1994:, 63). First, notwithstanding official defense policy pronouncements, a permissive environment existed for expansive defense procurement during this time. On the one hand, Nehru and other policymakers concerned with India’s great power potential realized that if India failed to begin to develop its military potential now, it may be at a disadvantage down the road, once the economy grew as was projected in five year development plans. Defense expansion from 1947 to 1962 then proceeded because of an Indian desire for prestige. On the other hand, India had acquired significant sterling balances with Britain in exchange for its participation in the Second World War. Thus, weapons purchased from Britain, as most were in the post-independence era, had little impact on the government’s budget. That is to say, buying weapons from Britain did not force policymakers to make the choice between defense or development; large sterling balances obviated this choice (Smith 1994, 71-72). These
two factors then created the permissive conditions under which expansive defense procurement could proceed.

Wainwright also calls attention to the impact of the exigencies of democratic politics on the implementation of the Blackett Plan. Specifically, because the Congress Party had alienated the left wing in the 1940s and 1950, in order to retain effective political control of the Lok Sabha, the right wing of the party that actively sought to protect and preserve Hindu culture, had to be courted by Nehru (Wainwright 194, 136). This right wing of the Congress Party, led by men like Vallabhbhai Patel, whose stature in the party nearly equaled Nehru’s own, led to the creation of the post of Deputy Prime Minister. While the slow and methodical modernization and expansion of the Indian defense industrial base was important for Nehru’s long-range plans, those long range plans would mean nothing were he not in office. As Wainwright remarks, “The slow, and often secret, expansion of defense industries was a less spectacular method of demonstrating the government’s determination to confront Pakistan than was the immediate acquisition of technologically advanced weapons” (Wainwright 1994, 136-137).

Smith also identified a principle-agent problem, which formed the core of elite ideological fragmentation on the issue of defense development 1994, 64-66). Arrayed against the coalition of civilian elites in support of Blackett’s defense plan was the military (Smith 1994, 53). The conventional wisdom on the Indian military praises the professional ideology imparted on the military by the British for keeping the military out of domestic politics since independence. As has been noted, the reconstruction of the British Indian Army following the Mutiny of 1857 saw the creation not of a constabulary
force, but of an Indian military similar to that of a European great power in order to contend with the perceived Russian threat to the northwest. A great power style military in the east formed an important part of the British imperial grand strategy.

Built into the European military model imported to India was a fetish for technology. It is important to bear in mind that the Raj built the modern Indian military at about the same time that the application of science to war was starting to transform warfare into an industrial competition between countries to see which could produce the largest quantity of weapons with the highest degree of sophistication. This was particularly true in the case of the smaller and less populous countries of Western Europe as compared to Russia, which substituted men for technology. Though the British never supplied the Indian military with the best weapons and equipment, let alone the most technologically advanced weapons, the education afforded members of the Indian officer corps emphasized the sort of maneuver warfare that would reach its apogee in the Second World War in the form of the German blitzkrieg. Socialized through a British tactical education and professional training, Indian officers thought in terms of European warfare rather than low technology warfare or domestic operations (Smith 1994, 53). Thus, it is hardly surprising that the Indian Army or Air Force submitted demands for cutting-edge weapons systems, regardless of the capacity of an adversary in the most likely conflict scenario.

Referring to the British Ministry of Defence, Blackett described this sort of fetish for technology among the military as “Whitehall thinking.” Observing this Whitehall thinking, Blackett said that of all the challenges he faced in India, his biggest obstacle was:
Indian officials and advisers thinking purely from a Whitehall angle. There was an appalling psychological dependence on every word that Whitehall speaks. I understand in the beginning, in 1948, there was very little time and experience to think for yourself. But a great many of your problems are due to imitative adoption of Whitehall habits. Actually a lot of that thinking should not be exported anywhere. Some of it is not even good here [Britain] (Quoted in Anderson 1999, 263).

The point Blackett made is quite simple: the war fighting plans popular among the Indian officer corps of the three service branches were wholly unrealistic for the sort of war they were actually likely to be involved in. Blackett was insistent that Indians needed to think about Indian problems and the appropriate solutions, not British perceptions of Indian problems and how the British would deal with them. An important, if subtle point to make as well is the powerful desire for the officer corps to emulate the British military system.

The problem Blackett faced in overcoming the Whitehall thinking he encountered among the officer corps had two dimensions. First, despite the transfer of power to India in 1947, many of the British officers who occupied the top command positions in the Indian military remained in the employ of the Government of India until the mid-1950s. This was a necessity given that the military personnel policy of the Crown Raj barred Indians from occupying important positions in the higher defense organization, leaving Indian officers poorly prepared for these commands following independence. To be sure, it was not likely that the British officers who ran the Indian military for nearly a decade following independence were going to discard their Whitehall mindset.

The second problem Blackett encountered with regard to Whitehall thinking related to the loyalty of the British officers in the Indian higher defense organization. British officers retained by India retained a dual loyalty, creating operational problems
and issues relating to force structure and procurement (Venkataraman 2011, 83-86).

With regard to the former, the contradiction between loyalty to the British crown and their employers created a problem for British officers in Indian and Pakistan during the Kashmir War in 1947. With regard to the latter set of issues, Blackett perceived the British general officers in charge of the Indian Army and Navy as being interested in selling India the varied and sundry products produced by British arsenals (Anderson 1999, 263). Blackett’s assessment of Air Marshall Elmhirst is much the same as that of the British officers in charge of the army and navy:

The Airforce chief, Air Marshall Elmhirst, ‘tried to make India buy long-range bombers’ said Blackett, which would ruin India while being useless in local wars. Worse, he said, long-range bombers would have been dangerous to India, inducing massive and uncontrollable retaliation (Quoted in Anderson 1999, 264).

All of this is to say, that while British officers ran the Indian military, Whitehall thinking was and would remain pervasive among members of the defense establishment.

Yet, routing out Whitehall thinking was not simply a matter of “Indianizing” the officer corps and the higher defense organization. For better or worse, militaries are inherently conservative institutions and like other bureaucracies are extraordinarily resistant to change. This is important because in order to produce the requisite officers to staff the military establishment in both administrative and combat commands, new schools of military education would have to be built; ones that would impart an understanding of war and the organized application of violence in the context of India. Notably, this would have to be free from the sort of technology fetish seen in the West.

State Organization
Following independence, the Government of India confronted a number of daunting challenges. Among these challenges was how to deal with a military, which from the
perspective of Nehru and other influential members of the Congress Party was a threat to the consolidation of a democratic regime, a fear that became particularly acute after the 1958 coup in Pakistan (Smith 1994, 47; Wilkinson 2015, 95-97). Perhaps more importantly, Nehru feared that a powerful military might also lead to overspending on defense, which India could hardly afford, especially in light of the ambitious state-led development plans in the works. The focus of this section is on the institutional reforms taken following independence to fragment the institutional power of the military, with the goal of making clear how these institutional reforms hurt the process of military industrialization, in the aeronautics sector in particular. This fragmentation had two key dimensions, the insertion of civil service officers into the higher defense bureaucracy and the insertion of the Ministry of Finance into all procurement decisions.

While members of the Congress Party were suspicious of the erstwhile members of the Indian Civil Service, now the Indian Administrative Service (IAS), they were contemptuous of the Indian military. While the civil servants of the Raj were members of a “law and order” bureaucracy designed to advance the interests of the colonial power, as the coercive arm of the Raj, the British led and Indian staffed military was responsible for some of the most egregious atrocities committed by the British in India (Wilkinson 2015, 95-96). Thus, under the logic of democratic politics, rapprochement was possible between the urban sophisticates of the Congress Party and the civil service; however, such an alliance between Congress and the military was simply not possible. Moreover, there was a distinct feeling that domestic governance was entirely possible without the military because it had been of no use in the struggle for independence. Yet, Nehru was compelled to recognize the necessity of a military, if for no other reason than the fact that
almost immediately after independence India fought its first of four wars against Pakistan. The problem then for Indian political elites was how to reform the military to ensure it was subservient to legitimate civilian authorities, without sacrificing its efficacy (Wilkinson 2015, 97).

Thanks to the policies of the Crown Raj, the British Indian military inherited by the Congress Party in 1947 was largely isolated from politics, but this was a double-edged sword. On the one hand, because of the ideological indoctrination of the officer corps and the recruitment of the so-called martial classes, the military was a well-organized and highly cohesive fighting force. Evidence of the quality of the Indian military was its performance in the First and Second World Wars. On the other hand, the organization and efficacy of the military could enable the leadership of the officer corps to engage in politics even more effectively (Wilkinson 2015, 96). The Pakistani military coup in 1958, underscored the concern of Congress Party elites with regard to the military. The “military problem” then for politicians had two potentially contradictory dimensions. To ensure full civilian control of the military and mitigate the possibility of a coup, the institutional solidarity of the military needed to be degraded. However, as the First Kashmir War made clear, civilian politicians needed to ensure that the military retained enough institutional cohesion to be effective in deterring and defeating all adversaries.

To ensure civilian dominance over the military both a “divide and rule” strategy similar to that of the Raj and a reform of the military bureaucracy combined to solve the Indian military problem (Wilkinson 2015, 28). However, in opting for political control of the military, Nehru’s efforts to ensure civilian supremacy over the military contained
both elements of policy continuity and change that characterized civil-military relations in India following August 1947. In considering these elements of policy continuity and change, what is important to highlight is the fact that the goal was to fragment the institutional power of the military to prevent any challenge to civilian authority. However, the institutional reform of the military is of greatest interest from the perspective of defense production.

In an effort to subordinate the military to civilian control the newly independent Indian government made some thoroughgoing institutional changes in order to fracture the political influence the military could wield in a democratic India (Smith 1994, 64-65; Venkataraman 2011, 69-73). In accordance with this policy, a three-tiered committee system was set up to manage India’s military, headed by the Cabinet Committee of Defence to whom the Defence Ministry reported directly. The Defence Minister ran the Ministry of Defence and chaired a committee comprised of several secretaries, all of whom were civil service officers, as well as the three service chiefs. Finally, to promote inter-service coordination, there existed a Chief of Staff Committee, headed by the longest tenured service chief. This institutional structure was by design cumbersome and meant to ensure civilian supremacy, even at the cost of making strategic planning more difficult. The relevant question given this project’s focus on defense industrialization and especially the development of an aeronautics industrial base is the following: What impact did these institutional changes have on defense industrialization?

In addition to making strategic planning more difficult, the reorganization of the Indian higher defense organization following independence had two effects on defense industrialization. Beyond the extreme difficulties in long-range planning engendered in
the higher defense organization described above, the Ministry of Finance and the Defense Research and Development Organization (DRDO) were each given an important veto in the weapons procurement process that were to have significant ramifications on the development of the force structure of the Indian military and the IAF in particular. For its part, the Government of India vested the Ministry of Finance with the authority to determine if the government had funds for equipment requested by the military. Additionally, upon its creation in 1958, the DRDO acquired the responsibility to determine where a weapons system was to originate; either in the domestic defense industry or procured from abroad.

The financial aspect of Indian defense has since the time of the British Raj been front and center in the minds of policymakers in London and later New Delhi. Indeed, despite the fact that the British abandoned much of their fiscal discipline in the periods surrounding the First and the Second World Wars, the future leaders of India never lost sight of the great toll defense spending had on the Indian people. In fact, the economic burden of imperial defense borne by Indians due to the First World War was a major contributing factor to the first civil disobedience movement (Wainwright 1994, 32). Likewise, the anticipation of a similar defense burden in the run up to the Second World War and the fact that the British did not ask the Indians if they wanted to help defend the British Empire contributed to the beginning of the Quit India Movement in the 1930s (Wainwright 1994, 32). More importantly however, Nehru and influential members of the Congress Party were of the mind that economic development and defense spending, even in the context of defense industrialization were contradictory objectives.
Thus, following independence, the issue of defense finance was to come to the fore once more, as Indians became responsible for the defense of their own country. As discussed previously, Nehru’s nonalignment policy was designed to help bend the defense cost curve downwards. Specifically, by seeking not to engage in the Cold War and the associated global military buildup, Nehru hoped to be the enemy of none and cordial with all. However, in addition to a neutral grand strategy, the Ministry of Finance was also instrumental in keeping defense spending in check (Thomas 1978, 90-91),

R. Venkataraman, a retired air force general and respected Indian defense analyst, paints the following picture of the management of the defense budgetary structure following independence:

During the British period, defence expenditure was not voted. Acting on the Esher Committee recommendations, a Deputy Financial Adviser was attached to each of the major branches of the Army Headquarters [this included the Navy and Air Force as both were integrated into the Army Headquarters]. After August 15, 1947, defence expenditure came under the scrutiny of the legislature. To meet the requirement, Deputy Financial Advisers were attached to each branch of the Army HQ, Naval HQ, and the Air HQ, besides the Departments of Defense Production, Pension, Budget, and even to the Inter-Service Committees such as the Principal Personnel Officers’ Committee and Principal Supply Officers’ Committee. Subsequently, the Ministry of Finance (Defence) designated a Financial Adviser (FA) who headed a separate wing of the MoF [Ministry of Finance] on a year round basis, serving both as an adviser and a controlling authority for safeguarding economic efficiency and propriety in defence expenditures (Venkataraman 2011, 197-198).

Two specific points are important to make clear with regard to Venkataraman’s observations. First, Venkataraman does well to point out that following independence, the defense budget was subject to parliamentary oversight. However, nearly all analysis to date on the degree of parliamentary oversight in defense matters indicates that due to Nehru’s personal popularity and widespread electoral support for Congress, parliament exercised little effective oversight in defense matters (Thomas 1978, 68; Smith 1994,
Second, the Congress government doubled-down on British colonial policy and actually assigned more financial advisers to oversee the workings of all subordinate branches of the Ministry of Defence. Not only did they double-down on British policy, they went further by creating a separate permanent division of the Ministry of Finance to deal exclusively with issues stemming from and related to the military element of national security (Thomas 1978, 90).

The two different levels of oversight had complimentary effects. With respect to the myriad financial advisers assigned to all wings of the Ministry of Defence, these IAS officers worked closely with defense officials, civilian and military alike, to formulate budget proposals submitted to the Finance Wing of the Ministry of Defence. Within the Finance Wing, the financial adviser had a hand in constructing the overall defense budget submitted to the Ministry of Finance for consideration. Once at the Ministry of Finance, the Defence Wing of the Ministry of Finance would amend the defense budget proposal as required by the guidance received from the Minister of Finance. Thus, the safeguarding of the Congress Party’s economic development goals with respect to the defense budget occurred right at the beginning of the budgeting process every year. In a very real sense, as analysts of Indian higher defense organization have noted, political not Ministry of Defence procurement goals received pride of place in the budget process, with the Ministry of Finance having a direct veto over military force structure in their capacity as financial advisers (Venkataraman 2011, 200-201).

To be sure, a defense budget process dominated by civil service officers is bound to be cumbersome and may have deleterious effects on military force structure. The reality of the situation was that the financial advisers overseeing defense budgets were
either civil service officers or economists, and both lacked the relevant expertise to make
timely and appropriate decisions regarding defense affairs. In fact, such a lack of
expertise often led to unnecessary delays, as Ministry of Finance officials would submit
multiple highly detailed requests for information to the military on even routine matters
because of their lack of specialized knowledge of defense matters (Thomas 1978, 95).
While this convoluted bureaucratic process did produce substantial delays and may have
limited the efficacy of military statecraft, from the perspective of Nehru and his Cabinet,
these measures were wholly consistent with making as much money available for
economic development programs as was possible. Again, it is important to bear in mind
that the proportion of the Indian budget dedicated to defense in 1950 was 29 percent of
government expenditure, so the military was not starved of resources (Smith 1994, 72).

In addition to the tight fiscal control over the defense budget, the government of
India was also interested in developing an indigenous weapons production capacity.
India inherited from the colonial government 19-ordinance factories. In addition, it
inherited all of the facilities designed to build and construct major weapons systems
created to help supply the Indian and American war effort against Japan in the Pacific.
Despite this endowment, the marriage of science and industry during the Second World
War, as well as the subsequent rapid developments in weapons systems following the
war, combined to make these factories increasingly obsolete when compared with similar
defense production infrastructure in Britain, France, or the United States. Additionally,
the 1947 Kashmir war made clear to the responsible authorities that the ordinance
factories simply did not have the capacity in their current state to supply the Indian
military with the weapons and munitions required in time of war. Thus, following the
Kashmir War, not only did the government of India seek to modernize its military, it also sought to modernize the modest defense industrial base it inherited. The acquisition of European fighter jets and plans to modernize and expand the Indian defense industrial base serve to highlight the tension between Nehru’s policy of creating an affordable military suited to its strategic environment and his desire for India to earn international prestige.

The second major impact the IAS-military nexus had on defense industrialization had to do with the linkage between defense science and military production. The Indian defense industry was effectively an enclave community, which entirely excluded private capital from this sector of the economy. In place of a nascent defense contractor(s) emerging, a very large public sector defense science establishment began to develop during this period first under the leadership of the Defence Science Organization in 1948 (Kavic 1967, 126). Then in 1958, the Defence Science Organization, the technical development establishments of the three services, and Directorate of Technical Development and Production merged to form the Defence Research and Development Organization (DRDO) (Koithra 1999, 365-366). The creation of the DRDO centralized all aspects of defense research and development under one roof, including crucially aeronautics. From its inception, DRDO was to be the nodal government agency responsible for building the defense industrial base so as India could achieve self-reliance in the defense sector and with that end in mind, it also has been responsible for the indigenization of imported weapons systems (Cohen and Dasgupta 2010, 32-35). Unfortunately, the failure of the DRDO in both facets of these organizational objectives
has left India crucially dependent upon imported parts and technology since the 1950s (Cohen and Dasgupta 2010, 34).

Though not unlike defense prime contractors in developed countries, such as Boeing or BAE Systems, the DRDO is a unique entity. Seen from the vantage of the acquisition process, when the decision was taken to purchase a new weapons system for any of the armed services, DRDO is the first wing of the Ministry of Defence to handle this request. Specifically, DRDO makes the decision to buy, make, or buy and make. It is this authority to decide where Indian weapons where purchased that differentiates the DRDO from Boeing or Lockheed Martin. Notably, it is an explicitly political decision fraught with all the complications that come with defending bureaucratic turf. The incentive for officials at the DRDO has been to issue make or buy and make decisions even when the weapons system sought is well beyond the existing or likely near-term competencies of the organization (Cohen and Dasgupta 2010, 33).

Following a decision to make or buy and make, the DRDO operates in a very similar way to that of Raytheon or Dassault. That is to say, the DRDO works together with the appropriate departments in the DRDO to establish a set of performance parameters for the new weapons system. Once the proposal is submitted, work can commence on developing the new weapons system. For a very complex weapons system, such as a combat aircraft, this involves the development or repurposing of nearly all major subsystems from scratch. In some way, this process is somewhat like trying to invent the wheel. Following development, testing and certification take place.

Once the development of a new weapons system has taken place, it is sent to one of the defense public sector undertakings (DPSUs), where serial production can begin. In
the case of all aircraft made in India, the DRDO sends the project to Hindustan Aeronautics Limited (HAL). Interestingly, until this point in the development process, little thought was given to exactly how series production would commence. What this means is that DRDO’s competencies lie in the development of the basic scientific knowledge and the limited application of this knowledge to the development of an aircraft. They do not have the requisite skills for the complex process of systems integration, which is critical for building a single aircraft, let alone series production.

Interestingly, neither did HAL. Very little communication takes place between the designers at DRDO and the engineers at HAL. What is worse and is likely the root of the problem, the DRDO and HAL are not within the same lines of authority within the Ministry of Defence.\textsuperscript{70}

Given these inherent problems, it is important to note another difference between defense contractors in developed countries and DRDO. That difference is accountability and the possibility of negative repercussions. The bottom line is as far as DRDO goes, it is a monopolist because the defense sector is the exclusive preserve of the government. What this means is that whereas private defense companies, such as Curtiss-Wright, that are unresponsive to government needs or consistently fail to deliver go the way of the dodo; they become unprofitable, insolvent, and extinct. To be sure, individual employees of the DRDO found to have negatively impacted operations may well be subject to discipline, but despite persistent failures on the part of DRDO to deliver aircraft for the

\textsuperscript{70} While the DRDO and HAL are both under the direct supervision of the Defence Minister’s Committee, the DRDO is under the authority of the Defence Science Advisory Committee and HAL is under the authority of the New Weapons & New Equipment Production and Supply Committee (Smith 1994, 206).
IAF that it requests, in an acceptable timeframe, and on budget have not to date resulted in any major overhaul to the DRDO (Cohen and Dasgupta 2010, 33).

With respect to poor DRDO performance, DRDO officials often explain their failings in terms of the unrealistic expectations on the part of the armed services (Cohen and Dasgupta 2010, 33). The reality is for at least two reasons, the military and the IAF in particular, frequently make requests for technologies that are far beyond the capabilities of the DRDO. One reason this is so is because the track record at DRDO has been so poor, with projects running decades behind and millions of rupees over budget that the IAF repeatedly changes its specifications in response to the changing state of aeronautics technology. An additional reason is that the members of the military are focused on acquiring the weapons systems at the cutting-edge of technology, consistent with the Whitehall thinking identified by Blackett (Cohen and Dasgupta 2010, 34).

State-Society Linkages
While the Indian economy has always been a capitalist economy, it has differed from many others with respect to the degree of authority it has delegated to the market. Specifically, at the Avadi Conference of the Congress Party in 1955, the government had worked out a classification scheme of industrial activity and apportioned only consumer goods and services sectors of the industrial economy to private capital. The Indian government reserved to itself the “commanding heights” of basic industry and those strategic industries deemed important for national survival (Matthews 1989, 51-52). Logically, this meant that the government reserved for itself all defense industries.

Proponents of a public sector defense industry enunciated the logic for this arrangement in three straightforward arguments. First, the Congress Party and its “Gandhian strain” of defense thinking, with its long-standing and firm commitment to
strategies of non-violence strongly opposed profit making by weapons industries. Second, not only should the private sector be allowed to make a profit on weapons, if the profit motive were not strong enough for Indian private industry to make weapons, they could become unreliable suppliers and imperil national security. Finally, private industry was alleged to lack the degree of sophistication necessary to build modern weapons systems, which demand a high level of precisions in manufacturing and operate with close tolerances.

To be sure, nearly every one of these arguments for reserving defense production for the public sector were refuted at the time they were made. Perhaps the best argument made against nationalized defense production was in the ubiquitous categories of food and clothing. The reality was that Indian companies even in the late-1940s could produce these sorts of goods, especially clothing, far more efficiently than could public sector industries. Moreover, as discussed in the preceding chapter, the United States built up a significant defense industrial base in India during the Second World War to support the Allied war effort in the Pacific. With specific regard to the aeronautics sector Cohen observes:

By the end of World War II, India had acquired the fundamentals of an aircraft industry, including a modern repair and manufacturing facility and an Indian-owned airline. During the war, the United States had developed a major repair facility at Hindustan Air Limited (HAL), in Bangalore. It was designed to overhaul and repair a wide range of American and British aircraft in service throughout South and Southeast Asia. HAL grew rapidly and at one point began to manufacture light aircraft and parts. It remained a state-owned corporation, primarily because of its military applications (Cohen 2001, 99).

However, arguments that Indian industry was capable of producing at least some of the items required for national defense fell upon deaf Congress Party ears, a luxury of political dominance.
It is important to make this point about the political dominance of the Congress Party for at least one simple reason. To date, Cohen and Dasgupta argue that political ideology and Indian defense organization are a driving factor in the poor state of readiness of the Indian military and thus the impotence of its grand strategy (2010, 1-2). While ideological factors certainly play a role, ideology is not the sole factor. Political prerogatives are of little explanatory value if the holders of a particular set of goals do not have the capacity to act on their prerogatives. Of course, scholars such as Barry Buzan have highlighted this point in his research on securitization theory, noting that it is the privileged position of securitizing actors that in large part helps them create an intersubjective understanding of a threat among an audience. All of this is to say, that without the authority afforded by public support in a democracy, policy prerogatives for better or worse are not worth very much.

4.2.3 State Support for the Aeronautics Sector
The Indian aeronautics sector received considerable government support between 1947 and 1962, relative to other sectors of the defense economy. Much as there was more prestige associated with importing sophisticated combat aircraft than military trucks, there was more prestige in fostering the capabilities to domestically design, develop, and produce sophisticated aircraft than military trucks (Wainwright 1994, 140). Notably, the concern for the prestige associated with the development of an aeronautics sector was visibly on display when then minister of communications, Jagjivan Ram, issued the airworthiness certificate for the HT-2 light trainer aircraft, indicating that this event marked “the dawn of India’s emancipation from dependence on Western countries for aircraft design and construction” (Wainwright 1994, 140). Additionally, during a state visit, Vice President Richard Nixon was given a tour of the HAL factor in in Bangalore,
which led him to predict that India would experience rapid economic development based on its technological prowess (Wainwright 1994, 140). During this period, government support for the aeronautics sector can be broken down into two basic categories: licensed production and indigenous projects.

Licensed Production
From 1947 to 1962, though India imported weapons from France and Canada, British weapons systems comprised the majority of India’s arms imports. During the 1950s, Indian imports of British combat aircraft dwarfed the expenditures on weapons for the other branches of the Indian military. Notably, “nearly two thirds of India’s armaments imports came from the United Kingdom. From 1954 through 1960 the IAF acquired an impressive array of weapons, with its aircraft purchases alone accounting for over £100 million” (Wainwright 1994, 167). These acquisitions included the acquisition of hundreds of Spitfire and Tempest fighters, de Havilland Trainers, hundreds Vampire fighters, Canberra bombers, and Folland Gnat fighter jets (Smith 1994, 68-69). Notably this build-up in the IAFs capability began as early as 1948 when the Indian government purchased Spitfires, Tempests, and trainer aircraft from Britain, predating Pakistan’s defense treaties with the U.S. and the PAK’s receipt of American fighters in the mid-1950s.

Much to the credit of the Government of India, in many cases, the government did not simply purchase these weapons outright from Britain. Rather, in the case of at least the Vampires, Percival Prentice Trainers, and Tiger Moth Trainers, licensed production

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71 Though the deal that led to licensed production of the MiG-21 dates to this period, I do not address it in this chapter. As will be made clear in Chapter 5, acquisition of the MiG-21 was based at least in part on the perceived threat from China. Additionally, the deal took several years to consummate and was heavily influenced by India’s geopolitical position in the mid-1960s.
of these airplanes all took place at HAL’s production facility in Bangalore (Smith 1994, 159). And following the conclusion of the deal with Folland in 1956, the Gnat was produced under license in India as well, along with the Orpheus -701 engine that powered it (Smith 1994, 159). In terms of building industrial potential, the Folland deal was a major boon for the development of the aeronautics sector.

Folland originally developed the Gnat as a fighter jet for the NATO alliance; however, NATO rejected it. Lord Mountbatten suggested to Nehru that this plane would suit Indian defense needs well and Nehru agreed. Initially, India ordered 50-100 units, with licensed production to follow (Smith 1994, 159). However, still smarting from delayed delivery of Vampire and Tempest fighter jets, the IAF was looking to diversify the source of the combat aircraft and the French offered the Oragaun along with financial inducements to members of the air force. Eventually, because of Nehru’s personal intervention in the matter, IAF objections to the Gnat were overcome and in 1956 the deal was consummated with the first deliveries in 1963. Crucially, Folland went bankrupt in the early 1960s and India was able to purchase much of the technology and rights to Folland patents for the Gnat. Smith notes that as a result of this technology acquisition that, “While the RAF kept the physical assets, India received the rest including design jigs and the test facilities. This success led to the production of 200 unites, allowing HAL to achieve economies of scale. Eventually 85 percent of the airframe and 60 percent of the engine were produced indigenously” (Smith 1994, 160).

