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Government Bytes:  
Industrial Policy in the Indian Software Industry

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## ABSTRACT

India's meteoric economic growth rate has been a subject of much discussion since it began its economic liberalization in the early 1990s. The software segment, in particular, has seen unprecedented growth rates over the past twenty years. Why is India unique? By marshaling evidence on the role of the state in interaction with the software sector, this paper attempts to provide a corrective to the dominant perspective that has an excessively market oriented view of the sector's development. More specifically, by discussing India's broad-scale import substitution industrialization (ISI) efforts from the 1950s to 1991 and its transition to a more open economic structure, as well as more industry specific policies within a theoretical context, this work attempts to identify the key driving forces and impact of government policy through systematically examining the development and growth of India's software industry in light of various theoretical claims about the rationales for state intervention.

## I. INTRODUCTION

India's meteoric economic growth rate has been a subject of much discussion since India began its economic liberalization in the early 1990s.<sup>1</sup> One broad sector, the information technology (IT) industry, has become the primary example of the economy's dramatic transformation. Currently, for example, Indian firms account for 55 percent of the global outsourcing market.<sup>2</sup> India's IT sector is expected to grow to US\$76 billion, making up 6.4 percent of its GDP.<sup>3</sup> Driving much of its success in IT has been the growth of one key segment, India's software industry. This high skilled segment of the industry, dominated by domestic firms since its inception, has had great global success.<sup>4</sup> Based on the latest available data, Indian firms accounted for over 4 percent of the US\$225.5 billion global market for software in 2009. The software segment is growing at a rate of 48.5 percent.<sup>5</sup> Comparable industries in other developing countries have been primarily founded by multinational corporations (MNCs) and have provided fairly routine work. Why is India unique?

The dominant perspective on the software industry's success is that entrepreneurs managed to circumvent state regulation, driving this sector's growth in view of India's existing comparative advantage. Two leading critics of industrial policy, Howard Pack and Kamal Saggi, in a brief review of India's software industry, conclude, "All of it was privately initiated. Governments at various levels became involved only after the success of the

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<sup>1</sup> 8.8 percent in 2010 (Associated Press, 2011).

<sup>2</sup> *IB Times* (2011), p. 1.

<sup>3</sup> *IB Times* (2011), p. 1.

<sup>4</sup> The IT industry is traditionally divided into hardware, software, services, and telecom equipment and services.

<sup>5</sup> For the worldwide market, see Datamonitor (2010). Data on India from the Department of Electronics and Information Technology of the Ministry of Communications & Information Technology. The latest data on the ministry's website is from 2009.

sector was evident, ratifying the success rather than catalyzing it. The industry expanded on the basis of comparative advantage and never needed any protection.”<sup>6</sup> From this perspective, the puzzle that we need to explain is how the industry managed to *avoid* becoming entangled in bureaucratic red tape that has beset other industries. By contrast, a leading critic of this neoliberal view, Anthony D’Costa, in a comparative study of India’s auto, steel, and software industries, argues that “While it is true that the government did not get into production or intervene in the day to day matters through regulatory policy, the origin of the Indian IT industry can be traced to the state in the 1970s.”<sup>7</sup> Ashish Arora and his collaborators have a more balanced view, claiming that the software industry’s success can be attributed to “a combination of resource endowments, a mixture of benign neglect and active encouragement from a normally intrusive government, and good timing.”<sup>8</sup> What is one to make of these contending perspectives?

Assessing the extent to which any industry, including the Indian software industry, would have been different without government intervention cannot be determined with certainty, for this is a difficult counterfactual—be it for those who believe that intervention made *no* difference or those who would claim it *did*. Still, by marshalling evidence of the role of the state in interaction with the software sector, this paper attempts to provide a corrective to the dominant perspective that has an excessively market oriented view of the sector’s development. More specifically, by discussing India’s broad-scale import substitution industrialization (ISI) efforts from the 1950s to 1991 and its transition to a more open economic structure, as well as more industry specific policies within a

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<sup>6</sup> Pack and Saggi (2006), p. 289.

<sup>7</sup> D’Costa (2009), p. 633.

<sup>8</sup> Arora et. al (2001), p. 1270.

theoretical context, this work attempts to identify the key driving forces and impact of government policy. Most works that have attempted to assess such state efforts have done so in a casual fashion, without linking the actions to carefully specified rationales for state intervention.<sup>9</sup> Here, by specifying four plausible rationales for government intervention and empirically assessing the support for these claims in light of the evolution of the Indian software industry since its inception, this work allows one to gauge the significant contributions of the state within a clear context of possible state roles.