Though licensed production of the Gnat was successful, other efforts at licensed production did not generate the sort of industrial capacity as did the Gnat program. This industrial weakness meant that even when India received the planes requested from
foreign suppliers, that they could not be fully utilized (Wainwright 1994, 168). Speaking to the capacity of the maintenance staff for IAF aircraft in the 1950s, Wainwright observes:

In 1956 British Vampires and French Ouragans formed the core of the IAF’s strength; by June 1958 India had 359 Vampires and 90 Ouragans. However, when India acquired the more advanced Hunters, Canberras, and Mystères, only the technicians and air crews who had worked on the Vampires and Ouragans were skilled enough to maintain and fly the new aircraft. Their unavailability to service the older airplanes rendered Vampires and Ouragans effectively useless for the IAF. By June 1958 it maintained only two squadrons of Vampires (Wainwright 1994, 168).

The key point to be made here is that the rapid introduction of high technology fighter aircraft rapidly outstripped the capacity of the aeronautics sector to service these planes. Revealingly, aircraft maintenance and upgrade capacity is one of the lowest rungs on the technological ladder of sophistication in the aeronautics supply chain. Thus, this observation suggests that even if Indian defense industrial policy was paying close attention to the formation of human capital, the rapid introduction of the next generation of fighter aircraft seriously undermined the capacity of the aeronautics industrial base.

In addition to a shortage of trained workers to perform maintenance, overhauls, and repair, the Indian industrial base lacked sufficient capacity to make important spare parts for the IAF fleet. Two key reasons existed for this lack of spare parts. First, British weapons procurement worked against India, because they “…were scaling back production because the RAF habitually used equipment and ammunition for up to twice the duration of its “book” life (Wainwright 1994, 168). However, the bigger issue was the fact that the Indian government did not sufficiently prioritize the acquisition of spare parts and “allowed already purchased equipment to pile up in its warehouse in England awaiting shipment to India” (Wainwright 1994, 168). The primary point to make here is
that this shortage of critical spare parts is striking and suggestive of the failure of Indian aeronautical industrial policy. Whereas the acquisition of high technology fighter jets was high profile and prestigious, as were investments in HAL, developing the sectoral capability and depth to manufacture spare parts was not provided for. No doubt, the development of such “low profile” industrial capacity was not prestigious enough for either foreign or domestic policy goals. However, if defense industrial self-sufficiency is the desired goal surely the development the industrial capacity to manufacture spare parts is crucial and an important step up the ladder of technological sophistication.

Finally, much as the rapid introduction of new aircraft outpaced the ability to maintain these weapons, so too did the subsystems required to utilize them. For instance, looking at the Canberra bomber, the navigation system for this aircraft was not readily available, requiring the IAF to find suitable replacements. Rather than seeking a domestic solution to the problem, a contract was signed with the Italian firm, Ferranti, which sold India the required equipment under the name “Blue Study” (Wainwright 1994, 168). However, “The IAF’s vacillation over its decision to acquire the bombers…made it impossible for all of them to contain “Blue Study,” and effectively grounded much of the Canberra fleet during its early years of operation. Furthermore, New Delhi was slow to provide workshops and repair facilities for its radar and guidance systems, thus undermining their effectiveness during the late 1950s” (Wainwright 1994, 168). What this suggests is that neither the DSO nor its successor, the DRDO, had yet developed to core competencies required to design and develop critical replacement subsystems for existing aircraft.
The success of the Folland Gnat notwithstanding, Indian attempts at using licensed production to move up the ladder of technological sophistication produced lackluster results. By the late 1950s, HAL lacked the personnel to perform the required maintenance and the ability to produce critical spare parts for the IAF fleet of fighters and bombers. Additionally, the DRDO had not yet developed the capability to design critical subsystems for existing aircraft. While the latter capability is nearly at the top of the technological ladder of sophistication, the ability to manufacture spare parts and perform maintenance is the first rung on this ladder. The failure to attain a footing on the first rungs of the production ladder suggests a poor developmental record for the aeronautics sector during this time.

Indigenous Projects
The second major category of industrial support the aeronautics sector enjoyed between 1947 and 1962 were indigenous projects. The most consequential of these projects was that of the HF-24 Marut. The Marut was an ambitious indigenous project to develop a Mach 1.5, twin-engine fighter/bomber, which got its start not in a solid analysis of the IAF of the threat posed by Pakistan or later China, but in the minds of Nehru and Menon who had defined self-sufficiency in defense economy as an Indian priority. Just as had the Brazilians, India invited renowned aircraft designer, Kurt Tank, formerly of Focke-Wulf, to work on this project, which was to have two phases: production of an airframe for supersonic flight and the domestic development and production of an engine capable of producing sufficient thrust for supersonic flight (Smith 1994, 160). While Smith identifies at least four key problems that led to the manufacture of a disappointing combat
aircraft, from the perspective of this project, the most interesting is that of coordination between politicians, the military, and industry.  

Smith observed that one of the key failings of the Marut project was a lack of coordination between the relevant members of the aeronautics enclave. Specifically, he notes that, “At no point is it possible to identify a well-orchestrated attempt to weigh the views of the military, politicians and industry on the project. Instead, progress was linear. As the project proceeded it passed form the hands of the politicians to the military and finally to industry. Or, to put it another way, the politicians defined the possibilities, the military defined the problem and industry was left to define the answer” (Smith 1994, 162). Evidence of this lack of coordination can be seen in all three of the key participants. For their part, politicians could neither obtain a suitable engine for the Marut abroad nor was an Indian engine design team ever sanctioned (Smith 1994, 162). While HAL had gained significant experience in the licensed production of the Gnat, particularly in the realm of reserve engineering, apparently it was not utilized on the Marut project (Smith 1994, 162). Finally, the IAF lacked both officers with technical expertise to assist in the design of the Marut and they were not in favor of acquiring an indigenously designed, developed, and produced aircraft (Smith 1994, 162).

The HF-24 did eventually proceed to serial production. However, only 145 of a planned 214 Maruts were built (Smith 1994, 16). This shortfall in production likely made the Marut project even more costly as the production run likely did not enable HAL to achieve economies of scale in production. Ultimately, the Marut never became a primary combat aircraft and was retired shortly after its introduction into the IAF fleet.

\( ^{72} \) For a complete discussion of all four reasons for the failure of the Marut project, see Smith (1994, 160-163).
4.3 Comparative Insights and Theory Testing
They primary goal of this chapter has been to examine the political origins of the aeronautics enclaves in Brazil and India. In the process of investigating the political origins of these enclaves, two sets of variables have been of primary importance, including external vulnerability and state power. This section reports the findings to this point, paying attention to variations in both external vulnerability and enclave cohesiveness within and across cases. Additionally, I discuss the relative utility of the novel neoclassical realist approach to defense development compared to existing theories.

4.3.1 The Political Origins of the Brazilian and Indian Aeronautics Enclaves
What political factors explain the unique characteristics of the Brazilian and Indian aeronautics enclaves that began to take shape in the late-1940s? I argue that elite perceptions of external vulnerability at the critical juncture explains how the enclave emerged in each case, thus determining these states’ power for sectoral development. In the case of Brazil, the strategic picture changed quite dramatically for the worse. Regarding external threats, Rio de Janeiro now had to contend with threats from two vectors. First, regional threats still loomed large as they had during the Old Republic. As was discussed, Brazilian elites believed war with a militarily stronger Argentina was still a possibility. Worse still, Vargas and his advisors feared the possibility of war against an Argentine-Paraguayan alliance. Yet what changed most dramatically from the time of the Old Republic and that of the emerging Estado Novo was the rise of extra-regional threats, namely the possibility of direct or fifth column attempts by either Nazi Germany or imperial Japan to acquire Brazilian resources to feed their domestic industries. Additionally, as was true to a limited extent during the Old Republic, policymakers highlighted the U.S. as an imperial threat, though of an economic nature.
Set against these external threats, Brazil had few solid opportunities for external balancing and Brazilian policymakers played their strategic hand as best they could. First, policymakers in Rio de Janeiro considered a regional alliance. However, this was viewed as unrealistic because of the existing regional rivalry with Argentina. Second, in addition to concerns about economic imperialism, policymakers considered the U.S. to be an unreliable balancing partner because of its unwillingness to invest in Brazil’s defense industrial base and because Argentine diplomacy during the Chaco War had delayed the delivery of U.S. weapons to Brazil. Third, Brazil did pursue an extensive trade relationship with Germany on a near barter basis, which saw primary commodities flow from west to east, in exchange for capital equipment for industrialization and weapons. This relationship ended because of the outbreak of the Second World War. Ultimately, German raids on Brazilian ships decided the issue of with whom Brazil would ally and as was the case during the Old Republic, a foreign policy of approximation with the U.S. was pursued.

As for India, perceived levels of external vulnerability were considerably lower than those in Brazil following the moment of national political consolidation. India gained independence and was the unquestioned hegemonic power in South Asia. In addition to its large size and population, the independent Government of India inherited from the Raj a highly professional military and a large defense industrial base built by Britain and the U.S. during WWII. Thus, even given the violence that accompanied the partition of the Subcontinent and the First Round war against Pakistan, Indian elites believed their geostrategic situation to be relatively secure. Additionally, Nehru and many of his key advisors believed that owing to its political, economic, and military
weakness Pakistan would eventually re-join India. Supporting this position is the fact that India began a military build-up that pre-dated the accession of Pakistan to CENTO and SEATO. In fact, the biggest strategic risk in the minds of Nehru and his advisors was getting involved in the Cold War, which could threaten India’s capacity for rapid economic development.

Given this relatively benign strategic picture, Nehru pursued a foreign policy of non-alignment. This policy had two dimensions. First, India pursued cordial relations with both the Soviet Union and the U.S., to obtain development assistance from both countries. Second, India became the self-styled leader of the non-aligned movement of newly independent countries. Ironically, it was precisely this policy of non-alignment that led India down the path of defense development. To pursue a truly non-aligned foreign policy, India needed to be self-reliant in arms production to ensure access to foreign weapons didn’t limit foreign policy prerogatives. Additionally, the pretension to global leadership required that India had the international prestige and the ability to furnish non-aligned countries with weapons to keep these former colonies out of the American or Soviet sphere of influence.

In addition to a relatively benign geostrategic position, India had relatively solid external balancing opportunities to support its non-aligned foreign policy. Specifically, the large sterling balances accrued during the Second World War enabled India to purchase Western arms, in particular, large numbers of combat aircraft from Britain and to an extent France. Not only was India able to purchase completed weapons systems, it also made large investments in purchasing much of the equipment to maintain and
produce many of these same systems. So while the incentive for defense development existed, levels of external vulnerability were assessed to be relatively low.

Given the observed levels of perceived external vulnerability in Brazil and India at the moment of national political consolidation, how did this affect state power for aeronautics sector development in each case? In the case of Brazil, higher levels of perceived external vulnerability relative to those during the Old Republic, led to increases in state power for defense development. Given elite perceptions that underdevelopment was a key source of national political and military weakness, Vargas sought to promote the rapid development of strategic sectors of the national economy, such as the petrochemical industry. The aeronautics sector was also a beneficiary of this developmental effort because of the demonstration effect of airpower in the São Paulo Civil War and the Japanese attack on Pearl Harbor. Consistent with the broader effort aimed at creating state institutions capable of facilitating development during the Estado Novo, key regulatory, demand-side, and supply-side institutions were established, which with maturity, would come to form the backbone of the Brazilian aeronautics enclave. These included the following: the MAER, the FAB, the ITA, and the CTA. In view of this projects focus on emulation, it is worth reiterating the fact that in creating the MAER, Brazil deliberately copied French regulatory institutions and in creating the ITA, the American university system were deliberately copied as well.

It should be noted that the efforts of Vargas at state-building as a component of internal balancing stand at odds with those undertaken during the Old Republic. When confronted with high perceived levels of external threat, policymakers during the Old Republic relied primarily on foreign policy approximation with the U.S. to hedge the
Argentine threat. Though emulation was pursued, it was geared towards the professionalization of the officer corps in the traditional sense, that is to say training them to be skilled practitioners in the application of violence for political ends. Of course, this was wholly consistent with the limited role elites saw for the state in supporting sectoral development in either civilian or military sectors of the economy. During the *Estado Novo* by contrast, while a foreign policy of approximation with the U.S. continued, a deliberate effort was made to improve the training and skill of officers and civilians alike to facilitate the development of the aeronautics sector. This was consistent with the economic nationalist position of elites in power from 1937 to 1945.

Notwithstanding the significant efforts at state-building to support aeronautics sector development, little observed development occurred from 1937 through the early 1960s. This was so for two key reasons. First, while the legitimate scope of state intervention in the economy significantly increased with the advent of an economic nationalist ideology during the *Estado Novo*, just as was true during the Old Republic, production was not the domain of the state. Production was the exclusive preserve of private capital. Second, though great efforts were made to develop an aeronautics enclave, its relative immaturity limited its contribution to state-led development.

With respect to the Indian case, despite the incentive perceived for defense development, low levels of perceived external vulnerability served to create an Indian aeronautics enclave that was comparatively less powerful than its counterpart in Brazil. The key institution that Indian elites constructed to support the development of the aeronautics sector following independence was the DRDO, whose responsibilities included basic scientific research across a broad array of domains, including aeronautics,
as well as the regulatory responsibility to decide where India purchased its weapons. In contrast to the Brazilian case, this agency was not a dedicated aeronautics R&D institution, nor did it train civilian engineers for work in the sector, as did the CTA and ITA, respectively. Moreover, the DRDO’s staff was comprised of civilian scientists and was managed by the Defense Minister’s Scientific Advisor. As far as industry was concerned, HAL was nationalized and while it was under the authority of the Ministry of Defence, it was institutionally isolated from the DRDO because it was under the direct authority of the Defense Production Committee. For their part, the IAF was isolated in the weapons acquisition process. The IAF’s role was simply to define performance parameters for new combat aircraft, DRDO was supposed to do the R&D work, and HAL was supposed to undertake and manage production.

The design of the aeronautics enclave that emerged in India following independence bears a striking resemblance to the concerns of the Raj, discussed in Chapter 3. As the reader will recall, the policymakers in charge of the colonial state had two key concerns regarding the military. First, because the Raj had to pay for itself and lacked the ability to extract much in the way of taxes from Indians, it was always concerned with the cost of the military. Second, the “indianization” of the military, the army in particular, was minimized to ensure the military remained loyal to the government. Following independence, the Government of India had similar concerns. On the one hand, the primary objective of the government was to promote rapid economic development and Nehru and his cabinet believed that defense spending was at odds with this goal. Yet, defense spending did in fact go up after independence because as was true during the Raj, Britain was paying for it. Specifically, as was observed,
sterling credits accrued by India during WWII obviated the choice between economic development and weapons. On the other hand, policymakers also feared a military coup, particularly after the military coup in Pakistan. Thus, to ensure the loyalty of the military to the government, its power was fragmented and several levels of civilian oversight were added to this end. Additionally, private capital was entirely crowded out of the defense sector because it believed it did not possess the requisite capacity to engage in production for defense.

This intentional fragmentation of the aeronautics enclave contributed directly to relatively little observed development in the Indian aeronautics sector compared to the pre-independence era. From 1947 through 1962, state policy for sectoral development focused on licensed production and indigenous design. Regarding licensed production, though the Folland Gnat was a great success, the rapid introduction of large numbers of increasingly sophisticated combat aircraft from England and France quickly outpaced the skills of the labor pool. Moreover, it appears that the availability of foreign aircraft and spare parts served to retard the development of an indigenous capacity to overhaul and repair aircraft or make the myriad spare parts required throughout the life cycle of combat aircraft. As for indigenous design, among the struggles in the development of the HF-24 Marut, it was clear that a failure of coordination between political elites, the DRDO, HAL, and the IAF was the key stumbling block of this unsuccessful project.

4.3.2 Theory Testing
How well do existing theories of defense development perform in explaining the observed developmental outcomes? Regarding the neorealist theory of defense development, the expected correlation between external threat levels and the rationality of defense industrial policy obtains in Brazil and India. This makes sense given that
external threats were higher in the former than in the latter case. However, the neorealist theory lacks a causal mechanism to explain variations in the rationality of the policies pursued in Brazil and India. The scope of the neorealist theory of defense development does not provide the causal mechanism that explains the causal link between external threats and developmental outcomes. The neoclassical realist theory of defense development advanced herein out performs the neorealist theory because it incorporates this causal mechanism; state building.

What of the defense dependency argument? To reiterate, the defense dependency approach suggests that defense industrial outcomes are a function of the structure of the international arms market: As the sophistication of technology in the market increases, thereby increasing the cost of weapons systems, the chances of successful defense industrialization outcomes in developing countries decreases. This argument makes very little contribution to understanding defense development outcomes in Brazil or India in the periods under study in this chapter. In the case of India, the structure of the international arms market had little to do with poor outcomes in the aeronautics sector during the period from 1947 to 1962. As was noted above, the weakness of the aeronautics enclave in large part explains the failure of sectoral development in either the case of licensed production or domestic designs. In the Brazilian case, sectoral development was limited following the creation of the aeronautics enclave because the enclave lacked the resources to support sectoral development and the state choose to refrain from direct support for industry. Neither of these reasons relate at all to the structure of the international aeronautics market.
Finally, the institutional capacity argument does help to explain developmental outcomes in both cases. Specifically, given the relative weakness of the aeronautics enclaves in both Brazil and India, one should expect limited development. This is precisely what I observed in both cases. Yet, it does not explain the weakness of the strategic enclaves insofar as it does not consider the politics that led to the specific institutional configuration of each enclave, thereby determining their power for sectoral development.
Chapter 5: Institutional Reform and Stasis in Aeronautics Enclaves

Between the 1960s and early 1990s, there was a considerable divergence in the development trajectories of the Brazilian and Indian aeronautics sectors. From 1969 through approximately the end of the Iran-Iraq War (1988), the Brazilian aeronautics sector became a globally integrated enclave, producing medium technology civilian and military aircraft to meet domestic demand, as well as for export to developed and developing countries alike. It is no stretch to say that during this time period, Brazil’s aviation sector moved up in the global value-chain from a fourth to a third tier producer, with overlapping competencies mirroring those in developed countries, namely systems integration. By contrast, however, despite significant early technology transfer from the Soviet Union and to an extent France, the Indian aeronautics sector did not develop any new competencies that could move it up in the global value chain and thus in the production tiers of defense producers. Indeed, between the 1960s and early 1990s, the Malaysian aeronautics sector caught up to and eclipsed that of India and without the benefit of Allied defense industrialization during WWII (Cohen 2001, 99-100). This observed variation in the development trajectories of the aviation industries in Brazil and India is something of a puzzle for two reasons.

First, beginning as early as the late-1960s, the structure of the global arms market changed radically. This change was the result of four interrelated trends including the following: increased competition from a growing number of suppliers; increased technology transfers from developed to developing countries; a growing commercial logic in global arms sales; and the globalization of arms production (Conca 1991, 80). The import of this structural shift in the global arms market is important for the narrative
herein because it represented an opportunity for developing countries to expand and modernize their defense industrial bases, including their aeronautics sectors. Yet, looking at the cases of Brazil and India, only one of these countries were able to make good on this opportunity. To be sure, India’s troubled relationship with the U.S. may well have limited the former’s opportunity for defense development. However, Brazil had tense dealings with the Carter Administration and was always wary of the U.S. commitment to South America during the Cold War. Additionally, though the Brazilian aeronautics sector enjoyed substantially greater linkages with the U.S., India’s aeronautics sector had significant linkages to the Soviet Union. Furthermore, both Brazil and India worked closely with France during the time under consideration. If Brazil and India had approximately equal opportunities to expand and modernize their aeronautics sectors as a result of trends in the global arms market, why did only Brazil make good use of this opportunity?

Second and equally puzzling, the development trajectories of the Brazilian and Indian aviation industries also run counter to neorealist theorizing on defense development. Hoyt theorized that as external threats increase, so too will the coherence and presumably success of defense industrial policy. Yet, when looking at long term trends in the levels of external threat experienced by India and Brazil between the 1960s and early 1990s, one finds lower levels of threat paired with better defense development outcomes in the latter case and vice-versa for the former case. Specifically, the relative level of external threat for India is unambiguously greater than that of Brazil from the 1960s until the 1990s. With the conclusion of the Sino-Indian War, India found itself mired in long-standing enduring rivalries, that eventually became nuclearized, with its
neighbors in the NWFA (Pakistan) and NEFA (China). Additionally, U.S. gunboat diplomacy in the 1970s heightened fears about extra-hemispheric intervention in South Asia by great powers (Cohen 2001, 136). Despite these threats, the Indian state appears to have been no more effective an agent of aeronautics sector development between 1962 and the early 1980s, than it was between 1947 and 1962. By contrast, in the period under consideration, the level of external threat faced by Brazil dropped quite considerably. Evidence for this statement is drawn readily from the historical record. For instance, the Itaipú treaty (1979), the surprise Argentine-Brazilian nuclear disarmament agreement in the 1980s, Argentine abandonment of its Condor II missile program, and the beginnings of regional integration in the 1990s all point to significantly decreased levels of external threat to Brazil from its historic rival (Holsti 2005, 176). Additionally, in the mid-1980s, Argentina and Brazil agreed to co-develop a plane that came to be known as the CBA Vector, and the 1980s saw the beginning of the South American integration project known as Mercosur (Franko-Jones 1991, 153; Burges 2011, 28-33).

To be sure, if the once simmering regional rivalry between Argentina and Brazil still existed, one would be hard pressed to find evidence of it. However, it was precisely during this period that the Brazilian state became a very effective agent of aeronautic sector development. If neorealism doesn’t account for the observed variation, what does?

In this chapter, I argue that the observed variation highlighted above, is explained by shifts in state power resulting from the “fitness” of the political regime for its external environment. On the one hand, the Brazilian military overthrew the democratic regime in place from 1945 until 1964 because there was consensus among elites that this regime was ill-suited to resuscitate aflagging economy and was reckless in its efforts at mass
mobilization. Following the coup of March 1964, the Brazilian military consolidated a regime whose twin goals were political stability and economic development. By means of ruthless repression of dissenting voices in civil society, the Brazilian military insulated key state institutions to pursue technocratic development programs. In what follows, I illustrate how the established aeronautics enclave was a direct beneficiary of the increase in state power represented in the military regime. On the other hand, there was no similar event in India that brought new elites to the fore, with alternative ideas about how state power should be organized or for what end. Though it is true enough that the level of external threat may have increased and the INC would lose its hegemonic position in Indian politics, there were no events that caused any elites to seriously contest the fragmented-multiclass state that developed in India following independence. As such, there was no catalytic event to cause any change in state power, thus the aeronautics enclave did not undergo any significant revision, for better or worse, and the Indian state remained an ineffectual agent of sectoral development.

This chapter follows the same basic outline as did the preceding chapter, as it is broken down into three primary sections. The first two sections of this chapter are dedicated to discussions of the Brazilian and Indian cases. In looking at both cases, I seek to highlight the relationship between perceived external vulnerability, changes in state power for defense development, and aeronautic sectors development outcomes. With respect to Brazil, I focus on the factors leading to the March 1964 coup, the consolidation of a military dictatorship and the associated institutional reform of the aeronautics enclave, and state support for aeronautic sector development from 1969 through the early 1990s. Regarding India, I focus on the continuity of the perceived
external threat confronting India, stasis in the structure of the aeronautics enclave, and state support for aeronautics sector development from the early 1960s through the early 1990s. The concluding section of this chapter provides comparative insights culled from both cases, as well as assessment of the novel theoretical model of defense development advanced in this dissertation.

5.1 Institutional Revision in the Brazilian Aeronautics Sector
Both Conca (1997, 119) and Franko-Jones (1991, 68-69) quite correctly highlight the importance of the year 1969 for the Brazilian aeronautics sector. It was in 1969 that the single most visible instance of institutional reform to occur in the aeronautics enclave took place with the creation of Embraer, following the failure of private, indigenous capital to take up production of what would become the Bandeirante. Though far less visible, other changes were afoot too following the creation and maturation of Embraer. For instance, the CTA became the central actor in coordinating technology transfers from foreign firms to the aeronautics enclave through the Institute of Industrial Coordination and Promotion, created in the early 1970s (Conca 1991, 40). The IFI would later go on to focus on the certification of Embraer aircraft so they could be sold abroad (Conca 1991, 42). Additionally, the ITA added a doctoral degree program to its offerings in 1968 (Conca 1991, 40). The goal of this section is not simply to highlight the institutional changes which occurred during the military dictatorship, but also to highlight the political determinants of these changes and their consequent effects on the development outcomes of the aeronautics enclave between 1969 and the early 1990s.

I make a very simple argument in this section: elite perceptions of external vulnerability lead to a massive increase in state power with the consolidation of a military dictatorship, enabling high levels of coordination in the aeronautics enclave, and effective
aeronautics sector industrial policy. The generals in charge of Brazil from 1964 through 1985 sought to promote development through highly centralized planning and the rationalization of the bureaucracy for this purpose. The aeronautics enclave was a key beneficiary of these efforts, which resulted in the developmental success enjoyed by the aeronautics sector. The evidentiary burden of this section then is to make explicit the relationship between external vulnerability, institutional reform of the aeronautics sector and changes in state power, and the state’s successful support of the aviation industry in Brazil. This is a heavy burden to bear as it is only in the mid-1970s that the Brazilian military began to be alarmed by what most would readily consider external threats.

However, the key to understanding the relationship between external vulnerability and defense industrialization in the case of Brazil is to understand the strategic worldview of the military as developed and disseminated by the ESG. I next measure changes in state power and relate them directly to the aeronautics sector. Finally, I connect state support for the aeronautics sector between 1969 and the early 1990s to the developmental success achieved.

5.1.1 Brazilian External Vulnerability

The impetus for and the dramatic expansion of the Brazilian military industrial base began under the presidencies of Artur Costa e Silva and Emilio Médici in the late 1960s. In accordance with the National Security Doctrine, developed by the Escola Superior de Guerra (ESG) beginning in the early 1950s, the primary source of external vulnerability was revolutionary warfare, sponsored by the Soviet Union. From the vantage of Brasília, Soviet-backed revolutionary warfare had been used with spectacular success in both Vietnam and more alarmingly, Cuba, to topple governments. The military and civilian elites believed that because of Brazil’s underdeveloped economy, the country was
particularly susceptible to the sort of revolutionary tactics used in Vietnam and Cuba and domestic events appeared to confirm their fears. Specifically, increasing labor militancy associated with the radical left, the populist drift of João Goulart’s presidency, and continued popular resistance to the military dictatorship from 1964 to 1974 were all seen by the military as attempts at revolutionary warfare. It was in this context that the military assumed control of the government and pursued both broad-based economic development and defense industrialization.

The goal of this section is to make explicit the relationship between external vulnerability and defense industrialization in Brazil. The key to understanding the relationship between perceived levels of external vulnerability and defense industrialization in the case of Brazil is to understand the strategic worldview of the military as developed and disseminated by the ESG. In making the connection between external vulnerability and defense industrialization, this section proceeds as follows. First, the strategic worldview of the military and the most likely threats to Brazilian national security will be discussed, followed by a brief overview of the factors that gave this worldview salience. Second, I discuss the structural changes in the global political economy of defense as they relate to improved external balancing opportunities for Brazil.