The question of state intervention more broadly, and industrial policy specifically, has become a growth industry in itself in light of China's apparent success in using government intervention to help its industries become globally successful.<sup>10</sup> Moreover, in the aftermath of the global financial crisis, many critics have questioned the "Western" approach (particularly the "Washington Consensus" view that critiqued state intervention policies).<sup>11</sup> As the U.S. government as well as both developed and developing countries throughout the world have responded with an activist policy of bailing out firms that are in trouble (e.g. the U.S. auto industry) as well as promoting "green growth" poles, the appropriate role of the state in the economy is now hotly contested.<sup>12</sup> More specifically for India, as its software industry faces increasing global competition, the extent to which the government might facilitate its future success is thus of crucial import. And if there are

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<sup>9</sup> See for example Balakrishnan (2006), who succinctly frames the debate in his title: "Benign Neglect or Strategic Intent? Contested Lineage of Indian Software Industry."

<sup>10</sup> A typical definition of industrial policy is provided by Pack and Saggi (2006), p. 267-268: "any type of selective government intervention or policy that attempts to alter the structure of production in favor of sectors that are expected to offer better prospects for economic growth in a way that would not occur in the absence of such intervention in the market equilibrium."

<sup>11</sup> See Williamson (2004), who provides his own view of his coining of the term "Washington Consensus."

<sup>12</sup> These arguments are widely discussed. One summary comes from *The Economist* (August 5, 2010), which notes that there has been a revival of discussion of industrial policy because of the need to save jobs, rebalancing away from finance and property, emergency demands to save big firms that lead to similar pressure for bailouts from smaller firms, and responding to the success of China and South Korea.

positive lessons to be learned from this sector, can the government facilitate the growth of other sectors in the Indian economy?

The analysis is structured as follows. Section 2 of the paper begins with a brief background on ISI, examining the general rationale and efforts to promote broad-scale national economic transformation. It then provides an analysis of the theoretical rationales for more specific industrial policies. In particular, four approaches provide insight on this question. First, economists have now converged on a set of standard arguments about state intervention to bolster a specific industry based on market failure arguments. These include knowledge spillovers, dynamic scale economies, information externalities, and agglomeration effects. Second, a more political approach focuses on government goals in promoting a domestic industry for national security and the state role in international negotiations that might affect specific sectors. Third, rather than a top down state-led focus, one might argue that intervention is simply driven by rent seeking behavior on the part of private-sector actors, and the government because of its weakness (or lack of specific state goals) does its bidding. Finally, state intervention may take place to address previous government policies in a particular market that may be seen as being inadequate or failures in some fashion.

Section 3 systematically examines the development and growth of India's software industry in light of these various theoretical claims about the rationales for state intervention. After reviewing the general contours of the software industry's success in India and an overview of ISI policies in the Indian context, the analysis periodizes specific intervention efforts in the software industry by the Indian government. This empirical analysis focuses on evaluating the competing theoretical claims developed in Section 2.

In Section 4, the analysis turns to current challenges that the software industry faces. Although the Indian software industry has shown great success as indicated by its sustained rapid growth and increasing employment numbers, it faces a challenge from “top” and “bottom.” Specifically, as with many emerging market industries, moving to higher valued added products brings the industry into more direct competition with the software (and more broadly, IT industry) produced in rich countries such as the United States and Europe. At the same time, emerging competitors with lower costs pose a threat to current industry success, particularly in view of rapidly rising wages in the Indian software industry. In some sense, at least at the bottom, the question it faces is how to avoid becoming a victim of its own success. Here, the issue then becomes: can the government play a positive role in helping the industry to effect a needed transformation to remain competitive? A second theme tied to the international context concerns the rise of protection against Indian IT sector, most recently manifested in the increase in U.S. visa fees for workers, a case which India has taken to the World Trade Organization (WTO) and which remains to be adjudicated.

Section 5 concludes with a discussion of the overall findings of the paper, evaluating both the theoretical approach developed here as well as the empirical evidence on the patterns of state intervention in the Indian software industry, with an eye to shedding light on the debate on the extent and benefits of government policy. Looking to the future, it also considers whether the government may be able to play a beneficial activist role in the software industry in India as it attempts to reposition itself for global competition.