External Threats
The National Security Doctrine (NSD) that informed the military masters of Brazil from 1964 through 1985 has been read by a variety of scholars according to their research aims. No doubt these interpretations shed valuable light on important research questions of interest for social science. The interpretation of the doctrine offered herein is that of a strategic assessment, nothing more. From the perspective of this study and the discussion
at hand, the NSD is important because it affords analytic leverage on the issue of external vulnerability. The key point to be made here is that in the context of the Cold War and a world split between contending political-economic systems, the Brazilian military believed that owing to economic underdevelopment and a weak state, Brazil was particularly vulnerable to Soviet-backed revolutionary warfare.

The Strategic Worldview of the Brazilian Military
The NSD was primarily the work of one of Brazil’s foremost geopolitical strategists during the 1950s, General Golbery do Couto e Silva (Alves 1985, 8). Developed during the Cold War, Golbery identified three types of warfare. First among these was total warfare, which involved the complete political and economic mobilization of nations to fight what could be civilization ending wars due to the advent of nuclear weapons. Total warfare was figured to be exceptional and rare because of the destructive potential of this type of warfare and was theorized to take place between the USSR and the U.S. along with their respective blocs. The second type of warfare was classical or conventional warfare, which is distinguished from the former because, “It is conceived basically as a war of external aggression, or a war that is conducted between states, and in which one nation declares war on another as a reaction to external attack” (Alves 1985, 16).

The third type of warfare and that of greatest interest for present purposes is undeclared or nonclassical warfare and is defined by internal subversion. The Manual básico, used widely at the ESG, further distinguishes nonclassical warfare into two categories. Insurrectionary warfare is defined as, “an internal conflict in which part of a population attempts to depose a government by the force of arms” (Alves 1985, 16). Revolutionary warfare is defined as, “a conflict, normally internal, that is stimulated and aided by an ideology. It attempts to gain state power by progressive control of the
nation” (Alves 1985, 16). The key difference between insurrectionary and revolutionary warfare then are the tactics used. Whereas armed conflict defines insurrectionary warfare, the sine qua non of revolutionary warfare is the use of ideology to win the hearts and minds of the people who constitute a nation.

Whereas historically, Brazilian policymakers and the military had been concerned about the threat posed by its regional rival Argentina, during the 1950s and 1960s, fear of revolutionary warfare became the single most feared threat. In the Manual básico one finds the justification for this gestalt shift in the minds of the military:

In countries of weak national power, where the political structures are unstable, the indirect action strategy of aggression is much more effective, for it may potentially increase antagonisms and pressures inside the country. Thus, it is also evident that attention to internal national security must be an important priority, especially where, in addition to the conditions described, one also finds geographical conditions that reinforce this factor.

In nations with a low state of development, there can be a climate of insecurity that may be exploited and may allow the growth of influence or domination, whether it be in the political arena, or in economic, psychosocial, or military arenas (Manual básico, reproduced in Alves 1985, 18).

Two important points need to be made with regard to the text reproduced above.

First, in describing the threat posed by revolutionary warfare, the Manual básico highlights two fundamental, or permissive conditions that make a country susceptible to such a threat, including a weak national government and economic underdevelopment. Though discussed in more detail below, the growing perception among elites of state impotence and the extreme difficulty of hard import-substitution industrialization in the early 1960s were key reasons for military intervention in the political sphere to preempt revolutionary war. Notably, the solution pursued to both of these permissive conditions for revolutionary warfare in Brazil following the March 1964 coup was a highly centralized authoritarian regime focused narrowly on state-led economic development.
Second, the *Manual básico* explicitly notes that a country’s geography can exacerbate the potential for revolutionary warfare. This point deserves attention because Brazil’s geography, specifically the vast uninhabited expanses of the Amazon had long been identified as breeding ground for anti-government groups. One need only recall incidents such as the Canudos Affair, the near war in the Contestado, or the march of the *tenentes* column to understand the threat seen by the officer corps from Brazil’s vast ungoverned spaces. Though I forgo further development of this point because it is only tangential to my argument, the key solution to this problem of ungoverned spaces in Brazil was a renewed effort to politically incorporate the hinterlands into the political core of Brazil. Notably, ESG publications referred to the vast hinterlands as “paths of internal penetration” that must be “plugged” (Alves 1985, 24).

To summarize, the worldview of the Brazilian military elite, they believed the greatest national security threat that existed for Brazil was Soviet-backed revolutionary warfare. Two permissive conditions made revolutionary warfare in Brazil a possibility: a weak national government and economic underdevelopment. The vast ungoverned spaces in Brazil’s interior exacerbated the latent threat of revolutionary warfare because it gave safe-haven to subversive elements and their supporters. Prior to moving forward to a discussion of specific incidents that appeared to be instances of revolutionary warfare in Brazil, I would be remiss if I did not point out the strong observed continuity between the strategic mindset of the military from the 1920s through the 1930s (discussed in Chapter 4) and the generals at upper echelons of power in the 1960s and 1970s. Specifically, there is a great deal of continuity in the shared worldview that underdevelopment, a weak space, and the potential for revolutionary warfare could create a perfect storm.

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73 For a summary discussion on the causes and consequences of the *tenentes* column and their long march, see Flynn (1978, 43-48). See also, McCann (2004, 209-211) on the ideology of *tentismo*. 
national government, and vast ungoverned spaces all combined to make the Brazilian state incapable of confronting the national security threats it faced.

The Salience of the Military’s Strategic Assessment
What events gave credibility to the strategic assessment that revolutionary warfare was the most serious problem confronting Brazil? The specificities or efficient causes of the coup have been well described and in great detail by scholars like Flynn (1978, 242-282), Thomas Skidmore (2007, Chapter 8), and Ronald Schneider (1971, Chapter 3) and are well beyond the scope of this study.74 Much more important for the purpose of the narrative herein are the deeper or profound causes of the coup. Following Alfred Stepan, who synthesized the profound causes of the military coup most succinctly, I argue that a conservative revolution was made possible by three interrelated factors that gave salience to the military’s worldview and led elites on both the left and the right to withdraw their support for the democratic regime in Brazil. These factors include the following: increasing socioeconomic mobilization; the declining extractive capacity of the state; and a poorly institutionalized party system (Stepan 1971, 135).

Socioeconomic mobilization occurred because of rapid urbanization in Brazil during the 1950s and into the 1960s. Speaking specifically to this, Stepan highlights the fact that, “In the decade 1950 to 1960, Brazil’s rural population grew from 33 million to only 39 million, while the urban population grew much more rapidly from 19 million to 32 million” (Stepan 1971, 136). This rapid increase in the urban population represented a significant increase in the number of people looking to the government to provide goods, services, and jobs. Or, to use Stepan’s language, “With regard to the political system, the

74 For a good account of the events of 1964 in Portuguese, see Dreifuss (1981).
rapid urbanization…increased the number of “subjects,” that is, “people oriented toward the output, administrative, or ‘downward flow’ side of the political system”” (Stepan 1971, 136-137). To put a finer point on this, because of urban workers’ increased access to education when compared to rural workers, this allowed them to pass the literacy test required for voting and as a result, between 1945 and 1960, the number of registered voters in Brazil nearly doubled from 7.4 million to 15.5 million (Ronning 1976, 216).

Socioeconomic mobilization was exacerbated by three key groups that encouraged this process in Brazil. First, politicians exacerbated this phenomenon in their efforts “to co-opt the new social groups by initiating extensive social welfare legislation. Numerous politicians attempted to win political followings by articulating and championing the just, latent demands of the new social groups” (Stepan 1971, 137). Ultimately, the populist orientation of politicians during Brazil’s experiment with democracy significantly increased the regulatory and distributive demands placed on the government by these new social groups. On the one hand, set against a deteriorating national economy, in which inflation skyrocketed, the government became directly involved in settling strikes and in setting minimum wage laws (Stepan 1971, 137). On the other hand, set against this same dismal economic backdrop, the government subsidized the price of bread and bus fares to meet demands in these two key domains, which drove up budget deficits (Stepan 1971, 137). A knock-on effect of subsidizing bread and bus fares was an increased strain on perpetually tight foreign exchange reserves, because Brazil had to import the wheat for bread and the oil for buses (Stepan 1971, 137).
The second and third key groups that exacerbated the trend of socioeconomic mobilization were urban and rural unions. Regarding urban workers, the corporatist trade union system established during the *Estado Novo*, began to break down during the 1950s and especially into the early 1960s (Ronning 1976, 216). Increasingly, urban labor was being organized by leftist groups that were alleged to be associated with subversive communist infiltration of the working class; the key antagonist in the perceived threat of revolutionary warfare. Though nowhere near as significant as urban unionization, rural trade unions also became legal in 1963 for the first time (Stepan 1971, 137). This was a significant development as Stepan notes, because, “This law hastened the competition between individual political leaders, the church, and the government’s highly political land reform agency (SUPRA) to organize the peasants into cooperatives, peasant leagues, and rural unions,” which ultimately reflected, “a major change in the quality and quantity of political demands that the peasants and their political mentors were making on the political system” (Stepan 1971, 137).

The second key structural factor that made possible the coup of March 1964 was the decreasing extractive capability of the government. The source of the declining extractive capacity of the Brazilian state in the early 1960s was an economic downturn. Throughout the 1950s, Brazil enjoyed one of the highest economic growth rates in the world, which made it possible to satisfy the increasing demands of urban workers through the course of the decade (Stepan 1971, 139). This was so because even though the state’s capacity to collect direct taxes did improve between 1945 and the 1960s, a disproportionate share of government revenue came from import and export duties. So, when the growth rate of the per capita GNP declined acutely in 1962, followed by a real
decline in the per capita GNP growth rate in 1963, the Brazilian government faced a situation in which its main source of revenue was declining (Stepan 1971, 136). Worse still, as a result of the economic downturn, the revenue the government collected from direct taxes also fell by about three percent in 1963, further diminishing the ability of the state to satisfy the demands of its constituents.

In response to the sharp economic contraction and seeking to shore up his political support, João Goulart pursued a countercyclical fiscal policy and increased the budget of the federal government as a percentage of GDP from 10.9 percent in 1959 to 14.4 percent in 1963 (Stepan 1971, 139). At the same time Goulart was increasing government spending, tax receipts dropped from 23 percent of GDP in 1959 to 20 percent in 1963 (Stepan 1971, 139). As one would expect, an increase in a country’s money supply created a serious inflation problem in Brazil. Speaking to inflation in Brazil, Stepan points out that, “Brazilian inflation, always chronic, became acute after 1961 as prices rose by over 50 percent in 1962, 75 percent in 1963, and were rising at the annual rate of over 140 percent in the three-month period before the collapse of the Goulart government” (Stepan 1971, 140). The declining extractive capacity of the state had two important political repercussions.

The first of these political repercussions was social conflict between the working classes on the one hand and the middle classes and military on the other. Speaking directly to this clash of interests, Stepan observes:

This sharp rise in prices set off increasingly bitter rounds of wage struggles and tended to deepen the hostility of the middle classes to labor and the government. Many in the middle classes felt that their own salaries could not keep pace with inflation, and they often blamed labor strikes for pushing costs up and blamed the government for yielding to labor (Stepan 1971, 140).
The point to be made here is straightforward: the middle classes in Brazil directly attributed their declining economic quality of life with labor militancy and government policy.

For their part, the military was none too pleased with the economic climate that existed in the early 1960s. For one thing, as labor strikes grew more violent, “the military was often invoked to protect strikers against hostile state governments or employers and in some cases to prohibit the strike” (Stepan 1971, 141). Speaking specifically to the concerns of the military in light of labor militancy, Stepan notes that:

The belief grew among military officers that the government’s encouragement of strikes and the granting of large pay increases contributed to inflation, violence, and the erosion of their own status and salaries. Increasingly, military journals complained about inflation and the threat it presented. Characteristically, their articles attempted to document the decline in military real take-home pay in relation to other groups, especially labor unions (Stepan 1971, 141).

Notably, the military identified the same problems besetting Brazil as did the middle classes, namely that the government was encouraging the inflation that was eroding the status and way of life of the officer corps and middle classes. Yet the military’s understanding of the problem went further insofar as it identified labor unions and populist politics as the root causes of the economic problems to be fought against. As evidence of this, Stepan points to military documents from the period, the Documento LEEX in particular, which argued:

The armed forces lament the underhanded processes of demoralization which threaten them as a result of the damaging relationship between unions and Communists—which even some government authorities refer to as a Fifth Army.

As a result of demagogic and anarchic wage policies, a new and privileged group has been created in society at great cost to many other people. Due to galloping inflation and insufficient salary adjustments, new deprivations and abuses have been imposed upon the military (Documento LEEX, cited in Stepan 1971, 142).
The very clear point made in the text reproduced above is that the military blamed the leftward bent in national politics and its populist character, which contributed to inflation, on trade unions they suspected of being inspired by communism. In a very real sense then, these trade unions represented for the military and the middle classes the analogs of infantry and armored divisions in revolutionary warfare.

The second political repercussion of the economic crisis was the belief that the Brazilian model of national economic development was outmoded (Stepan 1971, 142; Kohli 2004, 190). Specifically, elites on both the left and right in Brazil began to talk about the failure the national development model employed since the days of the Estado Novo, that of import-substitution industrialization. Notwithstanding evidence to the contrary, highlighted retrospectively, elites began to believe this model was exhausted and needed to be replaced (Kohli 2004, 190). While both those on the left and those on the right favored heavy state intervention in the economy to promote national development, the left preferred a socialistic pattern of development and those on the right favored state-sponsored capitalism. The March 1964 coup and the consolidation of a conservative military dictatorship decided this issue definitively in favor of state-sponsored capitalism and at the expense of the working classes.

The third and final structural problem giving salience to the military’s worldview that revolutionary warfare in Brazil was imminent was the underinstitutionalized political party system. The concurrent realities of the increasing political demands made on the political system by the working classes and an economic crisis forced the administration of João Goulart to produce and attempt to implement an economic stabilization plan, the Plano Triennial. Yet, much as was true for the Vargas and Kubitschek administrations,
both of whom drafted and failed to implement structural reforms, Goulart lacked the sort of institutionalized political support required to undertake such sweeping and politically contentious reforms, such as land reform (Stepan 1971, 144). In fact, the proposed *Plano Triennial* was a key factor in the collapse of the developmental regime in place under Vargas and Kubitschek. Specifically, this national developmental alliance was underpinned by the contradictory support from the working classes that comprised the *Partido Trabalhadores Brasileiros* (PTB) and the *Partido Social Democrático* (PSD) comprised of landed oligarchs. During Goulart’s time in office, his policies alienated these groups, destroying the delicately balanced political coalition, or developmental alliance, upon which the nominally democratic government rested from 1945 through 1964 (Flynn 1978, 266-270).

Even though the Brazilian president during Brazil’s period of democracy was more powerful than presidents in places such as the United States, for economic stabilization plans to be passed, support from the Brazilian congress was paramount. Specifically, under the constitution in place during the period of democracy, the Brazilian Congress had, “…important veto power over key structural issues, such as land reform, tax reform, constitutional reform, and the granting of votes to illiterates. In addition, its capacity to appropriate a larger amount of funds than the executive requested made it a central organ in any attempt to establish priorities for development planning or for implementing a program of fiscal stabilization” (Stepan 1971, 144). It is important to note that the central features of the *Plano Triennial* addressed key structural issues like land reform, requiring congressional support; support the *Plano Triennial* did not receive following the collapse of the developmental alliance.
In seeking to explain the military coup in Brazil, Stepan observes that a regime’s survival is a function of its ability to maintain the support of both the loyal opposition and defenders of a regime (Stepan 1971, 147). In conjunction, the three trends in the Brazilian political economy discussed above caused both the loyal opposition and defenders of the democratic regime to abandon it, ultimately leading to a military coup.

On this point, Stepan is quite clear noting:

The civil-military crisis of 1964, however, was a crisis over the appropriateness, effectiveness, and legitimacy of the political system in meeting the challenge of development. It was the belief in the appropriateness and effectiveness of the existing civilian institutions that was eroded in the years before 1964, especially after 1961. The feeling that the political system was incapable of meeting the demands upon it, and that the legitimacy of the constitutional regime was declining undermined a basic element of the pattern of civil-military relations as they had existed since 1945 (Stepan 1971, 152).

The key takeaway form the vantage of this project in the text reproduced above is that the consequence of socioeconomic mobilization, the declining extractive capacity of the state, and an underinstitutionalized political party system was that the Brazilian political system was impotent and required change. Change the military would bring about.

External Balancing Opportunities
There is little doubt that the structural changes in the global arms production and transfer system, which began in the late 1960s, were a boon for Brazilian defense industrialization. Conca notes of Brazil in the changing global arms market that:

Brazil’s fledgling defense sector rode the wave of surging demand, commercialization, and technology dissemination in the 1970s to establish market position. The 1980s saw a continuation of this process of global market integration, as a series of more technologically ambitious projects were launched and Brazil itself became a source of technology for less-advanced Third World producers (Conca 1997, 75).

Yet, what is less clear or to date has been underspecified are the political factors that allowed Brazil to take advantage of globalizing arms production to develop its defense
industrial base, including the aeronautics sector. Put another way, what are the political circumstances that made the globalization of arms production an opportunity for external balancing for Brazil?

The answer to this question is quite simple: Brazil’s staunch alignment with the Western Bloc, if not always the U.S., during the Cold War allowed Brazil greater opportunities for integrating its defense industries, including the aeronautics sector, into global production chains (Schneider 1971, 66). Much as had always been the case, Brazilian elites saw themselves as an integral part of the Western world. Thus, it is no surprise that following the right-wing coup of March 1964, external relationships remained largely the same between Brazil and other countries within the Western Bloc. In fact, so concerned was the U.S. with the potential for Brazil to go communist in the 1960s, it made extensive preparations to support the military and right-wing civilian elements in what is known as Operation Brother Sam (Flynn 1978, 279-280; Pereira 2016).

The relationship between the U.S. and Brazil was not always so sanguine, yet it didn’t need to be to facilitate market integration. From nearly the start of the Cold War, Latin America was never a major recipient of military hardware from the United States. Rather, this equipment went to flashpoints around the globe in which military conflict between the East and West was likely. So, much of the military hardware exported by the United States prior to the late 1960s and 1970s went to places like Greece, Turkey, Iran, Vietnam, and Europe. In a similar vein to the views held by the Brazilian officer corps itself, U.S. planners saw Latin America as ripe for communist subversion, not
outright traditional warfare (Stepan 1971, 126). Thus, Latin America and Brazil were never major targets for U.S. military hardware.

With the emergence of the second-tier European weapons producers in the late-1960s and early 1970s, Brazil had a limited, but definite number of weapons suppliers to choose from apart from the U.S. Specifically, Britain, France, Germany, and Italy were all available and willing partners for two-way arms sales, licensed production agreements, co-production agreements, and technology diffusion. Additionally, in contrast to the political logic of the Soviet Bloc’s arms transfer and production system, the Western system was always capitalist and that means based on market logic. If a country hoped to develop its defense industries in such a context, it had to pay attention to market fundamentals.

To summarize, the globalization of the arms transfer and production system was a major boon for defense industrializers in Brazil, particularly in the aeronautics sector. Yet, there were specific political preconditions that made it possible for Brazil to integrate its defense industrial base into that of the Western Bloc. Namely, Brazil was aligned with the Western Bloc from the start of the Cold War. Moreover, the diversity of suppliers in the Western arms economy meant that even when U.S.-Brazil relations were mired in tension, as was the case during the Carter Administration because of its emphasis on human rights, there were other developed countries willing to participate in conventional weapons development with Brazil (Flynn 1978, 507-508). This stands in stark contrast to those countries in the Soviet-Bloc’s arms transfer and production system, in which a political rather than market logic predominated exchange relationships. This is a major difference between the Brazilian and Indian experiences in defense
development. Quite simply, Brazil for political reasons had better external balancing opportunities.

5.1.2 External Vulnerability, State Authority Structure, and the Aeronautics Enclave

The coup of March 31, 1964 has generally been interpreted as a reactionary effort that ultimately led to a government that worked for capital at the expense of the masses (Flynn 1978, 311-314). To be sure, this interpretation of the military coup is certainly accurate, yet it undersells the fact that this military coup, the subsequent dictatorship, and the associated policies were meant to promote Brazilian national security. In fact, seen from the view of the NSD, which constituted the ideology of the Brazilian regime, the end of national security required a state of sufficient power to mobilize all the requisite sources of material power to ensure that come what may, the Brazilian nation would endure. It is in this context that the coup and the establishment of what has been euphemistically called “tutelary democracy,” make sense (Stepan 1971, 234). As will be discussed below, the creation and consolidation of the military dictatorship, as well as state-led development were efforts at internal balancing. Furthermore, defense industrialization was in this context a further effort to emulate systems-leading countries.

Elite Ideology

The ideology of the military regime in Brazil has been well discussed by many eminent specialists on the political economy of Brazil (Stepan 1971, 172-188; Alves 1985, 15-23). These accounts call to readers’ attention to aspects of elite ideology during the regime. First, regarding the NSD associated with the ESG and the Sorbonne group of officers is a virulently anti-communist stance, a pro-capitalism position, and a commitment to democratic legitimacy, if only as a value rather than in practice. 75 The second aspect of

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75 On the Sorbonne group, see Schneider (1971, 143-144), Stepan (1971, 232-235), and Flynn (1978, 316).
regime ideology highlighted is the ideological conflict between the Sorbonne group and its archetypal leader, Castello Branco, and the *linha dura* group associated with the presidencies of General Artur da Costa e Silva and Emílio Garrastazu Médici.\(^76\) This schism within the military, though overly wrought by some, was real and palpable, yet had to do more with changing political conditions in Brazil following the coup of 1964, different military socialization processes within and among the service branches, and above all with different policy proposals for achieving the same ends as spelled out by the NSD: Brazilian national security (Stepan 1971, 237-248; Schneider 1971, 144).

Considering this reality, what follows eschews standard interpretations of the ideology of the regime in favor of a discussion of the two main objectives of national security policy: state-building and economic development.

The NSD elaborated by General Golbery and taught at the ESG, was very clear on the point that the state is the vehicle by which national objectives, including security are achieved. In the context of what was viewed as an inevitable confrontation between the Eastern and Western Blocs, the Brazilian state required sufficient capability to mobilize on a semi-permanent basis all of the nation’s resources to prepare for every possibility. As such, the state was required to formulate strategies and implement policies in four areas to provide for national security, these included a military domain, a psychosocial domain, a political domain, and an economic domain (Alves 1985, 21-22). In the estimation of the officer corps, during the democratic period from 1945 to 1964, the unity of the Brazilian nation was too inchoate to allow for rationally oriented strategies to be created and implemented serving truly national ends. Rather, politicians jockeyed for

\(^{76}\) On the *linha dura* see Schneider (1971, 143-145) and Flynn (1978, 377-378).
public support from narrow segments of society to serve their own ends, rather than national goals (Flynn 1978, 312-315). Goulart was the most obvious example of such a politician, who sought to mobilize the masses directly to impose his vision for Brazil on the nation.

Thus, following the coup, the military regime operating primarily in the military, psychosocial, and political domains, sought to build a new highly cohesive political system capable of pursuing national interests. Perhaps the best documented, if nefarious, aspects of the military regime’s state-building efforts were the institutional acts, which in broad strokes restricted or eliminated entirely the political rights of societal elites to dampen all opposition to the regime. It is important to note that these acts were considered necessary because while the military initially had civilian backing from a diffuse and heterogeneous lot, including the middle classes, agrarian elites, as well as right-wing ultra-nationalists, the economic stabilization measures of the Branco administration caused many of these groups to abandon their support for the regime (Stepan 1971, 235; Flynn 1978, 345-346). This opposition coalesced into a loosely organized social opposition movement, known as the frente ampla (broad front) (Schneider 1971, 223; Skidmore 1989, 49-51). The first and second institutional acts, as well as the Constitution of 1967, which institutionalized the authoritarian regime, served to further increase political protest of the regime, causing several coups within the military government; each successive coup brought with it harsher repression.

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77 For a detailed description of the main Institutional Acts see Alves (1985, Chapters 2-5).
78 On the increasingly repressive and authoritarian turn in the military dictatorship after Castello Branco, see Skidmore (1989, Chapters 4-5).
It is important to note that dissension within the military and thus the regime was born out of a divergence of perspectives between the military as a governing regime and the military as an institution (Stepan 1971, 226-228). It hardly needs to be noted that the logic of government and the logic of the military as an institution are considerably different. Whereas the task of governing requires dialogue and compromise to generate political support for policies, the hierarchical nature of the military is ill-suited for either open dialogue or compromise. Thus, as political issues with real potential for divisiveness rose to the fore within the military, there was little room for thoughtful dialogue and compromise. Rather, during the entire course of the dictatorship from 1964 through 1985, those members of the military responsible for running the government were buffeted by political opposition within the regime and from without. All of this is to say that while the military regime was able to remove many opponents from the political scene via cassation, it still faced considerable opposition within the rank and file officer corps. Thus, even though elite-elite and elite-mass political cleavages were minimized with outright repression, there was still room for politics even within the strong state built by the military.

The second key goal the military regime shared, though again divergent policy preferences did exist, was the imperative of economic development (Stepan 1971, 183; Schneider 1971, 245-246). As is clear from the slogan popularized by none other than Branco in a speech at the ESG shortly before his death, the twin pillars of national security policy were segurança e desenvolvimento, or security and development. In her analysis of ESG doctrine, Maria Alves summarizes Golbery’s notion of economic development as follows:
A nation’s security requires the development of productive resources, industrialization and effective utilization of natural resources, extensive transport and communication networks to integrate a vast territory, and the development and training of a skilled labor force with technical know-how. Thus among the most important factors in a nation’s security are its capacity for accumulation and absorption of capital, the quality of its labor force, the development of science and technology, and the efficacy of its industrial sectors (Alves 1985, 25).

To be sure, the ESG defined economic development along very broad lines. However, little imagination is required to understand the relationship between transportation and communication networks and the development and security goals of the regime. Thus, in no uncertain terms, rapid economic development was an internal balancing strategy capable of ameliorating the threat posed by communist-inspired subversion in Brazil (Alves 1985, 25).

To be very clear, the end of national economic development pursued by the military was very different than that pursued in India. Whereas in India, economic development was at least rhetorically aimed at ameliorating the poor living conditions of the masses, in Brazil development was geared to national security ends. Specifically, despite the fact that various presidents of the military dictatorship couched their policies in terms of the defense of the nation, the term nation was in reality very narrow in its application. As Flynn notes, despite the fact that the military claimed to be above class interests, the policies pursued by the government were designed to support industrialization first and foremost (Flynn 1978, 312-313). Moreover, in the Manual básico, the potential need for successive generations of Brazilians to sacrifice in order for national goals to be achieved was expressly noted (Alves 1985, 28). As was noted in the preceding section, all of this is to say that in the face of a revolutionary threat, economic development had two key functions. First, to ameliorate the domestic conditions which
made Brazil especially prone to the threat of revolutionary warfare. And second, to improve the transportation and communication infrastructure in Brazil that would facilitate the rapid identification and eradication of revolutionary groups in the vast hinterlands of Brazil.

It is important to note that within this understanding of economic development, defense industrialization held pride of place for two key reasons. First, the military needed weapons systems because those they possessed were outdated (Schneider 1971, 256; Conca 1997, 86). Additionally, given the vast dimensions of Brazil, light aircraft were particularly well suited for monitoring subversive activity and the FAB would continue to pursue missions that facilitated national integration as it had during the Estado Novo (Selcher 1977, 15-17). These missions would include the military air mail and counterinsurgency operations as well. Second, it was argued that given the level of sophistication embodied in modern weapons systems, development of a defense industrial base would facilitate broader economic development by means of the spin-off effect (Conca 1997, 87).

One additional fact, regarding the ideology of the military regime is worth note and that is their belief or faith in the ability of technocrats to manage the economy (Stepan 1971, 231; Flynn 1978, 331; Schneider 1992, 55-58; Kohli 2004, 197). Not unlike the Vargas during the Estado Novo, or for that matter Vargas and Kubitschek during the democratic period that followed, the state figured to play an important role in the process of rapid industrialization under the military. Notably, the state in alliance with foreign capital and domestic capital were viewed as key drivers in the process of industrialization. On the one hand, it was argued that the state was key in both creating a
healthy atmosphere for foreign investment, from which it could cull technology and modern management techniques. On the other hand, the state was also an instrumental in stimulating domestic capital to undertake entrepreneurial ventures which for organizational reasons, they were reluctant to do. Though military governments did impose some basic limits on matters of economic policy, such as the strict national character of Brazilian defense firms, the stewardship of the economy was left to a core of highly skilled and respected technocrats. In other words, the military regime insulated the economic bureaucracy and strategic enclaves right from the get go from the pressure of domestic political politics, to ensure its development freely along rational lines that privileged economic efficiency.

State Organization and the Brazilian Aeronautics Sector

Following the start of the military regime in 1964, efforts were made to create the institutions capable of making the Brazilian goals of security and development a reality. Politically, the institutional acts and the subsequent Constitution of 1967 were all attempts to institutionalize the reforms implemented by the military to help create a more stable and cohesive polity. With specific regard to security, the most notable instance of institution or state-building was the creation of the Serviço Nacional de Informações (SNI), or the National Information Service (Schneider 1971, 132). Consistent with the vision of the NSD, a strong intelligence gathering capability was needed to help identify and act against potential subversives operating in Brazil. Additionally, the National Security Council was eventually reorganized and made the locus of all high level policy decisions. With specific regard to the aeronautics enclave, what changed in particular was the entry of the state directly into the production of airplanes. As will be discussed below, because private capital was not forthcoming to manufacture the IPD-6504,
members of the CTA lobbied the government to create Embraer, a public-private partnership as a national champion aeronautics firm.

As was described in the last chapter, the construction of a major aeronautics industrial park in São José dos Campos, São Paulo was a major fillip for the aeronautics enclave and sector. The CTA and ITA were both located within the industrial park and the FAB had a major base of operations adjacent to the CTA. Located within this aeronautic enclave at São José dos Campos were the organizations to train a highly skilled workforce and to design and develop airplanes. Bernardes notes that by the late 1960s, the CTA had not only designed the IPD-6504, which was to become the Bandeirante, but it also had under development a small plane for use in agriculture, the Ipanema, as well as a glider called the Urempema (Bernardes 2000, 168). However, the key ingredient lacking in the aeronautics sector was a firm capable of series production of planes designed and developed by the CTA. By 1969, this issue would be resolved through the creation of Embraer.

Embraer was created by the Brazilian government for one simple reason: private capital proved reluctant to enter the aeronautics sector. To be sure, the examples of failed aeronautics firms such as the Companhia Aeronáutica Paulista, the Companhia Nacional de Navegação, or Sociedade Construtora Aeronáutica Neiva existed. Yet, Bernardes notes that potential private investors in the aeronautics sector wanted specific guarantees from the government, though none were forthcoming, and many entrepreneurs believed only the government could make such an undertaking successful (Franko-Jones 1991, 69; Conca 1997, 119; Bernardes 2000, 160). Thus, in light of private capital’s unwillingness to make investments in the production infrastructure of the aeronautics sector, Decree
Law no. 770.8/69 established Embraer in August of 1969 as a public-private partnership which would be 51% owned by the government and controlled by the Ministry of Aeronautics (Bernardes 2000, 161). The remainder of the working capital of Embraer was to come from the private sector in the form of a tax credit offered to businesses. None other than Minister of Finance Delfim Neto, the architect of Brazil’s economic miracle, proposed a 3% tax deduction for private capital that bought Embraer stock, though in the end the tax deduction was only 1% (Franko-Jones 1991, 83). Additionally, consistent with the capitalist ideology of the regime, this public-private partnership was to be run as though it was a private enterprise, to make sure it operated efficiently (Franko-Jones 1991, 83).

In addition to other aspects of the aeronautics enclave, it is very important to be clear about the impact of the public-private partnership that was Embraer. Speaking directly to the importance of private capital in Embraer, Franko-Jones notes that:

> Although the Brazilian government changed the parameters of investment decisions to allocate money to the aeronautical sector, the capital remained private. This is important because it is precisely this private element in the firm that encourages Embraer’s dynamic production and marketing decisions (Franko-Jones 1992, 85).

To be clear, Franko-Jones is suggesting that the incorporation of private capital in Embraer was one key in explaining how it could operate according to market, as opposed to a political logic. It is worth mentioning that the fusion of public and private capital was wholly in keeping with the ideology that private enterprise should be relied upon whenever possible to lead the national development effort because of its efficiency.

An additional factor that was unique to Embraer and has been identified as part of its success, was been the pool of skilled labor from which it can recruit (Conca 1997,
120). Specifically, Embraer has been able to recruit from the IPD division of the CTA, in particular. The salience of such an opportunity is that it is believed to facilitate the ability of the aircraft design bureau of the CTA and the manufacturing firm to work together synergistically to develop aircraft and pursue series production. Notably, this sort of linkage between the state and the firm is exactly the sort of relationship Evans refers to as reinforced Weberianism (Evans 1995, 40-41). As will be shown in the case of India, the divorce between the divisions of the DRDO responsible for aircraft design and development and HAL was a critical stumbling block in the development of the Indian aeronautics sector. Notably, the first several directors of Embraer were all ITA graduates and members of the FAB. Ozires Silva, an officer in the FAB and the project leader on the IPD-6504 was to become the first chief executive of Embraer.

It is interesting to note that to ensure the economic autonomy of the Brazilian aeronautics sector, Embraer was setup with the experience of the automotive sector in mind. With specific regard to the automotive sector, what the military had learned was that by assuming a position in the global markets for automobiles, foreign manufacturers were able to control the direction of the development trajectory of the industry and their production plans. The key lesson learned here was that because the original equipment manufacturer, or so-called prime contractor, designs and develops a product, they have some freedom to decide which subsystems were to be included in a product and where they would come from. Thus, in seeking to maintain the economic autonomy of the fledgling aeronautics sector from foreign capital, Embraer was positioned from the very beginning as a prime contractor. That is to say, from the start the decision was made that Embraer would not be vertically integrated, making all the subsystems and parts
upstream that comprise aircraft (Dagnino and Pronça Júnior 1989, 7-8). Rather, Embraer
would be a prime contractor specializing in systems integration. Acquiring this capacity
served the firm and sector well as it sought to integrate into global markets. In fact,
Embraer has become well known for being able to produce virtually bespoke aircraft.

A second key institutional arrangement made during this period was the creation
of the Sistema Integrado de Transportes Aéreos Regionais (SITAR), or the Integrated
System of Regional Air Transport (Bernardes 2000, 172). SITAR was created by law
76.590 in November of 1975. The goal of this system was to serve areas of the country
whose needs were not well met by major airlines because of the small size of the
populations in the regions. SITAR divided the country up into 5 separate regions and
created five national airlines to service these regions. Thus, in much the same way as the
creation of the FAB in 1941 served to expand the demand for domestic aeronautics firms,
so too did the creation of SITAR.

With the creation of Embraer and SITAR, the aeronautics enclave in Brazil was
complete. It was composed of three key points: CTA, Embraer, and the demand side.
Each of these three actors brought crucial resources to the table in the making of an
aeronautics sector. CTA represented the R&D and educational hub of the aeronautics
enclave. Embraer was vested with the responsibility to manufacture and market products
designed and developed within the CTA and eventually in its own R&D facilities. The
FAB, SITAR, and foreign markets would all prove crucial in resolving that most
fundamental dilemma in industries with excess capacity: how can enough demand be
ensured over the long term, such that a profit can regularly be turned. Sitting within the
middle of this three sided relationship was the Ministry of Aeronautics, which served as
the key regulatory clearing house for all issues related to aeronautics, just as it had since its inception in 1941.

State-Society Linkages
One of the more interesting features of the aeronautics enclave in Brazil is the relatively scant linkage between the state and society. This is interesting because even though the regime was pro-capitalist and believed private enterprise should have the space for independent industrial development, this was not the case. In fact, with few exceptions, Brazilian industry was held at arm’s length from the aeronautics enclave. As will be noted, this was in large measure for political reasons. I discuss state-society relationships in the defense industry and the aeronautics enclave along three dimensions: state-private capital linkages; state-university linkages; and state-labor linkages.

Beginning shortly after the installation of Castello Branco as the president of Brazil, efforts were made to facilitate linkages between commercial and military industries. Owing to the economic crisis in which Brazil remained mired despite Goulart’s ouster, the military regime sought to utilize idle industrial capacity in order to boost the economy. Conca notes that linkages between the state and industry were attempted as a Keynesian stimulus to the economy (Conca 1997, 86-87). From the viewpoint of the military, the economy had to be mobilized for development, which was a strategic national security priority of the government.

Such linkages were facilitated by means of the creation of the Permanent Group for Industrial Mobilization (GPMI), which was to bring together the military and representatives from industry. To this end, “GPMI’s directorate included one representative from each service and a representative of Brazil’s leading industrial association, the Federation of Industries of the state of São Paulo (FIESP). GPMI
commissions were created for military vehicles, aeronautics, naval equipment, electronics and communications, munitions and armaments, hospital and pharmaceutical products, food, textiles, again bringing together the service branches and industrialists” (Conca 1997, 87). Within the framework of the GPMI, critical information flowed in two directions (Conca 1997, 87). On the one hand, firms became aware of opportunities for defense production. On the other hand, the government garnered information with regard to the competencies of domestic firms.

The GPMI was most influential between 1964 and 1967 under the Branco administration, with declining influence thereafter (Conca 1997, 87). Conca notes that one key reason for the declining influence was because with the beginning of the economic miracle in the late-1960s, such public-private partnerships became less attractive to civilian firms (Conca 1997, 87). Furthermore, Conca observes that the GPMI was significant in the process of defense industrialization for the following reasons:

The lasting impact of the GPMI activities for defense-sector structure were twofold. The organization played an important role in facilitating the first of several phases of military-industrial “spin-in,” in which civilian firms entered defense production. Second, the GPMI established the initial pattern of civil-military relations in the defense sector…GPMI succeeded in boosting collaboration between military and industry (Conca 1997, 87).

Interestingly, as Conca does well to note, this linkage between the military and industry rested at the core of the ESG ideology. However, with the declining influence of the GPMI, such a relationship would not come to fruition.

It is important to note that some new private firms in the defense sector did materialize during the period from 1964 through the mid-1980s. Notably, these firms all existed upstream from the prime contractor, Embraer. Additionally, many of these firms
did not actually engage in the production of military equipment, but rather manufactured routine supplies and stores according to Conca (1997, 56). Interestingly, the supplier firms organized into a producers’ union in the mid-1980s, called the Brazilian Association of Defense-Material Industries (ABIMDE). The goal of this organization was to lobby the government on behalf of its members, to “regularize,” the relationships between state and industry (Conca 1997, 57). That is to say, ABIMDE sought to institutionalize cooperation between the defense industries, dominated in large part by powerful personalities, such as Ozires Silva, so as to create better opportunities for the small and medium-sized businesses comprising the second-tier Brazilian defense contractors. Nonetheless, ABIMDE never made much headway. Part of ABIMDE’s problem stemmed from the fact that most of the firms it represented were relatively small firms and too few in numbers to have much impact and Embraer never joined (Conca 1997, 57). Additionally, ABIMDE never joined FIESP, also blunting its political power (Conca 1997, 57).

In general, the relationship between the Brazilian defense industrial base and private industry was one lacking in embeddedness. That is to say, there existed few strong links between the state and private capital through which a two-way exchange of information about market opportunities, the needs and capability of private capital, or the willingness and need of the state to help facilitate development. Interestingly, with specific regard to the aeronautics enclave, even though 600 to 1,000 private firms were said to supply Embraer, most of these firms were supplying either non-military or low-technology parts (Conca 1997, 56).
A second key dimension along which state-society linkages can be assessed is by looking at the relationship between the state and universities. As has been noted, in developed countries, tight linkages between universities and defense firms have been an important element in their success. Perhaps the most famous, or well-recognized, state-university relationship with direct benefit for a defense industrial base is that between MIT and DARPA. Yet, in Brazil, for explicitly political reasons, universities were also excluded from the defense enclaves. There are at least two concrete reasons for this. First, there was mutual enmity between the military and many universities, stemming from the purges and occupations of universities by the military between 1964 and the 1970s (Conca 1997, 44). For this reason, a direct linkage between the state and universities was politically untenable (Conca 1997, 44). Second, the military had the ability to channel money directly into research institutes it had setup prior to 1964 and thus, “By 1981 more than two-thirds of total federal spending for science and technology flowed through this second channel” (Conca 1997, 45).

Finally, it is important to highlight the nature of state-labor relations with regard to the Brazilian defense industry and the aeronautics enclave in particular. To be direct, the demands of labor were not a major concern for Brazilian defense firms. This was so for at least two reasons. First and foremost, much of the labor required by the defense firms, Embraer included, was highly educated and skilled and not the sort of low-skill, routine labor found in the automobile industry (Conca 1997, 57). As noted, Embraer became known for its ability to create bespoke products on time and on budget. To accomplish such a feat in a field of manufacture with such high tolerances required a highly skilled work force. The second reason that labor demands seem not to have
affected the defense industries too much is because of, “…antiunion tactics on the part of some of the leading defense firms. Such tactics are said to have included restrictions on circulation of union literature, harassment of union members, and targeted layoffs of workers who chose to join the union” (Conca 1997, 59). With specific regard to the aeronautics sector, it is interesting to note that as the downturn in the defense industry began in the late 1980s, Embraer was sufficiently unencumbered by organized labor that it, “…fired 242 employees with “hostile attitudes” during a two-day strike, and four separate strikes caused work stoppages at the firm in 1989” (Conca 1997, 59-60).

Using Evans’s term, the relationship between state and society with respect to the aeronautics enclave and the defense industry generally is well characterized as lacking embeddedness. Neither Embraer nor the other major defense firms in Brazil were well connected with either capital or labor. Interestingly, the weak connections between the state and society were manifest in a shallowness of the defense industrial base recognized first by Medici. In fact, Medici and subsequent military presidents tried to correct this problem through national science and technology plans however these plans did little to address the problem (Franko-Jones 1991, 98-100). Conca argues that one of the biggest consequences of a lack of embeddedness for the aeronautics sector and the defense industrial base more broadly, was that as an economic crisis emerged in the defense industries in the early 1990s, it lacked the broad-based domestic support found in other countries for defense industry where greater embeddedness existed.

5.1.3 State Support for the Aeronautics Industry
Given that nearly the entirety of the aeronautics industry was contained within the structure of the Brazilian state, the state’s support for the industry spanned the full gamut of supply and demand side tools (Conca 1997, 119-120). On the supply side, the state
provided land, technology, a trained work force, capital, and export subsidies. On the demand side, the state leveraged civilian and military demand and later export demand to make the sector a going concern. This much is well known. What is particularly interesting from the perspective of this study however is the relationship between the organization of the enclave and the quality of the industrial policy employed to advance sectoral development. The general tendency of aeronautics industrial policy from 1964 through 1990 was a shift in development strategy from one of import-substitution to an export-led model of sectoral development. This trend reflected the commercial logic of the mandarins of this sector, of which both Franko-Jones (1991, 108-113, 147-159) and Conca (1997, 120) have both made explicit reference too.

To begin with, it is important to appreciate the fact that as was true of the broader commercial economy, international capital played an important role in the development of Embraer. Evans has described the pattern of development in the Brazilian economy as that of dependent development. What Evans meant was that the Brazilian economy was dependent on the transfer of both financial and human capital from multinational corporations to Brazil for the accumulation of capital that drove industrialization. This development was dependent, because decisions about where to conduct research and development, as well as where to produce goods, were taken in the headquarters of foreign corporations, rather than by Brazilian industrialists; nonetheless real industrial development did occur in Brazil. The state was crucial in facilitating the pattern of dependent development because it needed to create a stable political climate conducive to investment and change the incentives of MNCs so that they would not only invest in Brazil, but reinvest in Brazil.
Conca notes that the development of the defense industry broadly and Embraer more narrowly reflects the general pattern of dependent development, though with two caveats. First he notes that:

…with few exceptions…foreign direct investment was limited and did not yield effective multinational control. Instead, technology licensing, coproduction, and offset agreements linked to arms purchases were the normal conduit for both multinational participation and technology transfers (Conca 1997, 79).

Additionally:

A second major difference between defense-sector expansion and the broader pattern of dependent development involved the basic form of domestic capital. Evans and others have shown that in autos, pharmaceuticals, chemicals, and a number of other key industries, local private capital has been represented in the “triple alliance” by the largest private economic groups. By contrast, in the emerging military-industrial sector the involvement of local capital was generally limited to small, capital-scarce firms that either converted into military production during periods of recession or else were grown by the state under military supervision. Avibrabras, Engesa, most of the defense electronics firms, and the key aerospace and aeronautics suppliers all fit this pattern (Conca 1997, 80).

All of this is to say that there was a complex pattern of state and MNC cooperation, which helped shape the pattern of industrialization in the defense economy and the aeronautics sector more specifically.

Though Conca’s description of the developmental trajectory of the aeronautics sector captures essential features of the sector, it is not a flattering portrait. Moreover, it fails to account for the real agency exercised by the Brazilian government and Embraer. In so doing, Conca actually departs quite substantially from the actual meaning Evans’ gave to the term. For Evans, the broader process of industrialization in Brazil certainly did proceed along the lines noted by Conca, but real capital accumulation did occur.

A more accurate, if flattering, portrait of the developmental trajectory of the aeronautics sector comes from two of the foremost Brazilian experts on defense
industrialization, Renato Dagnino and Domicio Proença Júnior (1989). These scholars paint a balanced picture of both the path trod by Embraer and the aeronautics enclave, which also takes into account the real agency exercised by the state in supporting the development of the sector through an emphasis on finding and supporting opportunities for domestic and international expansion of the enterprise. For Dagnino and Proença Júnior, the foundation of the success, albeit modest in nature, of the sector begins with the high levels of coordination within the aeronautics enclave and the culture found among its members.

As was noted in the Chapter 4, the portion of the state dedicated to creating and executing aeronautics industrial policy was dominated by the MAER. Under the direct control of MAER was the CTA and its major subordinate institutes, the ITA and IPD, the FAB, and of course Embraer. Within this enclave, there was an esprit de corps among the people at the CTA, Embraer, the FAB, and the MAER with one narrow objective: the development over the long-term of a fully indigenized aeronautics sector. With this singular goal in mind, the Brazilian government, meaning Embraer with the supervision and support of the MAER, pursued a unique strategy for sectoral development that always emphasized gaining new competencies and moving up the ladder of technological sophistication. Dagnino and Proença Júnior, as well as Bernardes, do the very best job at documenting this process and connect it to specific projects. Following these scholars, I point to three such projects that served to define the Brazilian strategy for sectoral development, including the licensed production of the Xavante, the famous Piper deal, and the sale of the Tucano intermediate trainer to the RAF.
When Embraer opened its doors in 1970, it faced the formidable task of taking the plans for the *Bandeirante* (IPD-6054) from the drawing board and entering serial production. This task was made formidable by the fact that Embraer had never undertaken serial production of any aircraft before. With this reality in mind, MAER modified the contract signed for the purchase of *Aermachii* 326 trainer/attack aircraft, known in Brazil as the *Xavante*, from direct purchase of completed aircraft to one calling for licensed production at Embraer (Dagnino and Proença Júnior 1989, 9). Dagnino and Proença Júnior note that, “

The Italian personnel who came in the early 1970s to help local production spearheaded a major transfer of know-how for the Brazilians. All levels of Embraer were deeply impressed by the experience obtained from their Italian counterparts. As Embraer learned how to put out 100 or so Xavantes, it also gained the knowledge necessary to produce its own Bandeirante (Dagnino and Proença Júnior 1989, 9).

The point to be made here is that while foreign capital was indeed invited into Brazil to help stimulate the development of the aeronautics sector, this was deliberate and facilitated development. Specifically, the *Xavante* project, in addition to licensed production of other aircraft, such as the Northrup F-5 and later the Dassault Mirage, all added an important ingredient for sectoral development; the know-how to manage projects in the aeronautics sector (Conca 1997, 122).

The second key project in developing the core competencies of the Brazilian aeronautics sector was the licensed production agreement with Piper. The key achievement of the Piper deal was the acquisition by Embraer of the marketing capacity to sell their domestically developed and designed aircraft abroad. By the mid-1970s, Brazil was one of the largest markets for light aircraft in the Western world and Dagnino and Proença Júnior estimate that as many as 1,000 light aircraft were being imported into
Brazil by the mid-1970s (Dagnino and Proença Júnior 1989, 9). Additionally, they note that the ability to produce light aircraft presented little problem for Embraer at this time. Notably, by the mid-1970s, Embraer had been producing the Bandeirante, as well as the Ipanema; the former being of greater technological sophistication than the later. However, Embraer had problems in seeking export markets for its products. The U.S. market presented a problem for the aeronautics sector because the FAA would not certify a plane for use in American airspace, unless its counterpart agency had certified it for use in the home market. However, no such certifying agency existed in Brazil at the time and this responsibility was assigned to the IFI, which was a subordinate agency of the CTA and whose primary responsibility to this point in time had been facilitating cooperation between the aeronautics enclave and private companies.

To summarize the Piper agreement succinctly, the MAER took the decision to hold a competition between the three major American companies for access to the Brazilian market (Dagnino and Proença Júnior 1989, 9-10). In addition to Piper, the other two contestants were Beach and Cessna. The terms of the competition centered effectively on the transfer of technology from the American firm to Embraer. Ultimately, Piper offered the most attractive package to the Brazilian government and won the competition. Following the conclusion of this competition, several interesting policies were promulgated that helped the development of the sector. Most importantly, a 50 percent tariff was imposed on foreign built light aircraft (Dagnino and Proença Júnior 1989, 9). This very large tariff created in effect a protected domestic market for Embraer and Piper.
The Piper-Embraer agreement was a mutually beneficial agreement. Piper went on to sell, “5,000 planes annually, while Embraer was at pains to produce 556 at its highest output ever (1977), including licensed Pipers” (Dagnino and Proença Júnior Junior 1989, 10). However, of far greater importance for Embraer was the fact that, “As part of the terms of the agreement, Embraer used Piper’s international selling structure to market some of its own products” (Dagnino and Proença Júnior 1989, 10). The key here to note is that Embraer began manufacturing not only entire Pipers for domestic consumption, Brazil began to export Pipers, and the Brazilian aeronautics sector also became an important parts supplier for Piper products globally. It was precisely this experience that contributed to one of the hallmarks of Embraer’s business model: worldwide customer support and close relationships with foreign customers. In fact, today, Embraer maintains parts, sales, service, and training headquarters in North America, Europe, and Asia. So, while there was little embeddedness in the Brazilian aeronautics sector, because it was dominated by the state, Embraer employees themselves quickly gained an understanding of the markets they sought to enter. Equally important was the fact that Embraer employees, frequently graduates of ITA, had the deep technical knowledge, critical in identifying and exploiting the niches markets where Embraer has competed very successfully.

Finally, there was the Tucano project, which represented Embraer’s first foray into developing an explicitly military aircraft. The origins of the Tucano project are found in 1978, with the desire of the Brazilian Air Force Academy’s request for a

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79 It is interesting to note that the Super Tucano is still being used today by militaries around the world and was even considered as a light attack and counter-insurgency aircraft by the U.S. Air Force (Pietrucha 2016).
turboprop with the flight characteristics of a jet for training and ground attack (Bernardes 1999, 189). Funds for this project were furnished principally by MAER, which stipulated that the project was required to have an operational prototype in two years’ time (Bernardes 1999, 189). Despite its unfamiliarity with military aircraft, Embraer’s prototype, the EMB-312 Tucano took its first flight on December 19, 1980 and the production version went on to be Embraer’s most successful export product, superseding the Bandeirante (Bernardes 1999, 189).

Bernardes highlights two critical structural factors related to the global aeronautics market that explain the export success of the Tucano. First, the Tucano was a relatively fuel efficient aircraft because of its turboprop engine (Bernardes 1999, 189). This was important considering the 1979 oil shock, which once more made fuel economy a major concern for all oil importing countries. Second, there were no contemporary competitors offering a training aircraft with ground attack capabilities in the military market in the early 1980s (Bernardes 1999, 189). On this point, it is important to recall that the Cold War was pushing countries in the Western Bloc and the Soviet Union to pursue ever more baroque aircraft, while offering little in the way of substantive combat performance. Thus, structural factors help explain the export success of the Tucano, but only in part.

The export success of the Tucano was also due to the competencies the aeronautics sector gained in previous projects. On the one hand, it is incredible to think that had Embraer not gained experience in recognizing potential markets for its products that an export deal could have been signed with England for the Tucano to serve as a training aircraft for the RAF. On the other hand, had Embraer not possessed the support
of the CTA and been positioned from its founding as a systems integrator, as opposed to an assembly plant for foreign aircraft as was true of HAL during this time, an export deal with England would not have been possible. The fact is that the English made such extensive requests for modifications to the Tucano, that the version furnished to Britain was virtually a different airplane, earning the name Super Tucano (Bernardes 1999, 189).

While structural factors helped create a market for the Tucano, the capabilities of the Brazilian aeronautics enclave allowed Brazil to identify and respond to the market.

To summarize Brazilian state support for aeronautics sector development briefly, the state was guided by a commercial logic, commensurate with its capitalist orientation and alignment with the Western Bloc that guided development. Though the development of the sector reflects the general pattern of dependent development, the aeronautics sector successfully gained sufficient competencies to move up in the production chain from the fourth to the third tier. This was achieved through a series of licensed and co-production deals that were deliberately chosen to facilitate the development of domestic capabilities, including most importantly the know-how to manage series production of aircraft, systems integration, and marketing. None of these competencies are observed in the Indian aeronautics sector, to be discussed in the following section of this chapter.

5.2 The Institutional Status Quo of the Indian Aeronautics Sector

The second critical juncture affecting defense industrialization in India was the result of two wars in the 1960s. The first of these wars was the Sino-Indian War of 1962, which marked the failure of Nehru’s China policy. Lasting one month and concluding in a unilateral cease fire, declared by China, the Sino-Indian War also marked the start of an enduring rivalry, albeit of a relatively low-key nature. The second war, the 1965 Indo-Pakistani War, didn’t result in the loss of any significant territory as was the case in 1962,
but it had important strategic ramifications. First, despite the fact that the Indian military enjoyed outsized advantages vis-à-vis Pakistan in terms of numbers of men and war machines, military efficacy was severely hampered by poor inter-service coordination. Second, the outbreak of the war led Britain and the U.S. to halt all military aid to both countries, damaging relations between New Delhi, London, and Washington. Finally, China began a military aid relationship with Pakistan, adding one more vector for extra-regional powers to exert influence in South Asia in opposition to Indian interests. It was in the context of these two wars, particularly the Sino-Indian War that a major military modernization effort was begun in India, with widespread popular support.

Two factors mediated the impact of these negative shifts in the South Asian balance of power on the Indian state’s power for defense development and thus the possibility for better defense industrial policy. First, at the systems-level of analysis, the opportunity to purchase highly sophisticated weapons systems from Russia blunted the impetus for institutional reforms. The formation of a tacit alliance with Russia, built on economic and political ties dating back to the early 1950s, afforded New Delhi the opportunity to purchase weapons systems, including fighter aircraft, served to diminish the further development of the aeronautics enclave. This is wholly consistent with the theory of military emulation, which theorizes that even when the balance of power shifts decisively against a country, significant opportunities for external balancing diminish the structural imperative for copying systems-leading states security strategies.

Second, at the unit-level of analysis, defense policymakers drew the wrong lessons from the Sino-Indian War. Rather than pursue a systematic institutional overhaul of the defense establishment, as was indicated by the Brooks Henderson Committee
Report, the major response to the war was simply a massive rearmament campaign that began in 1964. Again, given an explicit recognition of the weakness of institutional aspects of the Indian military system during the 1965 war, military emulation theory suggests that one might expect to see institutional reforms. Yet again, as was true following the 1962 war, no serious institutional reforms were undertaken to produce a more effective military system in any respect from inter-service coordination to the defense industrial base.

Interestingly, the key lesson Indian defense makers drew from both the 1962 and 1965 wars was that they needed more sophisticated weapons systems. This lesson stands at odds with the actual experiences of both wars. In 1962, the conflict was primarily a land war, fought between light infantry units in the heights of the Himalayas. Neither side engaged their air force for fear of widening the scope of the conflict and because of concerns about the ability of their combat aircraft to operate from airbases at exceedingly high altitudes. In the 1965 war, with specific regard to the IAF, one of the interesting facts of this war was that the IAF Gnat performed spectacularly well when pitted against the cutting-edge American warplanes piloted by the PAF. Thus, in neither case would it seem that the acquisition of weapons systems of greater technological sophistication had any bearing on the wars likely to be fought in South Asia. Yet, the acquisition of high technology weapons systems became a chief priority following both wars. Not surprisingly, as will be noted, scholars have attributed this Indian technological imperative at least in part to the prestige associated with weapons like supersonic fighter jets.
The specific argument I make in this section is the following: Though the level of external threat was assessed to be higher for India following the 1962 and 1965 wars, the preference for high technology weapons easily obtained from Russia contributed to the underdevelopment of the Indian aeronautics sector. In support of this argument, I first discuss the change in the level of India’s assessed level of external vulnerability by examining the Sino-Indian War, the Indo-Pakistani War, and India’s relationship with Russia. Second, I discuss the impact of shifting levels of external vulnerability on India’s state power for defense development, with specific regard to the aeronautics enclave. Finally, I discuss state support for aeronautics sectoral development from 1964 through the early 1980s.

5.2.1 Indian External Vulnerability
The 1960s were a time of both changing levels of external threat, as well as shifting opportunities for external balancing options. As noted above, war with both China and Pakistan were the key drivers of external threat in South Asia. External balancing options shifted according to the vagaries of the political alignment of the two superpowers. Because of the outbreak of war between India and Pakistan in 1965, the U.S. cutoff military aid to both countries and the British followed suit. Russia stepped in to fill this void for India because at least in the short term, there was a convergence of economic, political, and strategic interests between these two countries. All in all, notwithstanding an increase in threat levels and a change in balancing partners, India remained the regional hegemon in South Asia despite the threat posed by China, Pakistan, or a Sino-Pakistani alliance. I what follows I will discuss the Sino-Indian War, the Second Round in the Indo-Pakistani conflict, and the Russo-Indian relationship with
an eye toward teasing out the strategic import of each as it relates to the level of Indian levels of external vulnerability.

The Sino-Indian War
The Sino-Indian War was possibly the single most important influence on Indian balancing behavior from late 1962 through to the Indo-Pakistani War of 1971. This outsized effect this war has had on Indian strategic thinking is at least partially because this war erupted seemingly out of nowhere, catching Indian policymakers charged with national security unawares. Given Nehru’s carefully crafted diplomatic approach to China, the outbreak of war signaled the end for non-alignment, as the strategy came to be seen as ineffectual in guaranteeing Indian national security. As will be noted in the following section, the Sino-Indian War was a primary catalyst for a massive military modernization program targeted in large measure at the Indian Army, but also at the expansion of the IAF as a 45 squadron force with contemporary combat aircraft (Smith 1994, 80-81).

The axis of conflict around which the Sino-Indian War was fought was the territorial boundary between India and Tibet, the McMahon Line and control of Tibet (Smith 1994, 75; Garver 84-84; Guha 2008, 176-178). For their part, the Chinese didn’t recognize this boundary because it was imposed on China by the British Raj. Given the explicit anti-imperialist stance of the new Indian government, as expressed notably in its nonalignment doctrine and through its support for the nonaligned movement, it is at once surprising and yet understandable that Indian elites sought to uphold the McMahon Line. From the point of view of Nehru and other foreign policy mandarins, the McMahon Line was legitimate and should be upheld. Understanding that border disputes were fraught with potential for military conflict, New Delhi was content with the McMahon Line.
Owing to his assessment of China based on numerous meetings with the Chinese foreign minister, Chou Enlai, Nehru believed that the McMahon Line was ultimately durable (Guha 2008, 180). Thus, when the Chinese began to probe the McMahon Line with light military forces and set up outposts in the Himalayas in what was then India, Nehru pursued a similar policy, setting off a series of skirmishes, leading ultimately to the spectacular and rapid defeat of India in war in 1962 (Kavic 1967, 169-174; Smith 1994, 75; Garver 2013, 91-92). It is important to note that for their part, the military was dead set against such provocative action against China. The dominant consensus among the Indian general staff, such as it existed at the time, was that the Indians were ill-prepared to fight a war with China, nevertheless, they went along with Nehru’s policies (Smith 1994, 76; Raghavan 2012, 121).

To be clear, the political preferences of Nehru, who alone held the foreign policy portfolio throughout his tenure as prime minister, were a key cause of the war in the first place. In particular, speaking to the events in July of 1962 that served as proximate causes of the war, Smith notes that:

In July, both sides met eyeball to eyeball when Chinese troops surrounded an Indian border post; the Chinese eventually retreated when the Indian troops stood their ground. Interpreting the Chinese action as a ‘blink’, the Indian Government became more strong-willed and began to challenge forcefully China’s movements into NEFA. By September the border dispute appeared to be on the verge of unravelling. Throughout the month the two sides clashed sporadically. By mid-October Nehru let it be known to the press that the Army had been instructed to eject the Chinese troops from NEFA. After further skirmishing the Chinese mobilized along the borders of Sikkim, Bhutan and NEFA. By 20 October the conflict had started and the Chinese advanced on both Ladakh and the NEFA fronts (Smith 1994, 75-76).
The point to be made here is that not only did Nehru’s diplomatic approach to China fail to apprehend Chinese intentions, nor did he correctly assess the risk associated with the game of brinksmanship the Indian Army was playing.

Given the fact that this study posits a causal relationship between external vulnerability and defense industrialization, specifically in the aeronautics sector, it is important to point out the role of air power in this conflict. Notwithstanding the build-up of the IAF combat aircraft inventory in the 1947-1962 period, the IAF’s role in the war was limited to that of troop transport and ferrying cargo. Smith, along with other knowledgeable experts, argues that this limited role afforded the IAF was the result of four factors. First, there were extreme problems operating combat aircraft at high altitude when loaded for combat (Smith 1994, 77). Second, the Chinese themselves lacked the requisite weapons to launch sorties against Indian targets during the war for the same environmental reasons that the IAF faced and Indian political elites feared that launching sorties against Chinese troops at lower altitude might cause a precipitous escalation in the war (Smith 1994, 77). Third, there were serious inter-service coordination problems making a close air support mission nearly impossible (Smith 1994, 77). Finally, Smith notes that, “the Army may have decided to sideline the Air Force as a way of downplaying the importance of airpower during a period when the IAF as an institution was in the ascendancy. Had the Army performed better it could have increased the legitimacy of its claim for increased capital expenditure following a period when its own fortunes had been meagre” (Smith 1994, 77). Thus, the role of airpower in the Sino-

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80 See also Kavic (1967, 115), Saigal (1977, 284), and Chaturvedi (1978, 121-122).
Indian War was minimal, though not necessarily because the potential for the effective use of such an instrument was lacking.

To summarize, the Sino-Indian War was as shocking as it was humiliating. The fact of the matter is that defense planners from the military right up to Nehru failed to appreciate the threat China posed to Indian national security. Moreover, the careful diplomatic policy crafted by Nehru proved to be a failure as well. In terms of the balance of military power, while India remained the dominant regional power in South Asia, threat assessments in New Delhi now came to see China in a new light; a very large aspiring great power with the capacity to threaten Indian interests well before analysts predicted was possible (Garver 2013, 93). The Chinese threat on India’s northeastern border then was a factor in an increasingly dour strategic picture.

The 1965 Indo-Pakistani War (The Second Round)
The 1965 Indo-Pakistani War marked the recrudescence of hostilities between India and Pakistan. The outcome of this war is somewhat in doubt and frequently has depended upon the perspective of the individual analyzing the war. However, some of the most recent scholarship with respect to Indian grand strategy suggests that the 1965 war was a failure when seen in the context of the ongoing enduring rivalry between India and Pakistan because the former clearly held the advantage over the latter, yet failed to press the advantage (Dasgupta and Cohen 2010, 8). It would only be in the Third Round (1971) of the Indo-Pakistani conflict that India would assert its status as the regional hegemon (Smith 1994, 92-94). In any case, it matters little as to which country was the actual winner and which the loser, because it was only the second iteration in what to date has been an enduring rivalry punctuated by four wars. More important are the ramifications, which following a brief sketch of the conflict will be discussed below. In
particular, there were two key strategic ramifications of the Second Round for India. First, the outbreak of the war led to an increasing strain on Indian relations with the Western Bloc, notably Britain and the U.S., both of which were important allies in the process of defense modernization following the Sino-Indian War. Second, while Pakistan was already a vector for extra-regional influence in South Asia, the Sino-Pakistani relationship that emerged in part because of the 1965 war meant Pakistan was a vector for yet another extra-regional power to influence the South Asia balance of power (Smith 1994, 85; Cohen 2001, 261).

The central axis of the Second Round in 1965 was the same as it had been in 1947: the mutual incompatibility of Indian and Pakistani national identities and the atrocities committed on both sides during the process of partition that reinforced these national identities. Given that the underlying cause of the conflict remained the same, what requires specification is the proximate cause which sparked the war in 1965. Simply put, the proximate cause of the war in 1965 was the sense in the Pakistan’s leadership that Nehru’s death in May of 1964 was an opportunity to resolve the Kashmir issue in their favor (Smith 1994, 85). The logic on the part of the Pakistan’s leadership was that the climate of political disarray in which India found itself was in following Nehru’s death could be exploited.

Though the Kashmir issue was the primary point of contention in the Second Round, the war actually began in the Rann of Kutch, where India and Pakistan were in conflict over territorial boundaries. Through the course of this 6-month war, the pendulum swung both ways, however Pakistani success is said to be more a case of the Indian military performing badly than the Pakistani military performing well (Smith
Ultimately, this war ended with India positioned to decimate Pakistan and resolve the Kashmir conflict in its interest (Wolpert 2009, 394-396). Yet, the Soviet Union intervened before the conflict could come to a decisive end leading to the Declaration of Tashkent in 1966 that effectively ended the war (Wolpert 2009, 396).

As was true of the Sino-Indian War, it is again important to consider the role airpower played in the Second Round. As was noted in the previous chapter, airpower in the Indo-Pakistani rivalry had been an important element in large measure because of the vast distances of the Subcontinent and the contested terrain. One of the particularly worrisome aspects of the PAF for Indian policymakers was that owing to the cooperative security agreement with the U.S., the PAF was equipped with near cutting-edge combat aircraft, including the F-86 Sabre of Korean War fame and the F-104 Starfighter (Smith 1994, 85). Arrayed against these highly sophisticated American fighters, the IAF was composed primarily of WWII-vintage bombers, fighters, and transonic aircraft like the Gnat. In fact, the Gnat formed the backbone of IAF airpower in the 1965 conflict and performed well beyond the expectations when pitted against the PAF’s American made fighters (Smith 1994, 85). Notably, because of its lightweight and high maneuverability, the Gnat was able to hold its own in combat against the Sabre. Additionally, the F-104 Starfighter in service with the PAF was reported to suffer from many of the same problems as did the Sabre and it was very difficult to maintain as was true even for F-104s in service in West Germany at the time. Overall, when considering the fact that the IAF had a 4:1 numerical advantage over the PAF and the striking success of the Gnat,
this should mitigate the impulse for further push for air force modernization (Tanham 1995, 27).

The 1965 Indo-Pakistani War had two important negative ramifications for the balance of power in South Asia from India’s perspective. The first of these negative strategic outcomes was increased tensions with Western Bloc leaders, the United States and United Kingdom. At first glance, given independent India’s emphasis on a non-aligned foreign policy, particularly under Nehru and prior to the Sino-Indian War, it might be hard to see why increased tensions between Indian and the Western Bloc would be problematic. After all, India’s primary foreign policy goal was to remain aloof from either superpower bloc in order to reap benefits from interaction with both blocs. On closer inspection however, American and British military aid was a crucial component in India’s defense modernization strategy following military defeat at the hands of China (Kavic 1967, 181-182; Smith 1994, 81). Furthermore, it should be reiterated that between 1947 and 1965, defense procurement policies, particularly for the IAF, favored the import of British combat aircraft over the slow and steady building of a domestic aeronautics sector. Thus, increased tensions with Western Bloc leaders meant a diminished opportunity for external balancing.

The second negative repercussion of the 1965 Indo-Pakistani War was that Pakistan came to be a vector for an additional extra-regional power, China, which could affect the regional balance of power (Smith 1994, 85; Cohen 2001, 261). A key reason the Government of Indian chaffed at cooperative security agreements between Pakistan and the U.S. was that it brought the Cold War to South Asia. The nature of the foreign policy relationship between Pakistan and the U.S. was a function of the American policy
of containment. With India unwilling to choose sides in the East-West conflict that was the Cold War, the Americans sought an alliance with Pakistan to hem in the Soviet Union to the south. In this way, Pakistan became a vector for American and possibly Russian influence within South Asia. In addition to a host of smaller countries that supported Pakistan in the 1965 war, the strategic rivalry between China and India made it possible and advantageous for China to support Pakistan. In fact, the 1965 war would mark the start of a Sino-Pakistani military aid relationship that would span decades. So even though the U.S. suspended all military aid to both India and Pakistan following the outbreak of war in 1965, China came to the assistance of Pakistan.

To summarize, the Sino-Indian War and the Second Round together constitute the major sources of external threat forming the second strategic juncture for India. Because of the war in 1962, China became a major strategic rival in the broader region of Asia. With respect to the balance of power between India and Pakistan, the 1965 war did not appreciably change the status quo ante. However, both India and Pakistan lost access to military aid from Western sources. Additionally, the Sino-Indian War made possible a military aid relationship between China and Pakistan. In the estimation of Indian policymakers, the Sino-Pakistani relationship had two negative implications for Indian security. First, Pakistan could count on Chinese weapons for their defense. Second, China might well be able to exercise political influence in South Asia because of the Sino-Pakistani relationship. From the vantage of a country which saw itself as the third pole of world power, such changes in its geostrategic environment were alarming to be sure.
An Incipient Russo-Indian Alliance
Even though India’s perceived level of external threat increased following the 1962 and 1965 wars, on balance the level of external vulnerability did not rise all that much. The simple reason for that was the consolidation of a military aid relationship between India and Russia. This relationship was born out of a convergence of geostrategic preferences in both the rhetorical and balance of power domains. As will be discussed, this relationship did not suddenly appear overnight in the 1960s, rather it has roots dating to the 1950s, in particular a trade agreement dating signed in the 1950s which allowed ruble-rupee exchange (Smith 1994, 83; Koithra 1999, 66; Cohen and Dasgupta 2010, 20). Additionally, the tightness or closeness of these implicit allies varied as did the strategic preferences of both countries; whereas Soviet interests were defined by the bipolar logic of the Cold War, Indian preferences were defined by trying to consolidate its regional hegemony in South Asia and carving out a power bloc independent of either the East or West (Koithra 1999, 66-67; Guha 2008, 172).

The origins of Russo-Indian cooperation are to be found in the 1950s. As is well known, Nehru was enamored of the pace, scope, and intensity of industrialization in both the Soviet Union and China (Guha 2008, 171). As such, Indian development policy followed what has come to be known as a socialistic pattern of development (Kohli 2004, 264-265). However, given that a market system was left in place in India following independence, it should be noted that India was much more a social democracy, whose political economy bore a close resemblance to that found in Western European countries at the time. Qualitative assessments of political economies aside, the key point to be made with respect to the ideological affinity Nehru held for the political economy of the Soviet Union made it possible and even desirable for a cordial relationship, which in the
1950s took the form of a trade agreement making it possible for bilateral trade to occur between the two countries and established exchange rates for rubles and rupees. This was key in facilitating future military trade because neither country had a hard currency and so India’s ability to use rupees for the purchase of military hardware made Russian arms more attractive than weapons offered by Western suppliers, which demanded payment in hard currency.

Beyond the ideological affinity between India and the Soviet Union and the commercial ties established in the 1950s, a convergence of geostrategic preferences made a military-economic relationship possible. It should be made clear from the outset, that India and the Soviet Union were playing two different, yet interconnected geostrategic games, each with their own logic. For Moscow, the only geostrategic conflict of interest was that between the Eastern and Western Blocs. Given this bipolar view of the world, a close relationship between the Soviet Union and India made very good strategic sense. On the one hand, with the passing of Stalin and the rise of Krushev to power in the mid-1950s, the Cold War shifted gears from outright East-West confrontation to the struggle for spheres of influence within the developing world. Given this broader strategic backdrop, close relations between Moscow and New Delhi made a great deal of sense as India was undoubtedly the single largest developing country and as the self-styled leader of the non-aligned movement, it might be possible for the USSR to exert influence on the members of the non-aligned movement if a close relationship with India could be arranged. On the other hand, a close relationship between Moscow and New Delhi would in and of itself be a rhetorical coup for the USSR insofar as it demonstrated that Moscow
could have a good relationship with country whose political economy was defined by

democracy and a market system (Koithra 1999, 66).

Again, from the Soviet strategic perspective, courting India made a great deal of

sense considering American inroads into South Asia and a deteriorating relationship with

China (Koithra 1999, 65). As has been noted, since the mid-1950s, the U.S. cultivated a

cooperative security relationship with Pakistan as part of the strategy of containment,

aimed at hemming in the Soviet Union from the south. This American-Pakistani

relationship came to fruition because India refused to choose sides in the East-West

conflict. Much more troublesome for the Soviet Union was the rapidly deteriorating

relationship between Beijing and Moscow. In fact, by the end of the 1950s, the

relationship between these the Eurasian and Asian giants had reached such a low that

Russia indicated that it would remain neutral in the Sino-Indian boundary dispute in 1959

and in the issue of the Sino-Indian War in 1962 (Smith 1994, 84). So, with American

efforts to hem in Moscow from the southwest and an emerging adversary on the Soviet

east/southeast, cultivating a close military relationship with India made complete sense as

it related to the balance of power.

For India, the strategic picture was a bit simpler. While those in India concerned

with foreign policy, Nehru in particular, long dreamed of exercising at least Indian

cultural power at the global level, the fact remained that India’s key strategic concerns

lay in South Asia, until at least the 1971 Indo-Pakistani War, which saw the consolidation

of India’s status as the regional hegemon (Smith 1994, 92-94). This being the case, as

noted in the preceding section, India faced threats from the same sources as did Russia; a

Pakistan backed by the U.S. and (later) China, as well as China itself. Given this
strategic reality, there were strong structural incentives for both countries to cooperate in the military domain.

Though Russo-Indian cooperation would be formalized in the Indo-Soviet Treaty of Friendship and Cooperation, signed in 1971, this was not a relationship akin to those among NATO countries. In fact, Soviet-Indian relations have gone through various periods of approximation and divergence from the mid-1960s through the collapse of the Soviet Union in the early 1990s (Smith 1994, 88-89, 105-109). Notably, this relationship was highly asymmetric in favor of Moscow, a fact that Indians were well aware of and chafed at. Yet, the Soviets had the weapons systems for land, aerial, and naval combat Indian policymakers believed necessary for national security and the defense industrial establishment India lacked to produce such weapons systems.

It is worth making two key and related points to of great interest to this study. First, whereas British and French aircraft were the mainstay of the IAF arsenal in the 1950s, beginning in the 1960s these outdated planes were replaced primarily with Soviet combat and transport aircraft (Smith 1994, 84). The most notable contribution the Soviet Union made to the IAF fleet was the MiG-21. Though the deal for the MiG-21 began to take shape just prior to the Sino-Indian War, New Delhi and Moscow took until September 1964 to complete the deal, with production beginning in India shortly thereafter. The MiG-21 ultimately became the backbone of the IAF and remain in service today. Though many Soviet-built MiG-21s entered service in India, hundreds of these were built in India a HAL’s MiG complex in Kanpur. Subsequently, several other MiGs entered Indian service, but the deal was the key foundation of Soviet-Indian cooperation in the aeronautics sector.
The second point with respect to Soviet-Indian cooperation in defense production and the aeronautics sector is that this relationship had a deleterious effect on the development of Indian defense industries in at least two ways. First and most important from the perspective of this project, the availability of Russian weapons systems on easy credit terms and payable in rupees obviated any need for structural reform that might have created an aeronautics enclave with greater levels of cohesiveness. Put another way, I argue that this opportunity for external balancing limited the structural incentive for internal balancing. Instead, as will be discussed below in due course, in purchasing MiGs from Russia, the Indians got turnkey factories and training in serial production of different models. However, as is discussed in due course, subsequent events call into question the degree of skills acquired by any of the actors comprising the aeronautics enclave in the design, development, and production of aircraft. While it is true that HAL was able to produce a modified version of the MiG-21 in the 1980s to extend the service life of the aircraft, the collapse of the Soviet Union saw India unable to get many of the spare parts required to keep their fleet of MiGs in the air. No doubt, this was partially because of Soviet unwillingness to share all of the technology associated with its aircraft in order to keep a valued customer.

The second way in which Soviet-Indian cooperation on defense production handicapped the Indian defense establishment and the aeronautics enclave was because of Soviet political control of the market for its weapons. Put simply, in much the same way as countries that purchased American weapons had to deal with the political prerogatives of the U.S., so too did Soviet client states (Krause 1995, 112-117). Moscow did not
permit the export of Indian-made Soviet weapons in the Eastern Bloc, making it difficult for the Indian defense industrial base to support itself through exports.

Summarizing Changing Indian External Vulnerability
To summarize, while India did incur new strategic threats in the 1960s, these did not directly translate into increased levels of external vulnerability. It is absolutely the case that in the strategic assessment of Indian policymakers that China and Pakistan became or remained important threats in the 1960s. Additionally, following the 1965 war with Pakistan, India lost access to weapons from both the United States and Britain, the latter its historical supplier even after 1947. Thus, regarding the level of external threats to India, it did indeed increase. However, mitigating this increase in threat levels was the mostly new and certainly dramatically expanded defense production relationship between Moscow and New Delhi. Though a limited defense trade existed between the India and the Soviet Union prior to 1962, this dramatically increased in the mid-1960s, filling the void created by the American arms embargo on India imposed in 1965. In fact, whereas American and British firms were reluctant to transfer technology to India, Russia readily provided India with turnkey factories for items such as aircraft, at least in theory helping India pursue the goal of defense self-sufficiency. However, as became apparent over the longer term, defense cooperation between Moscow and New Delhi proved little more valuable in terms of defense development than British-Indian cooperation had been. However, Soviet-Indian cooperation, an example of a new external balancing opportunity, blunted any impulse to undertake institutional reforms in response to increased threats from the Chinese and Pakistan. It is to a discussion of the impact of levels of external vulnerability on the aeronautics enclave I turn to in the next section.
5.2.2 State Power Following the Sino-Indian and Second Indo-Pak Wars

As one would expect, the debacle in the Himalayas and to a lesser extent the Second Round of the Indo-Pak conflict affected Indian foreign and defense policy. Regarding foreign policy, the Sino-Indian War partially discredited Nehru’s policy of non-alignment that prevailed up to 1962 (Cohen 2001, 49). Prior to 1962, it was the perspective of Nehru and his foreign policy team that, “…it was a matter of importance to both India and China that now had about 1,800 miles of common frontier, that they live in peace, friendship, and with respect for each other’s sovereignty and territorial integrity” (Thomas 1978, 41-42). However, after the Sino-Indian war, Thomas observes that:

The Himalayan defeat of 1962 then appeared to dramatically demonstrate to both Congress and Opposition party members the failure of India’s nonalignment policy. Nehru’s instant reaction was that India had been living in a world of her own creation removed from the realities of the international situation. Such beliefs of past perceptual failure and of misguided foreign and defence policies, were now suddenly accompanied by emotional and unrealistic declarations of new policy intentions whereby India would make China vacate her aggression (Thomas 1978, 45-46).

Notwithstanding the resolutions passed in the Lok Sabha and the Rajya Sabha committing India to recover its lost territory from China, India did not pursue an aggressive foreign policy posture towards China (Thomas 1978, 47). However, Nehru and successive prime ministers rhetorically if not always clearly in practice, did take a more realpolitik approach to foreign policy from here on out.81

In terms of defense policy, India’s more realpolitik and changed geostrategic environment elicited a corresponding increase in defense spending. Beginning in the 1964 fiscal year, the budget for the Indian military grew dramatically to 4 percent of GDP (Smith 1994, 79). Much of this increased spending was directed at expanding the overall

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81 For a good overview of the broad changes in Indian foreign policy between 1962 and 1970, see Thomas (1978, 48).
size of the military, creating units specifically trained for high-altitude mountain warfare, and acquiring modern weapons systems to outfit Indian Army. These expenditures made eminent sense given the fact that ground warfare dominated the 1962 and 1965 wars. Additionally, in the wake of the Sino-Indian War, the charge was made that Defence Minister Krishna Menon showed favoritism towards the IAF in terms of allocating funds for force modernization in the 1950s (Smith 1994, 79). None of this is to say that the IAF did not benefit from the concerted effort at defense modernization following the Sino-Indian conflict. From the mid-1960s through the 1980s, the IAF was expanded to a 45-squadron air force, representing a significant increase in the size of the IAF from the 25 to 30 squadrons fielded from 1947 to 1962 (Smith 1994, 80). And with the withdrawal of the Royal Navy from the Indian Ocean, the historically neglected Indian navy even saw some modest funds for procurement flow its way in the late 1960s (Smith 1994, 80).

Changes in Indian foreign and defense policy are important to note, yet of greater interest herein is that neither the 1962 nor the 1965 wars increased the power of the Indian state for defense development. Looking at the aeronautics enclave, neither war served as a catalyst for institutional reform, such that the institutional capacity of the aeronautics enclave increased. For its part, the DRDO’s remit remained basic science and decisions regarding how and where weapons systems and their components should be made. The IAF remained focused on its air defense role, placing a premium on the acquisition of fighter aircraft. Finally, HAL remained committed to series production of planes designed by the DRDO, as well as the licensed production of aircraft purchased abroad. As will be discussed in a subsequent section, this institutional stasis resulted in
ineffectual state support for aeronautics sector development following the strategic juncture of the Sino-Indian and Indo-Pak wars.

Given this lack of institutional reform, the question for this section is the following: What were the political determinants of the institutional status quo in the aeronautics enclave? I argue that elite ideology largely explains the absence of institutional revision following the convulsions of two wars. In what follows, I identify how continued elite consensus in the realm of defense policy hindered institutional reform, as well as how political fragmentation among elites unrelated to either war indirectly impacted institutional revision. Following the discussion of elite ideology, attention shifts to the organization of the aeronautics enclave, and state-society linkages.

Elite Ideology
Perhaps owing to the limited nature and short duration of the Sino-Indian and second Indo-Pak wars, neither resulted in a change in the elites governing India nor their policy preferences. This reality explains the relative continuity in the political class’s consensus regarding defense industrial policy, which I argue had a direct negative impact on the potential for institutional reform in the aeronautics enclave. Additionally, for reasons unrelated to either of the wars fought between 1962 and 1965, political fragmentation in the broader political arena had a negative, though indirect impact on the prospects for institutional reform in the aeronautics sector. Each of these themes is developed in turn.

Elite Ideology and Defense Development
Continued elite consensus on matters related to defense development was rooted in three core factors. First and perhaps most importantly, a broad consensus existed among politicians, the Indian Army’s officer corps, and in the press that Defence Minister Krishna Menon failed to equip the Indian Army to handle the Chinese threat (Smith
1994, 78-79). To be sure in the aftermath of the Sino-Indian War, alternative explanations were put forth absolving Menon of sole responsibility for defeat, however evidence of the broad consensus of his culpability comes from the fact that he was removed as Minister of Defence during the Sino-Indian War.\textsuperscript{82} To be blunt, poor relationships between Menon and members of the Congress made it easy to scapegoat him for the debacle in the Himalayas.

Far more important for present purposes is the primary ramification of scapegoating Menon for the outcome of the Sino-Indian War. Specifically, Smith observes that in scapegoating Menon:

Once Menon had been sidelined the Cabinet set about redressing what it considered to be one of the former Defence Minister’s key failures, defence preparedness. Whether or not this charge against Menon was justified, it had the effect of concentrating the Government’s attention on technological rather than institutional solutions to the country’s insecurities. Indeed, the former virtually cancelled out the latter: an under-equipped army is not necessarily in efficient or the victim of poor foreign policy, military, intelligence and political decision making…India was not a militarily weak country overall, even though the eastern borders may have been poorly defended and these problems compounded by an inhospitable terrain and acute logistical shortcomings. The modernization programme of the 1950s had given India a defence posture of some significance,

\textsuperscript{82} Drawing on the work of Vertzberger (1984) and Saigal (1979), Smith argues that India’s defeat in 1962 was, “The causes of the 1962 defeat remain, therefore somewhat confused. Clearly, the defence effort was deficient and it is likely that the war was lost through a combination of political miscalculation, inadequate security arrangements, intelligence failures, and military error, in that chronological order” (Smith 1994, 78). It should be noted as well that Nehru ordered the creation of a commission to investigate the Sino-Indian War and highlight the shortcomings of Indian defense management in this conflict. To date, perhaps in part because this committee’s report is said to be a damning indictment of the government, the Henderson-Brooks Committee Report is still classified by the Indian government, however the general contents of the report are well known and support Smith’s assessment. Specifically, based on a leaked copy of the Henderson-Brooks Report, Australian author Neville Maxwell (1970) argues that India lost the war because of the poor articulation of Indian politicians and the military. For their part, Nehru with his foreign and defense policy advisors pursued an aggressive diplomatic policy and started a dangerous game of military brinksmanship with China over the issue of Tibet, both policies lacked any firm backing in the form of military statecraft. As far as the military goes, it was overly cautious in terms of handling China, rather than putting forward a battle plan or strategy for high altitude warfare in the Himalayas, the military instead insisted that war with China should be avoided at all cost. What this in effect meant was that the strategic decision-making process regarding China was left entirely with politicians, not specialists in the application of violence.
inappropriate perhaps for defence against China and biased towards the Air Force but, nevertheless, India could hardly claim to be militarily weak (Smith 1994, 79).

To be clear, Smith is making the point that the Government of India admitted the wrong error. In so doing, it foreclosed the possibility of institutional reform in the Indian higher defense organization and limited the potential for reform of the aeronautics enclave, which could have made the Indian state a more powerful agent of aeronautics sector development.

Second, elite consensus remained regarding a theorized tradeoff between defense development and the number one priority of policymakers: economic development. Rhetoric from New Delhi regarding the importance of synchronizing defense spending and economic development plans notwithstanding, defense and development plans were never aligned. Rather, the defense plans were “non-plan” expenditures (Thomas 1978, 114). What this meant for defense industrialization was that:

Until this point the belief was that the presence of the Planning Cell would enable the Defence Ministry to be ‘heard’ at crucial stages of economic planning in India so that its needs could be adjusted in the overall allocation of resources. But the needs of defence were still categorized as ‘non-plan’ expenditure suggesting that it made no contribution to economic development and indeed perhaps reduced it. After 1972, the Government of India recognized that defence planning had to be integrated within the overall economic planning effort and that the defence ‘plan for 1974-79 should be coterminous with the Fifth Development Plan.’ This new system, the Government of India felt, would constitute a ‘significant advance in defence planning and brings to the fore the intimate connection between defence and development, between prosperity and security’ (Thomas 1978, 114).

Though the government’s pronouncement sounded optimistic, this optimism was short lived as defense industrialization made little progress moving forward.

Furthermore, in the process of creating successive defense plans, some of the seemingly intractable problems with defense development on the periphery came to be known to policymakers. For instance, in India, given its unfamiliarity in the process of
design, development, and production of weapons systems, the lag time between when a
need was articulated for a new weapon system by the military and when that weapon
system entered service was much longer than that of advanced developed countries
(Thomas 1978, 112). Even in the advanced developed countries, the development cycles
of new cutting-edge weapons systems came to about ten years from the start of the
project. This time lag meant in several cases, weapons systems designed in developed
countries were obsolete by the time they were fielded by a service. In the aeronautics
sector, one example of this problem in the U.S. is the B-1 bomber (Pace 1998).

The precarity of state finances and continued dependence on foreign suppliers for
weapons brought two other problems related to defense development to the attention of
Indian policymakers. On the one hand, India’s ability to procure weapons systems and
the related production technology was restricted by perpetually scarce foreign exchange
reserves (Thomas 1978, 110). On the other hand, and more importantly, when Indian
foreign exchange reserves permitted procurement and some form of licensed
production/technology transfer was agreed upon, these agreements frequently included
end use restrictions, prohibiting India from exporting domestically produced foreign
weapons. This problem served to limit India’s willingness to reverse engineer weapons
systems or export them. Speaking specifically to the problems raised by this dependence,
Thomas notes that:

As a percentage of the GNP, defence spending in India was modest compared to
that of China, Pakistan, the Soviet Union or the Western powers, and rupee
amounts could be raised further without undue effects on the economy. The bulk
of Indian defence expenditure went to pay and allowances and provisions of
stores for maintaining the almost one million strong armed forces of India.
However, most of the major projects of the Defence Ministry public sector
undertakings called for the import of key components and often foreign technical
services and assistance. Raising the defence budget therefore became not so
much a burden on scarce domestic economic reserves as scarce foreign exchange reserves (Thomas 1978, 110).

What the text reproduced above is hinting at is that the distribution of resources committed to defense in India was seriously out of line with its defense commitments and needs.

Finally, as noted above, India had yet to commit any serious money to defense R&D for some very sound reasons. Thomas highlights three barriers to Indian investment in defense R&D: the possibility of low scientific returns versus the relatively high cost of such scientific endeavors; a dearth of the adequate laboratories and scientists’ and the time lag from the start of research and delivery (Thomas 1978, 111). To be sure, these barriers were very real and proved insurmountable in the short term. Thus, “…despite the optimistic rhetoric, the goal of defence self-reliance from a technical standpoint was still a distant prospect” (Thomas 1978, 112).

It’s important to note that while elite consensus remained that a defense-development tradeoff existed, a new, yet a poorly received counterargument did emerge. Building on contemporaneous academic work from Emile Benoit (1973), K. Subrahmanyam, an officer in the Indian Administrative Service, deputed to the in the Institute for Defence Studies and Analyses at the time, argued that military industrialization did contribute to broader economic development (Thomas 1978, 115). Subrahmanyam’s contribution to elite discourse was that in introducing Benoit’s work to Indian elites, he broadened the debate on the defense-development nexus somewhat beyond the parochial and explicitly political concerns of policymakers, notably those who saw the world the way Nehru had. This contribution was in the form of three basic points culled from Benoit’s work and applied to the Indian context. The first and most obvious
of these points was that defense spending and development were not contradictory. The point was made that, “Sizeable increases in defence spending up to even double the Indian average of 3 to 3.5 per cent of the GNP may in fact help the economy” (Thomas 197, 128). Second and relatedly, Subrahmanyam directly challenged the idea that defense and economic development competed for scarce resources. He theorized that if well managed, defense development would benefit the national economy as a whole by means of creating a well-educated and a skilled work force, the spin-on effect, and generally boosting domestic demand (Subrahmanyam 1983, 140-143).

Subrahmanyam also made the argument that defense expenditure should reflect India’s national interests, rather than extant threats (Subrahmanyam 1983, 143). What he meant was that defense spending in the then present day must be forward looking and reflect India’s economic interests as they were figured to expanded around the globe. This argument was in stark contrast to the prevailing view that Pakistan was the preeminent national security threat to India, on which military preparations were focused. Interestingly, Cohen and Dasgupta have recently criticized Indian policy for its heavy focus on military modernization without a coherent foreign policy, or rather, without aiming (2010, 26-28).

Subrahmanyam’s work fell on deaf hears among politicians, as one would expect, however, his perspective received the support of the military. As Thomas highlights:

In May 1973, General Chaudhuri wrote that this ‘myth’ of defence usurping development programmes was still evident among Indian Ministers, the civil bureaucracy and the public whenever they attributed India’s slow economic growth to the non-productive expenditure incurred on defence programmes. Chaudhuri instead pointed out the high rates of economic growth in countries like Israel, Taiwan and South Korea which also had high rates of defence expenditure, and concluded that ‘economic progress is influenced by many factors and to try to
put the major portion of blame for our slow progress on our defence expenditure is, to say the least, both unfair and uniformed’ (Thomas 1978, 129).

Notwithstanding Chadhuri’s comments and those made by like-minded individuals, Indian policymakers did not support the idea of defense-led development.

The third and final element of elite ideology regarding defense spending that mitigated against reform of the aeronautics sector had to do with IAF doctrine. Specifically, the IAF did not play a significant role in either the 1962 or 1965 wars and almost no evolution in IAF doctrine occurred. With respect to the Sino-Indian War, the IAF was not utilized at all except in an auxiliary capacity to air lift supplies, troops, and casualties from point A to point B. The reality was that the Indian politicians managing the tactical details of the war were afraid of Chinese reprisals against Indian civilians. As Cohen and Dasgupta observe:

For most of its history the IAF was an air defense force designed to thwart enemy attacks. This suited India’s liberal political establishment, which had memories of the attacks in the 1940s by German, American, and Japanese aircraft on innocent civilians. It was not until India edged towards becoming a nuclear weapons state that the IAF was able to develop the doctrine, and persuade the politicians, that it had to become a truly balanced, modern air force (Cohen and Dasgupta 2010, 76).

Thus, because the Sino-Indian War did not prominently feature aerial combat (because of perceived operational issues in the Himalayas) the IAF never became an integral part of the Sino-Indian War.

With regard to the Second Round of the Indo-Pakistan conflict, it further retarded the development IAF doctrine. While the ground war was somewhat embarrassing, the IAF performed admirably against the Pakistani Air Force (PAF) equipped with state of the art U.S. fighter jets. This came to pass for two reasons. First, the F-104 and F-86 flown by the PAF were challenging to fly and fight under the best circumstances. Under
the conditions which the PAF found itself prior to the 1965 war, these were nowhere near the best of conditions and the F-104 proved to be more lethal to Pakistani pilots than to pilots of the F-104 in Germany or other U.S. allied countries flying this aircraft. Additionally, the Pakistani pilots had difficulty mastering the fire control system of the F-86; if you can’t shoot at a plane, you can’t kill it. Second, though the HF-24 Marut had by this point in time become a total failure, the Folland Gnat acquitted itself well in combat against the technologically superior American jets (Smith 1994, 85; Cohen and Dasgupta 2010, 73). Though possessing a much lower top speed than either the F-104 or the F-86, the Gnat was a far more maneuverable aircraft, allowing Indian pilots to outfight their Pakistani counterparts. Ironically, in terms of the development of the strategic doctrine of the IAF, the success of the IAF against the PAF meant little rethinking of its basic doctrine was done. Thus, the 1965 war was a positive experience in the short-run, but over the longer term, this victory was detrimental to the IAF.

In terms of force structure, what was the consequence of little evolution of IAF doctrine? Quite simply, the lack of a strategic doctrine meant that it was very hard for IAF officers to pitch to New Delhi proposals for new planes of any type. Instead, the IAF remained primarily an air defense force in the period from 1962 through the 1980s. Interestingly though, Cohen and Dasgupta note of this period that a debate did exist between the strategic and airlift roles of the IAF (Cohen and Dasgupta 201, 77). The IAF was a service in search of a mission.83

83 By contrast, Cohen and Dasgupta note that naval development was guided by the respected strategist, K.M. Panikkar, who “wrote a Mahan-esque tract on the importance of Indian maritime power that still serves as a blueprint for naval modernization” (2010, 74).
In part as a direct result of the lack of a coherent and developed strategic vision beyond air defense, the IAF was hurt in terms of its budgets following the 1962-1965 strategic juncture. While the IAF did continue to grow between 1962 and 1972, its growth was modest at best as its share of the overall defense budget remained at approximately 19 percent of defense outlays during this period (Thomas 1978, 174).

What is interesting to note from the standpoint of defense industrialization is the fact that the IAF’s procurement budget declined. As Thomas points out:

The more peculiar trend in Air Force spending, however, has been its declining share on Capital Account. Although capital allocations in the overall budget constitute only about 10 per cent annually and therefore make little impact on total percentages, the new trend is nevertheless significant in a capital oriented service like the Air Force. This share which was 41 per cent in 1962 (18 per cent on Revenue Account) and 40 per cent in 1963 (19 per cent on Revenue Account), had dropped to 15 per cent in 1972 (20 per cent on Revenue Account). In the following year 1973-74, the capital allocation to the Air Force had sunk to an all time low of 13 per cent (23 per cent on Revenue Account). Much of the declining share in Air Force allocations on Capital Account had passed on to the Indian Navy, whose share had risen from seven percent in 1963 to 49 per cent in 1973 (Thomas 1978, 174).

The trend in the decreasing capital account allocations to the Air Force correlate well with two points made above. First, the Indian Air Force performed very well during the 1965 war with Pakistan, perhaps suggesting to Indian policymakers that the Air Force had exactly the right equipment it needed to tackle its mission. Second, the mission of the IAF continued to remain ill-defined, limited primarily to an air defense roll. The conjunction of these two factors helps explain declining capital account allocation.

Elite Ideology and Political Fragmentation
Not only did sustained elite consensus on defense development mitigate against institutional reform of the aeronautics enclave, so too did ideological fragmentation among elites in the broader Indian political arena. Specifically, a generational change in
the leadership of the INC and its formula for electoral success resulted in an ideological schism. This ideological fragmentation indirectly affected defense development; Indira Gandhi’s personalization of the state bureaucracy to garner political support created an inauspicious environment for institutional reform of strategic enclaves, the aeronautics enclave included (Kohli 2004, 271). The linkage between ideological fragmentation and this negative ramification for defense development is developed below.

Ideological fragmentation occurred among members of the Congress because of the shifting political calculus of electoral victory in a changing Indian political economy. As Kohli observes:

Nehru’s death in 1964 marked the slow but steady departure of the first generation of nationalist leaders from the political scene. As nationalist legitimacy declined, numerous movements and parties opposing Congress’s hegemony emerged. The party’s old ruling formula—a mantle of inclusive nationalism and long chains of patronage fed by statism—was increasingly incapable of generating electoral majorities. Either Congress had to come up with a new winning formula or it would give way to other parties (Kohli 2004, 270).

It was Indira Gandhi, Nehru’s daughter, who was elected prime minister in 1966, who reformulated Congress’s strategy.

Gandhi’s new political strategy to maintain Congress’s hegemony was a populist appeal focused on poverty alleviation. She realized that the modest and uneven economic development that had taken place under Nehru meant little had changed for millions of poor Indians (Kohli 2004, 270). Additionally, Gandhi recognized that this poor population, a good number of whom had the franchise, was available for mobilization with the breakdown of the patron-client relationships Congress had previously used to secure electoral majorities. However, Gandhi’s populist rhetoric alienated entrenched powerbrokers on the right-wing of the INC, namely the so-called syndicate that was
responsible for the political machinations that saw Gandhi elected as prime minister (Kohli 2004, 271). A key ramification of this schism in the Congress was a de-institutionalization of the party and the personalization of political power.84

A knock-on effect of Gandhi’s personalization of power was that the Indian bureaucracy was no longer insulated from domestic politics. Specifically, positions and advancement in the ICS became dependent on an individual’s loyalty to Gandhi, rather than merit. One state institution on which Gandhi’s use of the bureaucracy as a patronage had a pernicious effect was the financial bureaucracy (Kohli 2004, 271). As will be noted in the succeeding section, the Ministry of Finance was an integral part of India’s strategic enclaves, the aeronautics sector in particular. However, the broader point to be made here is that ideological fragmentation among India’s political class hardly provided a setting conducive to the sort of institutional reform that would have yielded more effective developmental institutions to support either civilian or defense development.

State Organization and the Aeronautics Enclave in Gandhi’s India
As noted at the outset of this section, little observed institutional reform occurred in the aeronautics enclave. This makes sense given the maintained elite consensus of defense following the 1962-1965 strategic juncture and Gandhi’s personalization of political power. To reiterate, the aeronautics enclave was hardly an integrated unit directed by a centralized organization with a concrete vision for sectoral development such as MAER in Brazil. Rather, to borrow a metaphor from Kohli, the efforts of the constituent institutions of the enclave remained uncoordinated, as though they were horses each trying to pull a chariot in different directions (Kohli 2004, 21).

84 On the schism in the Congress Party, see Wolpert (2009, 400-403).
The DRDO and the IAF, the two primary institutions in the aeronautics enclave remained at loggerheads with one another. For their part, the IAF remained outside of the defense policymaking framework, even in matters of acquisition. Additionally, the Air Force remained interested in the acquisition of the latest and highest quality aircraft to accomplish its missions, regardless of country of origin and its requests for new aircraft reflected this interest. These requests reflected the threats the IAF officer corps expected to encounter and generally have changed as have aircraft technology has. Following the receipt of such a request for new aircraft from the IAF, the DRDO, exercising its institutional regulatory authority to decide the origin of a weapons system, made the decision to indigenously develop, purchase from abroad, or pursue some a licensed production agreement to fill the IAF’s request. It was precisely this decision regarding the origin of weapons systems for the IAF, or for that matter the Indian Army and Navy, that set the services and the state R&D service at odds within the aeronautics enclave.

Specifically, the DRDO had a clear conflict of interest when making decisions regarding where to acquire aircraft, tanks, and ships (Cohen and Dasgupta 2010, 32). On the one hand, the DRDO was the government regulatory agency that through its prerogative to decide a weapon’s systems origin, it was meant to facilitate import substitution in the defense industry to help make India self-reliant in war materiel. On the other hand, the DRDO was not a simple regulatory agency, it was also the state R&D institution. So, if the DRDO decided to indigenously design and develop a weapons system, such a decision would increase the budget and prestige of the institution in India.
Speaking to this conflict of interest and how the DRDO operated, Cohen and Dasgupta observe that:

The organization has adopted a classic foot-in-the-door strategy: winning initial support by promising products on the cheap but later citing sunk costs to demand more money. The DRDO argues that the armed forces continuously increase the specifications of weapons systems, so that terms set by the services are impossible to achieve. Agency officials publicly criticize the armed forces for their preference for foreign purchases; some privately suggest that political and military leaders are motivated by the prospect of corrupt gains in defense deals. State monopoly engenders increased opacity that makes specific decisions hard to judge (Cohen and Dasgupta 2010, 33).

The text reproduced above illustrates the timbre of the working relationship between the state R&D institution and the services in strategic enclaves. DRDO scientists, with no expertise in military operating conditions and threat environments, made regulatory decisions regarding where a weapon system should be procured from. Yet, because of its own limited technical competence across the spectrum of major weapons systems and in the realm of military aircraft as well, DRDO issued overly optimistic cost estimates and project timelines. While the overly optimistic cost estimates led to large budget runs, ambitious timelines caused the IAF to change system performance requirements to meet its perceptions of an evolving threat environment.85 While the IAF and the other services may well have made overly baroque requests on projects even as they were on going, by virtue of the fact the DRDO’s estimates of its own design and development capability were out of synch with reality, it invited the IAF to push for ever more sophisticated aircraft to cope with changing threat environments.

Regarding the production side of the aeronautics enclave, two developments occurred. First and least important, the state nationalized and merged a smaller aircraft

85 Cohen and Dasgupta note that the military simply wants the best weapons available, regardless of their source (2010, 34).
manufacturer, Aeronautics, with HAL in 1964. This merger served to enlarge the state’s
direct role in production. Second and more important, HAL’s production facilities were
split into two almost separate production systems, with relatively little interaction
between them (Smith 1994, 157). On the one hand, the legacy production facilities, those
established during WWII and expanded between 1947 and 1962, continued to produce
weapons systems originating in the West. On the other hand, following the agreement
with the USSR to produce the MiG-21 towards the end of 1964, three factories for MiG
production were setup. This MiG complex, as it is called, was centered around factories
in Nasik, Koraput, and Lucknow. As will be discussed in a following section, the MiG
complex was the primary locus of sectoral development from the 1960s through the
1980s, leaving the legacy production facilities to atrophy, starved as they were of
projects.

Owing to an incomplete historical record, one cannot be sure precisely how the
bifurcation of HAL’s production facilities affected the ability of HAL to perform serial
production of aircraft. However, two tentative hypotheses are viable. First, one can
argue that such bifurcation created excess production capacity, increasing the cost of unit
production. Tentative support for this argument comes from the reality that despite a
conspicuous lack of projects, the Indian government kept the Western complex
headquartered at Bangalore, rather than shuttering these plants. Smith notes that between
the late 1960s and early 1980s, “…some 70 percent of production capacity at the
Bangalore and Kanpur complexes had fallen idle” (Smith 1994, 168). Thus, any unit
costs associated with aircraft would necessarily have to account for direct inputs, as well
as idle capacity. Such estimates however are difficult to come by because of the
sensitivity of such information and doubts about the credibility of government figures. Second, given that there was apparently little interaction between the MiG and Western production facilities, an opportunity was likely missed to further develop the skills and training of engineers and workers alike.

In addition to the role of these primary actors in the aeronautics enclave, it is important to take stock of the role of the MoF as well. Following the strategic juncture, the Ministry retained its veto power over the acquisition of war materiel. Yet, what is of greater significance for present purposes is the fact that in the 1960s, it also acquired the regulatory responsibility for the negotiation of technology transfer and offsets for the defense industry (Smith 1994, 98-101). Given the generalist administrative training of IAS officers and the level of technological sophistication embodied in combat aircraft, it is implausible that these individuals possessed the requisite knowledge base and skill set to negotiate licensed production deals that moved the country up the production ladder. Additionally, it is worth noting that no official Indian offset policy existed until 2006.

Of further interest regarding the MoF is the potential the de-institutionalization of the IAS under Gandhi had on the quality of personnel attending to matters of defense procurement. Specifically, one could imagine that Ministry of Finance officers employed and promoted for reasons of loyalty to Gandhi, rather than merit, may not have been able to perform in their jobs as well as more competent officers. This is to say nothing of the potential for corruption, allegations of which dogged the arms procurement process in India since at least the 1960s (Cohen and Dasgupta 2010, 36-39). However, to date solid evidence regarding the relationship between the de-institutionalization of the MoF and
the power of the aeronautics enclave for state-led development is lacking in the historical record.\textsuperscript{86}

With the vantage of hindsight, it is easy to see how the organization of Indian aeronautics enclave lacked the institutional capacity of a developmental institution. Yet, policymakers were made aware of the problems in the enclave in the early 1960s. Specifically, a committee headed by one of India’s captains of industry, J.R.D. Tata, recommend in a 1963 report on the aeronautics sector “…both centralization and rationalization in the aircraft industry to promote the orderly and co-ordinated development of aircraft, propulsion, armament (including missiles), electronics, testing and evaluation” (Smith 1994, 168). Smith notes further that, “Although the recommendation was accepted in principle by the MoD, it was later rejected on the grounds that the ministry did not want aeronautics R&D to be entrusted to an authority outside the R&D organization [DRDO]” (Smith 1994, 168).

The Tata Commission’s report was not the only government sponsored commission to make plain the failings of the aeronautics enclave, so too did a committee led by C. Subramaniam. The Subramaniam Committee released its report in 1968 and made three basic criticisms of the aeronautics enclave. Its harshest criticism centered on the role of the IAF in sectoral development. Specifically, the Committee excoriated the IAF for its threat assessments upon which it based aircraft performance requirements because they bore little reality to the wars the service was likely to fight. Furthermore, it took exception with the fact that IAF performance requirements did not consider the

\textsuperscript{86} Though no direct evidence is presently available regarding this relationship, Kohli (2004, 271) draws a straight line between the de-institutionalization of the IAS, specifically the MoF, and low-state power for national economic development in India under Gandhi.
existing capability of the Indian aeronautics industrial base. Echoing the criticisms found in the Blackett Report “…the committee recommended the creation of expertise in research institutions outside the defence establishment to assist with assessing the relative costs and claims of defence requirements—a form of defence research policy institute” (Smith 1994, 167). Such an institute appears only to have been created in 1993, after the scathing and deeply influential report by defense analyst George Tanham (1992) that took the IAF to task for lacking a strategic vision (Cohen and Dasgupta 2010, 78).

The Subramaniam Committee was critical of the potential gains from ISI in the aeronautics sector as well. On the one hand, the Committee noted that, “production under license had meant that the design teams at Bangalore had not developed in step with production facilities; in 1968, the design team at Bangalore employed a staff of 335, a mere 20 percent of labour force and a much smaller percentage than obtained in the West European and North American defence industries” (Smith 1994, 167). The implication here seems to be that HAL’s engineering force was severely understaffed, constraining its ability to make important contributions in the reverse engineering of foreign systems and translating indigenous designs from the DRDO into plans for serial production.

On the other hand, the Committee was equally critical of a policy of defense ISI in the aeronautics sector. Specifically, with regard to an IAF request for a new ground attack fighter, the report observed that:

One way would be to introduce a new ground attack aircraft through manufacture under license. We do not favour it. This would be yet another type of aircraft to the five types which would be in service during [the] 1974-1979 period. Secondly, such a decision would be based on inadequate appreciation of the HF-24Mk1.R under development or of the potential for further development in the HF-24 aircraft. It is our finding that licensed production inhibits indigenous
development; in the present case it would completely extinguish development (Subramaniam Committee 1968 (note 52), 63-65, quoted in Smith 1964, 167).

The message here is sufficiently clear obviating the need for further elaboration.

However, it should be noted that while the Marut was considered a failure as a supersonic fighter, it may well have served well as a ground attack aircraft. This is so because the flight performance required of a ground attack aircraft is rather different from that of a dedicated fighter.

The final criticism made by the Subramaniam Committee concerned the management and organization of the enclave (Smith 1994, 168). With regard to the former, Smith observes that, “At the wider level, the committee echoed the criticism of the an earlier report prepared by a team of Swedish defence experts that research institutes were excluded from the planning process, that scientific expertise was not properly utilized and productivity was low” (Smith 1994, 168). With regard to the general organization of the enclave and again echoing the Blackett Report, the Committee noted that, “if research establishments and the industry were involved in the formulation of weapons policy, their inventive skill could make a real contribution” (Subramaniam Committee 1968 (note 52), quoted in Smith 1994, 168). Furthermore, the report was critical of the general disaggregation of the enclave between the DRDO, the IAF, and HAL (Smith 1994, 168).

The value of the evidence brought to light by the Tata and Subramaniam committees is twofold. First, each report highlights deficiencies in the organization of the aeronautics enclave that stymied the institutional capacity of the state to serve as a steward of sectoral development. Second, these reports were conducted and disseminated to policymakers following the 1962 and 1965 wars, which reinforces the point that for
institutional reform to occur, it requires not only political support, but that elites draw the correct lessons from conflicts in which a country has been ensnared.

State-Society Linkages Following the Strategic Juncture
Much as was true of the organization of the aeronautics enclave, little change in the relationships between the state, capital, and labor occured. As alluded to above, the private sector remained completely crowded out by the state’s monopoly of the entire defense industrial base. With specific regard to the state-labor relationship, it appears that strong links did exist between the state and labor, though concrete information on state-labor relations in the defense sector remains scant. For instance, Cohen and Dasgupta note that the DRDO has been subject to union interference (2010, 34).

Additionally, Verghese Koithara observes of the broader defense industry that:

Another major problem is over-manning. With both ordnance factory and DPSU employees guaranteed work till 60 years of age, restructuring is difficult. The skills that most employees have today are in very narrow areas and many of those areas are inappropriate for current needs. Most of the employees lack the education needed to absorb retraining for current jobs. Because of powerful trade unions, neither retraining nor the broad banding of skills needed to step up productivity is attempted (Koithara 1999, 372-373).

With specific regard to the aeronautics sector and recalling the Subramaniam Committee’s findings, which noted (based on a previous inquiry), that some 7,500 hours were spent manufacturing 18 tools for the HF-24 Marut, whereas by comparison it would have taken workers in the Swedish aeronautics sector about 720 hours to build the same types of tools” (Smith 1994, 168). Such a relationship between the state and labor in the defense industry suggests at least the inability, if not political unwillingness, to augment the size and skills of the workforce to meet industry needs. Given this inability to change the workforce to meet industry needs, the Indian state lacked an important source of power as a developmental actor.
5.2.3 State Support for Aeronautics Sector Development

When considering the progress of national economic development in Indira Gandhi’s India, Kohli characterizes this period as one of missed opportunity, if not economic stagnation (2004, 272). Evidence suggests that this era was a period of developmental stagnation for the aeronautics sector as well. State support for sectoral development was limited almost exclusively to the licensed production of 500 MiG-21 series aircraft between 1965 and 1985 (Smith 1994, 157). As will be illustrated in due course, experience producing MiG-21s yielded precious little in terms of upgrading sectoral capabilities or improving the sector’s depth. I argue that the narrowing of external balancing opportunities and increasing fragmentation of state power explains developmental stagnation in the aeronautics sector. The impact of these variables on sectoral development is made in the context of the MiG-21 program.

The origins of Indian MiG-21 production are found in the spring of 1962, only months before the Sino-Indian War. Sometime in the spring of 1962, policymakers in New Delhi came around to the view of the IAF that the service required a world-class supersonic fighter aircraft. Kavic highlights three factors that combined to inspire what has been labeled a frantic search for such an aircraft (Kavic 1967, 106). First among these factors was the arrival in Pakistan of several American F-104 fighters, which were in service in the U.S. and with several allied nations. Although there were doubts that Pakistan could fight the F-104s, neither Nehru nor Menon were willing to lose the international prestige associated with the Pakistani acquisition of modern supersonic fighters (Kavic 1967, 110). Second, the HF-24 program begun in 1956 had run into serious development delays leading to slippage of the delivery schedule and creating serious doubts as to whether this plane would ever be a world-class fighter (Kavic 1967,
Finally, considering Chinese violations of India airspace in the Himalayas in the run up to the war, Defence Minister Menon sought to acquire at least a marginally superior fighter to the MiG-19 then in service with the Chinese air force, if only for symbolic purposes (Kavic 1967, 113).

It was set against this backdrop that rumors of Indian interest in the MiG-21 were first reported. Kavic notes that:

In May 1962 several Indian newspapers reported that the government was interested in the Soviet MiG-21 fighter. After the appearance of these reports, the Indian government maintained a discreet silence for reasons that were clearly not unrelated to Congressional discussion of American economic aid to India. Nehru left for a Kashmir vacation on 16 May without comment on the MiG issue, while Menon’s only remark to newsmen after seeing the Prime Minister off was to declare that India had the right to purchase arms wherever she wished (Kavic 1967, 106).

However, following the passage of the American aid bill to India, Nehru and Menon went public with Indian interest in a deal for MiG-21s. In the Lok Sabha, Menon justified Indian interest in a deal for Soviet aircraft for reasons of, “price, ease of maintenance, and other advantages the MiG possessed over comparable Western types” (Kavic 1967, 107). For his part, Nehru expressed a preference for the MiG in June claiming they were best-suited to Indian needs, though he admitted in the Raj Sabha that no offer for MiGs had been made by the Soviet Union (Kavic 1967, 107).

It is important to bear in mind that India was still a geopolitical prize contested for by both the Eastern and Western Blocs and its consideration Soviet aircraft created alarm in Britain and the U.S. The alarm caused in London and Washington led Prime Minister Macmillan and President Kennedy to undertake, “…urgent bilateral consultations involving an attractive counteroffer to India of British or French jets” (Kavic 1967, 107). Contemporaneous press reports indicated that at least two different British offers were
made. One account has it that Britain offered the Lightning at one half of its market price, or $750,000 per aircraft and future negotiations for licensed production (Kavic 1967, 107). A second report suggested that Britain was prepared to sell India a squadron of 12 Lightnings, provided that the RAF received 12 F-104s from the U.S. (Kavic 1967, 107). These British offers were sufficiently attractive to dispatch an Indian team to Britain to evaluate the Lightning. At the same time, India expressed interest in acquiring both American F-101 Voodoos and French Mirage IIIs (Kavic 1967, 107-108).

For reasons that remain unclear, no deal was struck between India and Western suppliers and a negotiating team decamped to Moscow to pursue a deal on the MiGs. Kavic notes that this team was tasked with the discussion of “…the possible purchase of two squadrons of MiG-21s, their production under license in India, and the purchase of air-to-air missiles to arm them” (Kavic 1967, 108). These negotiations led to an agreement in principle between New Delhi and Moscow for the purchase of the 12 MiG-21s, including the provision of technical assistance for the establishment of Indian production facilities (Kavic 1967, 108). Despite having struck an agreement for the purchase of 12 MiGs and the provision of the associated production capacity, little came of this deal until after the Sino-Indian War. The reason for the delay was Soviet reluctance over extending the combat radius of the MiG-21 and modifications to allow for operations in all weather conditions (Kavic 1967, 199). Additionally, initial cost estimates for the deal rapidly rose from $143 million to $336 million (Kavic 1967, 199).

These delays afforded the Government of India the opportunity to look once more to Western suppliers for modern fighter aircraft between 1963 and 1965. It is important to note that the outbreak of the Sino-Indian War prompted India to return to its traditional
arms suppliers for immediate military assistance, including Britain, France, and the U.S. (Kavic 1967, 198-200). Given the short duration of the war however, little of this aid arrived in time to make a difference in the outcome of the war. Nonetheless, it did lead to continued supplier-recipient relationships between India and the West for a limited time. One important aspect of these relationships of relevance to this project was the Indian-Commonwealth-United States air exercises held in November of 1963 (Kavic 1967, 198). Press reports from the time indicated that these exercises were designed to show that without modern supersonic fighters, India remained vulnerable to air attacks, thus keeping alive the push for the acquisition of a suitable world class fighter (Kavic 1967, 198).

Given this continued need, ongoing problems with the Marut project, and protracted negations for the MiG-21, India looked to the U.S. to fill its need for a world-class fighter once more. Between 1963 and summer 1964, several potential deals were reported for Indian acquisition of American fighters. One such deal involved, “the possibility that India would receive all-weather F-102 interceptors simultaneously with American provision of these aircraft to Pakistan” (Kavic 1967, 198). Additionally, “The United States was believed to be willing to make available three to five squadrons of F-51 Skyray or F-5B Freedom Fighters equipped with Sidewinder missles” (Kavic 1967, 199). However, neither of these deals came to fruition, for reasons that are not found in the historic record as it currently exists.

The final potential Indian-American deal once more involved the F-104, the cutting-edge fighter of the day. Of the details for a potential deal, Kavic reports that:

Possible direct Indian purchase of some F-104s or the establishment of a F-104 assembly or production plant in India was also reported. With apparent
concurrency of the U.S. State Department, Lockheed representatives reportedly took the initiative to hold talks with senior officials of the Indian ministries of Defence, Finance, and Defence Production in New Delhi in late February 1964, Lockheed according to the report, proposed to establish a production unit in India for the F-104 or a comparable aircraft; if that was not acceptable to the Indian government, an alternative was the sale to India of a certain number of F-104s on a commercial basis. In May 1964 it was reported that India had proposed a $200 million American-built plant to manufacture F-104s in India, the project being preferred by ‘some’ Indian ministers to the MiG project. Although the report stated that Washington was unlikely to extend grants for such a project, American authorities had under consideration an assembly plant to be financed with a 20-year credit from the Export-Import Bank in the event the MiG project failed (Kavic 1967, 199).

Despite the fact that the first shipment of MiG-21s to India were delivered far from ready to fight, the MiG deal did go forward.

There were two key reasons that the MiG deal was taken up. First, despite what appear to have been extensive and serious Indian-American negotiations over the acquisition of fighter aircraft, Indian policymakers and even the IAF perceived the U.S. to be too reluctant to supply India with high technology weapons (Kavic 1967, 200). Bearing in mind the U.S.-Pakistan relationship, this Indian suspicion of American reluctance seems reasonable. Additionally, the onset of the Second Round of the Indo-Pak conflict in 1965 resulted in an American arms embargo on both countries, foreclosing the possibility of Indian access to American fighters, as well as the related production technology. Second, for reasons likely related to geopolitics, specifically the Sino-Soviet split, the Russians became much more willing to concede to Indian demands on the MiG-21 project (Kavic 1967, 200). Thus, in September of 1964 a subsequent and final agreement on the MiG-21 was reached in which, “Russia agreed to provide:

technical aid and plant to facilitate the establishment of MiG factories in India by the end of 1965; 38 more MiG-21s (in addition to the six promised in 1962 but as yet
undelivered) incorporating the modifications requested by India; and components for the
final assembly scheme in India which would include some of the 44 planes promised.
The Soviet authorities also agreed to keep India informed of subsequent improvements in
the design and equipment of the MiGs” (Kavic 1967, 200).

The details presented above represent the origins of licensed production of the
MiG-21 in India, though several elements require emphasis before moving forward. First
as noted above and detailed in the preceding chapter, by 1962 India’s ambitious efforts to
develop a world-class supersonic fighter aircraft was in serious trouble leading to doubts
about its ability to enter service with the IAF. The ultimate failure of the Marut project
represented a failure at internal balancing because the Indian aeronautics sector was not
equal to the task. Put another way, the state lacked sufficient power for aeronautics
sector development. Second both external threats and external balancing opportunities
proved important in the origins of the MiG-21 project. Regarding external threats,
Pakistan began receiving American F-104s leading to a loss of prestige for India.
Additionally, the threat and reality of war with China was an important driver for an
external search for a supersonic fighter to fill the void left by the slow failure of the
Marut project. As for external balancing opportunities, India was keen on acquiring not
only a world class fighter, but in increasing the capacity of its aeronautics industry as
well. The Soviet deal ultimately won out because of Soviet geopolitical calculus, as well
as the Indian perception that the U.S. was not a reliable balancing partner because of its
relationship with Pakistan. Ultimately, the 1965 Indian war with Pakistan foreclosed the
possibility of Indian-American arms sale because of an American arms embargo against
both belligerents.
From the time the final agreement for licensed production of the MiG-21 in India until the production line closed in the mid-1980s, this deal evolved rather smoothly. Speaking specifically to the evolution of this project, Smith notes that:

Production rates were consistently high and close to target and the IAF found the MiG-21 a dependable system. In part the success can be explained by the fact that the MiG-21 is a relatively simple aircraft utilizing Soviet technology of the 1950s. In addition, the USSR agreed to a precise and even-handed process of technology transfer which took place in five stages. In the first stage all the aircraft were imported. In the second stage all the aircraft were tested in India. Third, all the equipment was assembled and tested in India and fourth, sub-assembly was undertaken in India. Finally, attempts were made to reduce dependence upon raw materials (Smith 1994, 157-158).

Smith does not expound specifically upon why phased technology transfer was an important ingredient in successful licensed production of the MiG-21. However, appreciating the presence of a steep learning curve in the aeronautics sector and bearing in mind the step-wise approach employed in the Brazil to sectoral development, one can speculate that the sequential introduction of human capital for MiG production was important because it allowed those working in the Indian aeronautics sector the time to absorb this capital. Ultimately, the phased transfer of technology created a situation for India in which, “…only the designs, drawings and some of the more complicated materials were imported. This amounted to approximately 70 per cent indigenization in toolings and equipment with 20 per cent of that proportion supplied by ancillary industries under sub-contracting agreements” (Smith 1994, 158).

Yet, despite the success of licensed production of the MiG-21 in India, there were problems as well, which relate directly to the capability and depth of the sector. Regarding the later, the Indian aeronautics sector suffered from three key types of problems related to its depth. First, there was an issue of cheap raw materials, required
only in a small supply, which the Soviet Union regularly proved unwilling to export to India and for which there were no Western suppliers (Smith 1994, 158). Exacerbating this problem was the fact that the low supply requirements and cost of these made any potential industrial investment by the Indian government decidedly unattractive (Smith 1994, 158). Second, state efforts to encourage the development of domestic supplier industries were not very successful. For instance, “Indian Aluminium Co. has been encouraged to take up the production of aluminium sheets which are required in large quantities; as yet there is no indigenous source for aluminium sheets of the required 2-metre width of sufficient quantity” (Smith 1994, 158).

Third and finally, the Indian government frequently found itself dependent on Moscow for certain consumable products required to keep the MiG-21 fleet airborne. Smith notes that:

Another problem stemmed from those items which have a short life, such as adhesives and rubber items. It was difficult to persuade the USSR to export in the quantity and frequency required. The Indian MiGs are…used more frequently than their Soviet counterparts, and as a result the demand for brake pads, which require replacement after every 100 flights, is much higher. Therefore, whether too much or too little, materials and parts from the USSR have been extremely problematic…(Smith 1994, 158).

It is worth noting further that when New Delhi was able to convince Moscow to supply it with materials or parts for production and maintenance for its MiG-21 fleet, delays occurred frequently because of centralized Soviet production schedules.

As for the contribution of licensed production of the MiG-21 to the capabilities of the Indian aeronautics sector, here too results were lackluster. In 1976, New Delhi decided to acquire the MiG-21bis to replace the original MiG-21FL interceptors and MiG-21M attack aircraft (Smith 1994, 158). The MiG-21bis was the last update in this
family of planes and included upgraded engines, avionics, and weapons systems. Smith observes that, “…tooling up for production started in 1977 with the objective of providing 150 units before the line was due to be closed in 1984” (1994, 158). Ultimately, the test flight of the first locally produced Mig-21bis did not occur until 1983, a year before the original schedule stated the production line was to be closed (Smith 1994, 158). Even though HAL manufactured MiG-21 series planes for almost 10 years, producing over 200 such planes domestically, it was unable to complete this upgrade without Soviet assistance. Why was this the case?

In the simplest terms possible, the MiG-21 deal was limited to international collaboration between HAL and Soviet technical advisors and engineers. This explanation requires a bit of unpacking. Speaking to the historical failure of Indian defense industries to benefit from foreign interaction in terms of their capabilities, Koithara draws a direct line between Indian licensed production deals and the failure of defense industries to attain new capabilities. He observes that:

The major reason for the inability to benefit from foreign association is that, while India’s defence collaboration with foreign companies has been substantial in the field of production, there has been virtually none in the fields of R&D and sales. Practical weaknesses such as a lack of understanding, poor decision making structures and the inability to commit funds over needed periods have come in the way even more than the ideological preoccupations with self-reliance and non-alignment. In the modern defence context research, development, production and marketing form a continuum. The advantage to be gained from foreign collaboration increase with the length of the continuum that is covered (Koithara 1999, 375).

Koithara’s insights regarding the relationship between Indian acquisition policy and changes in sectoral capability can be applied directly to the aeronautics sector.

Specifically, two direct connections can be made between fighter acquisition policy and the capabilities of the aeronautics sector. On the one hand, there is a lack of
evidence that shows the participation of the DRDO in the process of licensed production of MiG-21s at HAL. Recalling that DRDO was the agency responsible for R&D and subsystem development for aircraft, its lack of involvement in the MiG-21 project seems a lost opportunity for learning. Given the comparatively small engineering team employed by HAL (discussed in the preceding section), the DRDO was the only member of the aeronautics enclave with the staff to reverse engineer admittedly antiquated Soviet technology. Furthermore, it is unlikely that knowledge and information gained from licensed production of MiGs, specifically in regards to systems integration, could flow between HAL engineers and DRDO staff because they were from different bureaucracies under different lines of authority. The relationship between the DRDO and HAL stands in stark contrast to the close relationship observed between the R&D and production organizations in the Brazilian aeronautics enclave.

On the other hand, neither HAL nor any other member of the aeronautics sector learned the marketing aspect of defense development, the final step in the production chain. Marketing in this context refers to the capacity to identify market opportunities in a sector, such as that developed by Embraer after its formation. In addition to the historical reluctance of Indian political elites to export weapons, the Indian aeronautics sector suffered from two handicaps in the search for market opportunities. First, though concrete evidence is lacking, it appears that HAL did not enjoy the benefits of a protected home market as did Embraer, rather its only market was the IAF. Evidence for this

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87 Of the reluctance of Indian elites to export weapons, Smith notes that, “as a leading member of the non-aligned community, India would be forced to conduct a considerable debate over the rights and wrongs of selling arms for commercial ends, if only for the sake of its credibility in the South” (Smith 1994, 140).
statement is drawn indirectly from the failure of the licensed production of the Hawker-Siddeley HS-748. Specifically, Thomas observes that:

Although the agreement had been signed in 1959, the first set of jigs for the HS-748 was set up only by mid-1960. The indication at this time was that the Indian Air Force would require 180 such aircraft. Subsequently, in 1967, the order was reduced to 27, with another 14 ordered by the commercial-government owned Indian Airlines Corporation. As a result of the curtailment of orders from 180 to 41 aircraft, the unit cost of production was severely affected. The 1967-1968 Committee on Public Undertakings reported that the Indian Airlines Corporation was unwilling to pay the high price because of low orders and consequently the cost of production of the HS-748 was much more than the price paid by the IAC and the IAF (Thomas 1978, 191).

Two points can be made about licensed production of the HS-748. First, regarding the level of protection the aeronautics sector enjoyed in the home market, the fact that a government owned enterprise such as Indian Airlines Corporation could seek planes elsewhere suggests that the home market was relatively unprotected. Second, based on the observations of Koithara, the problem for DPSUs in producing for the civilian market was that they were unable to achieve efficient production (1999, 373).

The second handicap faced by the Indian aeronautics sector in gaining the ability to market its products was its market opportunities. With the MiG-21 deal, India became integrated into the Eastern Bloc’s arms transfer and production process. Within this system, the Soviet Union leveraged access to its weapons for political purposes and likewise market access to its client states. This situation stands in stark contrast to the experience of Brazil, which became integrated into the Western Bloc’s arms transfer and production system. The key difference in the Eastern and Western blocs’ arms markets was not that the hegemonic powers used access to weapons for political control, but that in the Western Bloc, there were several second-tier states who for reasons of security and prestige sought to rebuild and sustain their defense industries. To accomplish this goal,
countries like Britain, France, and West Germany were forced to export, leading to the increasingly commercial logic of the Western weapons market. Aligned as it was with the West, Brazil encountered a market, necessitating the development of marketing acumen to be successful. Yet, in the explicitly political weapons market of the Eastern Bloc, there was little incentive to develop a capacity for marketing in the absence of a commercial logic to the market.

It is important to note that at the end of the 1970s and continuing into the 1980s, as the imperatives of force modernization were realized in New Delhi, interest in the Western weapons systems was rekindled. There are two key reasons for this. First and most profoundly, by the end of the 1970s, the Indian economy had recovered from severe economic shocks of the 1960s stemming from the underdevelopment of the agriculture sector relative to the industrial sector of the economy (Smith 1994, 87). This development meant that India had the requisite foreign reserves essential to procuring weapons from the West on commercial terms, obviating the economic advantages of the rupee-ruble or barter systems in use with the Soviet Union. Second, by the late 1970s Indian dependence on the Soviet Union for weapons troubled the leaders of the Janata Party that came to power following the emergency period declared by Gandhi in 1977. Given these realities, under the leadership of Prime Minister Moraji Desai, the Government of India pursued the acquisition of Western weapons systems, as well as the technology to produce them domestically.

Regarding IAF, deals for Western aircraft were pursued. One such deal reportedly involved the acquisition of American F-5G fighters (Smith 1994, 112). Another involved the potential acquisition of the French Mirage 2000 (Smith 123-124).
However, a deal was eventually struck for the procurement of the British Jaguar, though not untainted by at least the specter of corruption; a frequent problem in India that eventually led to Prime Minister Rajiv Gandhi’s departure from office (Smith 1994, 124). The Jaguar deal involved the direct purchase of some aircraft and a licensed production deal as well. To date, the details of how licensed production of the Jaguar affected the capacity or depth of the Indian aeronautics sector, particularly the industrial base dedicated to producing Western aircraft, have yet to be chronicled. Though given the severe problems encountered with the design, development, and production of India’s Light Combat Aircraft (LCA), begun in the 1980s, it seems little capability or depth were added to the sector through licensed production of the Jaguar. This assessment is further strengthened by the fact that little observable change occurred in the structure of the aeronautics enclave by the time the Jaguar deal came to fruition, likely leading to the same problems of technology absorption encountered in licensed production of the MiG-21.

Despite renewed interest in Western combat aircraft, upon her return to the Indian Government in 1980, Indira Gandhi pursued further deals for Soviet aircraft. To her credit, Gandhi leveraged Indian access and interest in the Western arms market to pursue deals for advanced Soviet weapons systems. Of note, the outlines of a deal were reached on licensed production of the MiG-27 to replace the obsolete MiG-21 (Smith 1994, 124). The Soviets also floated a proposal to sell India the MiG-29, which was still on the drawing boards and had not yet been offered to Eastern Bloc countries (Smith 1994, 126). India signed a deal for this aircraft to counter threats posed by Pakistani F-16s and it

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88 On the LCA, see Smith (1994, 171-176) and Cohen and Dasgupta (2010, 85-87).
entered operational service in 1985 with the IAF. However, India did not take-up the option for licensed production of the MiG-29. Moreover, Indian maintenance facilities for this aircraft only came online in 1996, some 11 years after its operational service began. Of further interest, India has subsequently contracted with Russia to provide upgrades for this aircraft, suggesting that the Indian aeronautics sector lacks the capacity to complete such work.  

Summarizing, one can say that the Indian Government’s support for aeronautic sector development has been meager, yielding lackluster results in terms of sectoral capabilities and depth. This was so for reasons related to external vulnerability and state power. With respect to external vulnerability, there was a clear need perceived by Indian policymakers for IAF modernization to counter threats from Pakistan and China. However, India was wanting in external balancing opportunities. None of the deals to acquire European aircraft following the 1962 war were sufficiently attractive to New Delhi. As for the deals for American fighters, none mixed the right combination of financing or licensed production options. Furthermore, Indians perceived the U.S. to be too unwilling to supply India with fighters and the associated production technology, making the U.S. appear to be an unreliable partner external balancing partner. As a result of the 1965 Indo-Pak War, an American arms embargo cutoff Indian access to American weapons, as well as weapons systems like the Swedish Viggen that utilized American technology (Smith 1994, 98). Under these circumstances, India’s only opportunity for external balancing was the Soviet Union, which agreed to an even-handed licensed production agreement on the MiG-21 only after the Sino-Indian split.

89 For details regarding the evolution of the MiG-29 deal, see "Mig-29 Baaz"
Regarding the Indian state’s capacity for sectoral support, or power for sectoral development, it was limited by the organization of the aeronautics enclave. Though licensed production of the MiG-21 could have led to increased sectoral capabilities and depth, no meaningful improvements in either domain of sectoral development was observed. One key problem was the fact that the IAF continually made requests for aircraft well above the capacity of the DRDO and HAL. A second problem was the divorce of the R&D pillar of the strategic enclave from the production pillar, which limited the transmission of vital knowledge on aircraft design, development, and production between these two stakeholders. Additionally, a relatively unprotected domestic market and the integration of the sector into the politically controlled Eastern Bloc weapons transfer and production system limited the ability of HAL to acquire marketing skills, limiting potential for exports. Thus, external vulnerability and state weakness were key drivers in the developmental stagnation of the Indian aeronautics sector during the Gandhi era.

5.3 Comparative Insights and Theory Testing

They primary goal of this chapter has been to examine the political factors that explain institutional reform or stasis of the aeronautics enclaves in Brazil and India that are associated with divergent development outcomes. In the process of investigating the determinants of institutional change in these enclaves, two sets of variables have been of primary importance, including external vulnerability and state power. This section reports the findings to of this chapter, paying attention to variations in levels of external vulnerability and state power within and across cases. Additionally, I discuss the relative utility of the novel neoclassical realist approach to defense development compared to existing theories.
5.3.1 The Political Determinants of Enclave Reform
What political factors explain the institutional change and stasis observed in the Brazilian and Indian aeronautics enclaves, respectively? I argue that institutional changes are the result of a state’s ability to respond to the structural incentives in the broader social milieu in which it exists. When states are perceived by those they govern to be incapable of responding to structural incentives, two outcomes may obtain. On the one hand, new elites may rise to the fore, with the goal of augmenting state power to better cope with structural incentives through emulation. On the other hand, elites that remain in power will seek to augment state power to better cope with structural incentives through emulation. This institutional reform via emulation may occur in the broader political system, but it may also occur in the military system as well. With respect to military emulation, what matters in determining the pace, scope, and intensity of this process are the perceived levels of external vulnerability held by either newly empowered elites, or those that remain in power. The cases of the Brazilian and Indian aeronautics sectors discussed in this chapter lend support to this argument.

In the case of Brazil, institutional reform of the aeronautics enclave became a possibility because new elites came to occupy the apparatus of state with distinctly different perceptions of external vulnerability from those they replaced. Whereas elite perceptions of external threats during both the Old Republic and the Estado Novo were of the traditional politico-military type, during the 1960s, members of the officer corps internalized the Cold War during the 1950s, theorizing that Brazil was particularly susceptible to revolutionary warfare. This susceptibility was the result of three factors: vast ungoverned spaces; a weak political system; and economic underdevelopment.
Three interrelated trends gave substance to the military’s understanding of Brazil’s susceptibility to revolutionary warfare. These trends included increasing social mobilization on the part of urban and rural workers, the decreasing extractive capacity of the state amidst an economic crisis and the associated fear that import-substitution industrialization was exhausted, as well as the inability of the political system to cope with these pressures. The political ramifications of these trends in conjunction were framed by a narrow group of elites, including politically active members of the officer corps and industrialists, as evidence that revolutionary warfare had come to Brazil. Thus, at the end of March 1964, the Brazilian military overthrew the democratic regime, justifying its actions and the subsequent consolidation of a dictatorship on national security grounds.

Set against this backdrop of external threats, was an increased opportunity for external balancing in the guise a globalizing Western Bloc arms market, which began in the late-1960s and accelerated in the 1970s and 1980s. While the U.S. continued to export arms largely in support of its Cold War objectives, a new tier of European arms producers emerged that required export markets to ensure the viability of their defense industries. This proliferation of suppliers meant that the Western arms transfer and production system was governed increasingly by a commercial logic, defined first by competition on price, but later on the amount of production technology a supplier was willing to transfer to a purchaser. For Brazil, staunchly aligned with the Western Bloc as it was, if not always on the best of terms with the U.S., this meant reasonably secure access to weapons and the associated production technology.
Set against this backdrop of external vulnerability, the dictatorship pursued defense development in furtherance of its two inextricably related goals: security and development. For instance, in the short-term state investment in the aeronautics sector in the mid-1960s was a Keynesian stimulus for the economy and it supported the counter-insurgency role of the FAB. By the late-1960s and early 1970s, under the leadership of hard line presidents Golbery and Médici, defense development became valued in its own right for its theorized contributions to the development of the broader Brazilian economy.

The emergence of the military dictatorship in Brazil following March 1964 did not just create a rationale for defense development, I observed a direct relationship between levels of perceived external vulnerability and an increase in the Brazilian state’s power for sectoral development. First and most importantly, the economic ideology of the military regime did not prevent the state from directly undertaking production. This serves as a key defining feature in state power between the Estado Novo, which left production entirely to private enterprise, and the military regime. Second, because of the perceived unwillingness of private capital to produce the Bandeirante developed by the IPD and consistent with regime ideology, the government created Embraer in 1969. The creation of Embraer represents institutional reform and the completion of the aeronautics enclave in Brazil. Finally, because of its commitment to economic development, if not private capital, the state repressed labor, enabling Embraer to alter its workforce according to its needs.

The institutional reform observed in the Brazilian aeronautics sector was directly related to the developmental success it enjoyed between 1964 and the early 1990s. Through a series of deliberately chosen licensed and co-production projects, Embraer
acquired several core competencies that saw Brazil move from the fourth-tier to the third-tier of producers in the global aeronautics production chain. These competencies include, the ability to manage aeronautics sector projects, systems integration, and global marketing. However, by undertaking production directly, the state crowded out some private capital limiting the scope of sectoral development.

Turning to the Indian case, I observed institutional stasis in the aeronautics sector, in large part owing to only slightly higher levels of perceived external vulnerability after 1962. Looking at external threats, Indian elites quite clearly modestly high levels of external threat from China and Pakistan, as well as from a potential China-Pakistan alliance, following the 1962 and 1965 wars. The Second Round of the Indo-Pak conflict served also to limit India’s external balancing opportunities as well with the imposition of the American arms embargo. However, neither of these wars changed the balance of power in South Asia, meaning India remained the regional hegemon, as it had been since independence. Moreover, in the 1962 war, aerial combat was nearly non-existent and the IAF over-performed against a technologically superior PAF during the 1965 war. As for external balancing opportunities, though the 1965 Indo-Pak war did lead to an American arms embargo against both belligerents, India continued to have relatively secure external balancing opportunities. Specifically, and for its own strategic reasons, the Soviet Union was willing to supply India with weapons systems and the associated production technology in many cases. This Indo-Soviet arms trade was based on a rupee-ruble exchange agreement and the Soviets offered much more generous financing terms than did their Western counterparts. Thus, while external threats increased, solid external
balancing opportunities blunting the incentives for institutional reform in the aeronautics enclave.

Specifically, I observed almost no impact from slightly higher levels of external vulnerability on the state’s power for aeronautics sector development after 1962. First, neither the 1962 nor the 1965 war caused new elites to rise to the fore, nor did it significantly change the preferences of the Congress Party elites who dominated the Government of India until the late-1970s. Interestingly, this was likely so because despite evidence that the Sino-Indian war was lost because of the weakness of the Indian military system, both the military and politicians blamed Minister of Defence Menon for failing to give the Indian military the arms and supplies it required to win. Thus, Indian policymakers drew the wrong lessons from the Sino-Indian War and instead of undertaking deep institutional reform of the Indian military system, policymakers pursued a massive military buildup.

Second, given the continuity of the elites in power and I observed relatively stable ideological preferences between the post-Independence era and that after 1962. Specifically, economic development was still the number one priority of the government. Additionally, even though there was some recognition that defense budgets and planning needed to be synchronized with the overall Indian budget, they were still considered non-plan expenditures. The non-plan status of defense expenditures was evidence of the fact that political elites in India remained wedded to the idea that defense spending was non-productive. This is interesting because early work by economists suggesting a positive relationship between defense and economic development was known in India and debated.
Third, given the continuity of elites in power and their preferences, I observed almost no organizational changes in the Indian aeronautics enclave. The sole responsibility of the IAF was to define the performance requirements of combat aircraft. The DRDO maintained its contradictory roles as the industry regulator and its chief supplier of new technology. And HAL remained separate and distinct from either the IAF or DRDO. Though it should be noted that the expansion of HAL’s production capacity was thought to perhaps have contributed to its difficulty in achieving economies of scale and economic production.

What were the combined effects of marginally increased levels of external vulnerability and institutional stasis on aeronautics sector development after 1962? To be direct, the period from 1962 until the early 1990s was one of sectoral stagnation. The primary effort made to develop the Indian aeronautics sector was licensed production of the MiG-21. For their part, the Soviets agreed to a technology transfer process that was described as even-handed and gradual. Yet, the Indian aeronautics enclave lacked the ability to absorb the human capital embodied in the transfer of Soviet production technology to India. DRDO appeared to have little involvement in the MiG-21 deal and it was the only constituent member of the enclave with the skilled workforce to reverse engineer Soviet technology. Worse still, HAL and DRDO appeared to have relatively limited interaction as well, limiting the transfer of information between both organizations. In addition to these problems, because of the largely political as opposed to market logic obtaining in the Eastern Bloc arms market, India had limited potential opportunities to developing marketing competencies. Thus, India remained a fourth-tier producer in the aeronautics sector, just as it had been during the post-independence era.
5.3.2 Theory Testing
How well do existing theories of defense development perform in explaining the observed developmental outcomes? First, no evidence was observed that would support Hoyt’s neorealist theory of defense development. As the reader will recall, Hoyt argues that as objectively measured external threats increase, so too will the rationality of defense industrial policy, thereby improving development outcomes. Yet, what has been observed in the Brazilian and Indian cases in this chapter is at odds with this prediction. As noted in the introduction to this chapter, Brazil faced decreasing levels of external threats and India faced dramatically increased levels of external threat. However, despite these levels of external threat, Brazil entered the third tier of aeronautics sector production and India remained in the fourth tier.

The neoclassical realist theory of defense development represents an improvement over Hoyt’s neorealist theory for two reasons. First, relying as it does on elite perceptions of external vulnerability, rather than objective assessments of external threats, the observer gets a clearer view of the systemic incentives that real policymakers believed they confronted. It is precisely these perceived systemic incentives that policymakers seek to respond to with policy. Second, the neoclassical argument advanced herein provides a causal mechanism linking perceptions of systemic incentives to policy rational, namely state building.

As for the defense dependency approach, it predicts that increasing as prices for weapons increase, the likelihood of defense development decreases. Based on this logic, one could plausibly expect that better development results would have been seen in India. Whereas the leadership of the Brazilian aeronautics enclave always sought to move up the ladder of technological sophistication with each project it pursued between 1969 and
the early 1990s, the Indian state supported sectoral development through the licensed production of the MiG-21, comprised of antiquated 1950s technology. India produced over 500 of these between the mid-1960s and the 1980s. Yet in that nearly 20-year period, it was unable to acquire some of the basic capabilities to upgrade the airplane without Soviet assistance, nor was sufficient sectoral depth achieved to supply spare parts and items required for routine maintenance for the MiG-21. This suggests that the level of technological sophistication and thus the price of weapons systems in an international arms market could prevent successful defense development, however it does not explain poor development outcomes in the Indian aeronautics sector.

Once more, the neoclassical realist theory of defense development offers a superior alternative to the defense dependency approach for at least one major reason. While the defense dependency approach highlights the importance of the structure of an arms market for defense development outcomes, it does not explain which arms market a country belongs. The weapons market a country participates in is a function of external balancing opportunities, a core component of the neoclassical realist theory offered herein. This is to say, the structural incentives a country faces in the arms market they participate in are a function of politics.

Finally, looking at the institutional theory of defense development, this theory does very well to help explain success in the Brazilian case and failure in the Indian case. Looking at the Brazilian case, I observed a much more cohesive aeronautics enclave, capable of formulating and implementing coherent and long-term industrial policy. In India by contrast, the aeronautics sector was exceedingly fragmented and therefore, lacked the capacity of the Brazilian enclave to formulate coherent and long-term
industrial policy. Yet, the institutional theory provides no explanation for the variation I observed in the institutional capacity of the Brazilian and Indian aeronautics sectors. This is so because the institutional theory does not focus on the political factors that shape the institutional configuration obtaining in a strategic enclave.
Chapter 6: Conclusion

The central research question driving this dissertation was the following: What are the political determinants of successful defense development in aspiring great powers? Answering this question involved several steps. First, I defined the process of defense development as a case of internal balancing. Building upon Resende-Santos’ (2007) neorealist theory of emulation, I conceptualized defense development as a process of high-intensity internal balancing undertaken for reasons of national security and international prestige, in the hopes of one day acquiring the capacity to indigenously design, develop, and produce cutting-edge weapons systems, comparable to those produced by system’s leading powers. This is a high-intensity process of emulation, because it requires the creation of an institution, a strategic enclave, to coordinate the relationships among powerful stakeholders, including at a minimum a research establishment and a production facility. The specific institutional, spatial and legal separation from other actors within the government, the military system, and society vary and serve to define the institutional capacity of a strategic enclave both within and between countries.

The second step in answering my research question involved the identification of a theory that explains the political factors driving cross-national variation in the institutional features of strategic enclaves. Drawing on the neoclassical realist theory of internal balancing, state formation literature, and the literature on developmental states, I proposed two key explanatory variables to explain defense development outcomes. The independent variable is perceived external vulnerability, defined in terms of elite assessments of threats and external balancing opportunities. The mediating variable is
state power, defined as the ability of the state to extract and mobilize societal resources to pursue national ends, which in this case is defense development. I hypothesized that as perceived levels of external vulnerability increase, states create stronger strategic enclaves capable of producing better defense industrial policy, thus improving developmental outcomes.

The third step in answering the research question was testing the proposed neoclassical realist model of defense development. To this end, diachronic comparative historical analysis and process tracing were employed in the cases of the Brazilian and Indian aeronautics sectors. My empirical findings confirmed the proposed neoclassical realist hypothesis. The case of the Brazilian aeronautics sector represents a case of successful defense development. Key to this success was the creation and subsequent revision of the aeronautics enclave at two strategic junctures in which elites perceived high levels of external vulnerability. At the time of the first strategic juncture, that moment of national political consolidation between 1930 and 1945, internal, regional, and extra-regional threats were the catalyst for the creation of a relatively autonomous aeronautics enclave comprised of the Ministry of Aeronautics, the Brazilian Air Force, and the Centro Tecnológico de Aeronáutica. During this period however, direct state support for sectoral development was limited by two factors, resulting in little appreciable sectoral development. On the one hand, levels of external vulnerability were not sufficient to shift elite preferences for purely capitalist development of the sector to state-directed development. Second, the institutions comprising the aeronautics sector could provide only limited assistance for sectoral development given their immaturity.
During the second critical juncture, that between 1964 and 1969, institutional revision of the aeronautics enclave was undertaken, increasing the state’s power for defense development. Set against the backdrop of the Cold War, civilian and military elites came to believe that Brazil’s vast ungoverned spaces and severe economic underdevelopment made it ripe for Soviet backed revolutionary warfare. Developments in the Brazilian political economy gave substance to these fears, leading to creation and consolidation of a 20-year military dictatorship, whose legitimacy rested on economic performance. Defense development played a key role in the dictatorship’s economic plans, first as a means of Keynesian stimulus, then as a driver of development.

Regarding the aeronautics sector, the perceived unwillingness of private capital to drive aeronautics sector development, led to a state production firm, Embraer, in 1969. Following Embraer’s creation and seeking to take advantage of the commercialization of the global weapons industry that began in the late 1960s, MAER pursued a series of licensed and co-production deals with mixed results for sectoral development. On the one hand, these deals integrated the aeronautics enclave into the global aeronautics sector and helped develop the core competencies of the sector, which include systems integration, the expertise to manage aircraft production, and experience in international marketing. It was the mastery of these competencies that made the Brazilian aeronautics sector a recognized case of successful development. On the other hand, certification requirements and offset requests by foreign countries limited the potential for increasing the depth of the sector, leaving Brazil unable to produce many of the subsystems of a complete aircraft.
Whereas the Brazilian aeronautics sector represents a case of successful sectoral development, the developmental trajectory of the Indian aeronautics sector represents a case of failure. At the first political juncture, that between 1947 and 1955, the ruling Congress Party was beset by a similar set of strategic circumstances as confronted Brazil. Specifically, the Government of India faced the challenge of consolidating national power in New Delhi, the violence associated with partition of the Subcontinent, and an implacable foe in U.S.-backed Pakistan, which started a war months after independence over the disputed territory of Kashmir. It is important to note however, that Pakistan was viewed as both militarily and economically inferior to India. Set against these threats, sterling balances accrued during the Second World War allowed easy access to British and French weapons systems, including combat aircraft. This level of external vulnerability was not sufficiently high enough to lead to the creation of a strong aeronautics enclave. Rather, Indian leaders’ traditional aversion to the military and fear of a military coup lead to the political domination of the military, to include the Indian Air Force. As such and in keeping with the divide and rule strategy inherited from the Raj, the higher defense organization was fragmented, with the Indian Air Force, the newly created DRDO, and HAL all under different lines of authority within the Ministry of Defence. State support for aeronautics sector development was pursued along two dimensions, neither of which served to build significant capabilities or depth of the sector. First, licensed production was pursued of some imported British and French aircraft, paid for with sterling balances. Second, indigenous development was begun on the overly ambitious and ill-fated HF-24 Marut project, whose failure was in large part due to the fragmented aeronautics enclave.
The second critical juncture in the Indian case, that between 1962 and 1965, did not lead to institutional revision in the aeronautics sector, despite demonstrably higher levels of external vulnerability. Regarding external threats, a boundary conflict over Tibet led to the Sino-Indian War in 1962 and war once more erupted between India and Pakistan in 1965. These threats led as well to fear among Indian elites of a two-front war against an allied China and Pakistan. Set against these threats, India’s external balancing opportunities were limited to the Soviet Union. In the period between the 1962 and 1965 wars, India did seek and receive some military support from Britain and the U.S., however the arms embargo imposed by the U.S. in 1965 effectively foreclosed the prospect of Western arms imports or defense development assistance. Despite the increase in Indian levels of external vulnerability, Indian politicians drew the wrong lesson from the Sino-Indian War specifically. Rather than looking critically at the institutional failures that led to the debacle in the Himalayas, Defence Minister Krishna Menon was blamed by both politicians and the Army for poor defense preparedness, meaning he didn’t give the Army the tools needed to secure victory. Nonetheless, the Government of India continued to support aeronautics sector development through licensed production of MiG-21 series aircraft. However, owing to the continued fragmentation of the aeronautics enclave, little appreciable change in the capability or sectoral depth were acquired from the MiG deal, leaving India stuck in the fourth tier of global aircraft producers into the mid-1980s.

The remainder of this chapter unfolds as follows. First, I situate my work within the literature on defense development in developing countries, of which aspirational powers form a distinct subset, as well as specifying policy implications of this research.
Second, I highlight the limitations of this project. Finally, I suggest avenues for future research.

6.1 Contributions to the Study of Defense Development
Scholarly inquiry can engage with established literature on a given subject in several ways, including, conceptual innovation, adding methodological rigor, empirically, or by providing policy recommendations. In developing this project, I sought to contribute to the excellent literature on defense development by making conceptual and theoretical innovations. Additionally, I aimed to provide some measure of policy relevant suggestions. I discuss each of these contributions in what follows.

The primary contribution this project makes to the established scholarship on defense development in developing countries is conceptual innovation. It does so by asking the ontologically prior: Of what is defense development an instance? When surveying the literature on defense development, one quickly identifies two approaches to the subject. The first approach, which I termed defense dependency, does well to describe the structure of global arms production and transfer system, as well as highlighting the structural disadvantages faced by developing countries that pursued defense development in the 20th Century. The second approach, which is comprised primarily of historically rich accounts of defense development usually in a single country. The very best scholarship in this vein identifies institutional capacity as the key variable explaining development outcomes. However, in neither approach do scholars take the ontologically prior step of defining the process in terms of statecraft, leaving existing studies of defense development isolated from the broader realm of international relations scholarship. By defining defense development as a process of internal balancing, emulation specifically, this project links the literature on this process with the broader
international relations literature and distinguishes it from the excellent contemporary literature on the global diffusion of weapons systems.

Conceptual clarity allows for theoretical innovation. Specifically, by defining defense development as an instance of internal balancing, I leveraged the insights of neoclassical realism to propose a novel explanation for successful defense development that goes beyond current theoretical treatments of the subject. As detailed in Chapter 1, defense development outcomes have been explained in three ways to date. On the one hand, scholars have explained defense development by means of structural conditions. Scholars falling under the broad umbrella of the defense dependency school rely on the conditions on the global arms and transfer system to explain the widespread failure of defense development in developing countries. In this rendering, the successful development of the Brazilian and Indian aeronautics enclaves is explicable in terms of the structural conditions obtaining in the Western and Eastern Blocs’ arms transfer and production systems. Certainly, given the different logics of each global market this makes sense; the Western Bloc’s commercialization offered more opportunities for development than did the political logic the Eastern Bloc’s. Yet, absent political considerations, how can one explain why Brazil and India had access to different markets? As such it is an incomplete explanation.

On the other hand, there an institutional explanation for defense development outcomes. Echoing closely the developmental state literature, these scholars do well to explain defense development outcomes by reference to the institutional capacity of countries’ strategic enclaves. Thus, in the cases of the Brazilian and Indian aeronautics enclaves, success in the former and failure in the later is simply a function of the relative
strength of the aeronautics enclave. This explanation is clearly not wrong as has been illustrated in this study, but neither is it a complete explanation. The fact is that state institutions, be they strategic enclaves or a postal service, do not emerge fully formed in a functionalist fashion. They are tools for states to achieve some desired end, in this case defense development, and are born of political bargaining. Thus, to reiterate a criticism of the developmental state model, to the extent that scholars focus on the institutional capacity of strategic enclaves to explains defense development and not politics as the key variable, it resembles a web with no spider (Cumings 1999, 87).

Still a third approach to defense development relies on levels of external threat to explain the success or failure of this process. In the lone neorealist treatment of the subject, Hoyt argues that rising levels of external threat lead to more rational and thus more successful defense industrial policies. However, applying this theory to the cases of Brazilian and Indian aeronautics sector development is problematic. Based on Hoyt’s theory, one should have expected successful development in the Indian case. By almost every objective measure, India was in greater existential peril from Pakistan, then China and Pakistan, than was Brazil. Yet, it was in the Brazilian case that successful development was observed. Given the way I defined defense development, I am clearly sympathetic to Hoyt’s argument, however it simply does not hold up under empirical scrutiny. Absent domestic political considerations, the neorealist treatment of defense development is lacking in at least two crucial ways. First, it cannot explain why Brazilian elites perceived higher levels of external threats than did Indian elites. Second, it cannot account for the creation of strategic enclaves, which are the institutions responsible for formulating and implementing defense industrial policy.
The neoclassical realist theory of emulation I offer to explain defense development in aspirational powers draws on and seeks to move beyond each of the three extant theoretical approaches. First, the independent variable, perceived external vulnerability, takes account of external threats and external balancing opportunities. Accounting for external threats takes seriously Hoyt’s concerns, though it reflects elites’ understandings of a country’s geostrategic situation, which is wholly appropriate for a theory attempting to explain unit-level variation. With the incorporation of external balancing opportunities, I take seriously the issues raised by defense dependency and institutional scholars regarding access to the global weapons market. However, I do so by emphasizing the explicitly political nature of global weapons markets. Put another way, my argument accounts for the political dimensions of why a given country has the market opportunities it does when it comes to defense development. Second, the inclusion of a mediating variable, state power, forces one to account for the relationship between perceived levels of external vulnerability and the specific institutional relationships that define the power of the strategic enclave, in this case the aeronautics enclave. This was the crucial step missing in both the neorealist and institutional theories of defense development.

The third and most limited ambition of this project was to make some policy relevant conclusions. The impetus for this project was China’s rapid ascent toward the rank of great power status and its efforts to develop a modern defense industrial base, capable of producing weapons systems that rival those of the U.S. Yet, uncertainty remains regarding China’s actual ability to indigenously design, develop, and produce such weapons systems. If a better understanding of the process of defense development
is established, it could reduce uncertainty regarding China’s defense industrial capacity and possibly prevent these countries from falling into the Thucydides trap described by Allison (2015). It was set against this backdrop that I raised the question of the political determinants of successful defense development in aspirational powers.

Looking at the case of China, the headlines regarding high-profile public demonstrations of cutting-edge weapons systems such as current generation fighters and operational stealth-detecting, quantum radar all miss the bigger picture.\(^9\) Recent research by Richard Bitzinger (2011, 2016) and Tai Ming Cheung (2016), reveals that China is once more attempting significant institutional reform to its strategic enclaves to foster greater capabilities and sectoral depth. Based on my theory of defense development, I make one policy relevant observation in two parts. First, policymakers in Western capitals should take care to pursue strategic policies that do not raise perceived levels of external threats. Strategically unmoored arms racing or the abandonment of the decades-old One China Policy seem ill-advised.

Second, efforts to limit China’s access to technology directly related to weapons systems or of a dual-use nature should be redoubled. While exports of weapons systems to China from the West have been limited, it is the dual-use technology that is perhaps of greatest concern. This is so because among the features of China’s current defense development drive are efforts at spin-in, or the incorporation of civilian technology into the defense industrial base. As firms like Airbus, Boeing, Dassault, Embraer, Lockheed Martin, or Raytheon rush to enter the Chinese civilian market it is important to acknowledge the fact that the technologies introduced even from these companies’

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civilian products may contribute to the development of China’s defense industrial base, as was observed in the Brazilian aeronautics sector. Managing such technology transfer is admittedly very difficult given that these companies in many cases are publicly held and thus accountable to shareholders. Moreover, stagnant or declining defense expenditures in these companies’ home markets are a key push factor in seeking export markets.

To summarize, this project’s value added is three-fold. First, in defining defense development as a process of internal balancing a measure of conceptual clarity has been added to the defense development literature, which also links it with the broader international relations literature. Second and building on my conceptual contribution, I pursued theoretical innovation by applying a neoclassical realist approach to defense development. This novel approach incorporates the insights of previous scholarship on defense development, while putting both international and domestic politics front and center. Finally, this project attempted to provide some policy recommendations regarding Chinese defense development. Specifically, I recommend caution to policymakers in raising the perceived level of Chinese external vulnerability.

6.2 Limitations
All research projects have limitations and this project is no different. The primary limitations center on data and research design. Regarding data, there are several key limitations. In a perfect world, one would be able to conduct in-depth interviews with all the policy principles in all the relevant stake-holding institutions involved in defense development to generate causal process observations. This simply was not possible for two reasons. First, for reasons of economy, a research team with the requisite research and linguistic skills is required for such an undertaking, something only the most
accomplished and seasoned scholars are likely to have, as was the case for Robert Putnam (1994) or Alejandro Portes and Linda Smith (2012). Second, given the empirical scope of this project, spanning as it does nearly a century in both cases, many of the relevant policy principles are long deceased.

Given these limitations, I was forced to rely on the wealth of historically detailed scholarship on Brazilian and Indian defense development to generate data. This reality limited my research in the following ways. Given different research aims and theoretical perspectives, I frequently encountered conflicting viewpoints on different issues. To minimize the risk to the present study, in making decisions regarding which information to privilege, I relied on triangulation and the strength of the research supporting one claim over another. Additionally, I ran into the problem of missing data in the historical record, for instance I had trouble finding information regarding the relationship between the state and labor in both the Brazilian and Indian aeronautics sectors. I had no ready remedy for this problem, though it presents an opportunity for future research.

The second key problem related to data that I encountered was a lack of reliable statistics for either the Brazilian and Indian aeronautics sectors. As previous scholars have observed, data released by governments relating to defense expenditures and the financial health of defense industries is frequently problematic for at least two reasons. First, as noted in the Indian case, accurate data may not be available on the economic performance of a defense industry because of poor accounting practices within the industry itself. Second, governments may intentionally obscure economic data to paint a picture of economic health for both domestic and international consumption. This limitation was key in considering how to operationalize my dependent variable, defense
development. Rather than relying on official government data, I chose to focus on the acquisition of demonstrable sectoral capabilities and the depth of the sector. In this way, the risk associated with using government supplied data, was minimized.

The second important limitation of this study is its research design, which could affect its generalizability. With an eye towards generalizability and thinking once more in terms of a perfect world, it would have been preferable to test the novel theory of defense development advanced herein in a large-n statistical study. This would have demonstrated its generalizability in a well-accepted way. However, the complexity of variables such as external vulnerability, state power, as well as the unreliability of economic data on defense industries, a large-n statistical study was impossible. Given this reality, I employed the time-tested approach of comparative case analysis, selecting my cases according to Prezworski and Tenue’s “most similar systems” logic of inquiry.” Furthermore, I was able to multiply the data I generated by developing both within and cross-case causal process observations. Both are well accepted approaches to qualitative research. The burden of deciding how well I have managed both the limitations related to data and research design I have acknowledged falls upon the judgement of the reader.

6.3 Future Research
Making use of the theoretical framework established in this project, the study of defense development in aspirational powers can be advanced in two ways. First, future research can continue to focus on the cases of Brazil and India. On the one hand, a future study could pick up where this one left off with a further exploration of the development of each countries’ aeronautics sector development following the 1980s. In the Brazilian case, significant changes occurred in the aeronautics sector following the transition to democracy. Specifically, the industry has been partially privatized, with the state holding
golden shares allowing it final say in all major decisions. Additionally, since the presidency of Fernando Henrique Cardoso, the state has pursued a business-friendly development policy that seeks to aid the development of Brazilian industry. This would provide a tough test of the theory developed herein as any material threats to Brazilian national security have been considerably diminished, especially following the creation of Mercosur.

Looking at the case of the Indian aeronautics sector, it looks as though it remains mired in dysfunction. Despite several additional wars with Pakistan and the continuing hostile relationship with China, judging by the tribulations of the Light Combat Aircraft (LCA) project and its recent hunt for a medium multi-role fighter, it appears that the Indian aeronautics sector has not improved its capabilities or its sectoral depth. It would be interesting to investigate how Indian policymaker’s perceptions of external vulnerability have contributed to its underperformance in the aeronautics sector.

On the other hand, future research on the political determinants of defense development outcomes in the broader Brazilian and Indian defense industrial bases could prove fruitful. In both cases, defense development occurred in not only the aeronautics sector, but in the aerospace sector, land-warfare weapons systems, and naval weapons systems all with varying levels of success. In the case of India, successful development also obtained in the development of nuclear weapons. If the neoclassical realist theory of defense development developed and tested in this project could withstand empirical scrutiny when applied to these cases, it would lend support to its generalizability.

Finally, future research should consider Chinese defense development. Since the communist victory over the Kuomintang, the Chinese government has pursued ambitious
defense development schemes, though in many cases with little success. The causes of these failures generally accept the overly bureaucratized nature of the Chinese defense industry and its vast excess capacity. Yet, understanding the political causes of past failures may help illuminate the potential for future success as China’s ascendance towards great power status continues.
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