## **II. THEORETICAL RATIONALES FOR STATE INTERVENTION**

This section provides a discussion of theoretical arguments about industrial policy and state motivations to intervene in the economy. Before turning to the more specific analysis of this newer industrial policy literature, the first section focuses on broader efforts to promote industrial transformation through ISI. Then, the section considers four different approaches that might lead governments to engage in industrial policy, including market failures unable to be addressed by the private sector, national security and international concerns, regulatory capture, and state intervention to address perceived previous governmental failure. In each case, the section details the specific concerns identified by these approaches, the instruments that governments might use, and as a prelude to Section 3's empirical analysis, some indicators to gauge both the motivation of the government in its intervention efforts and possible success of policy choices.

### **State-Led Transformation: From ISI to New Industrial Policy**

Although arguments about “industrial policy” go back to the time of Friedrich List and Alexander Hamilton the most influential call for a state role in economic transformation in the post-World War II era came from an Argentine economist—Raúl Prebisch. Put succinctly, he argued that the terms of trade were going against developing countries, as the prices of raw materials fell relative to the price of manufactured goods.<sup>13</sup> In his view, as long as developing countries focused on commodity exports, they would be disadvantaged as developing countries were forced to export more and more to purchase the same amount of manufactured imports. Prebisch's solution was to promote domestic



industry through a variety of intervention mechanisms, with the goal of developing a competitive manufacturing sector—what came to be known as import substitution industrialization (ISI). Such a transformation would allow technology to be diffused throughout the economy, and overcome a perceived market failure on a broad scale and become a forerunner of the new industrial policy ideas discussed in the theory section below. Drawing also on the work of Albert Hirschman who focused on bottlenecks in development,<sup>14</sup> the ISI approach sought to create backward and forward linkages in the economy by bolstering both upstream and downstream economies—once again a forerunner of some of the recent views of the broad-scale benefit of promoting the information technology industry.

Achieving a successful manufacturing sector in the face of competition from foreign corporations who were much more efficient than domestic firms called for a systematic effort to restrict imports and prevent the entry of multinational corporations into the domestic market. The set of policies included tariffs, quotas, import licenses, exchange rate overvaluation to import key capital equipment, management of foreign exchange, and forcing multinationals to form joint ventures in cases where the state sought access to technology. In addition, to overcome market failure in the private sector, advocates of ISI also sought to create state owned enterprises (SOEs) that would be able to supply the domestic market and eventually help the private sector through a transfer of technology and organizational strategy.

This set of policies became the *sine qua non* of economic policy throughout most of Latin America, Africa, and Asia. In India, Prebisch's approach found a ready audience,

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<sup>14</sup> Hirschman (1968), p. 1-32.

particularly with P.C. Mahalanobis, who was instrumental in developing India's five-year industrial development plans in the 1950s. As Bruton notes,<sup>15</sup> Mahalanobis believed in the necessity of creating a heavy industrial sector because of its purported technological spillovers to the rest of the economy. The Indian government thus implemented a policy of ISI, and created an extremely protectionist and self-reliant environment (discussed at length in Section 3).<sup>16</sup> These policies were implemented to prevent relatively uncompetitive Indian firms from facing global competition. Following Prebisch, the belief was that firms would learn to become efficient and eventually become competitive in the global economy after having an opportunity to develop in a protected environment. Instead, India experienced the so-called "Hindu rate of growth" of 3.5 percent for most of the post-WWII years<sup>17</sup>—good in historical terms but poor as compared to the fast growing countries of East Asia.

It is worth noting that although India has been seen by such leading experts on industrial policy such as Dani Rodrik as "the giant archetype of a closed, import-substituting economy,"<sup>18</sup> there are important differences between India and Latin America. Of greatest significance was the fact that India, as opposed to most Latin American countries, was a newly independent country, seeking to enhance its economic power in a world that it perceived as hostile (indicated by the war in 1947 just after independence between India and Pakistan). As Bruton notes, "The USSR's commitment to central planning and to large-scale, capital intensive industrialization was especially appealing to those countries that put great weight on becoming a world economic power. India was such

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<sup>15</sup> Bruton (1998), p. 906.

<sup>16</sup> D'Costa (2011b), p. 7.

<sup>17</sup> *The Financial Express* (2004), p. 1.

<sup>18</sup> Rodrik (1996), p. 10.

a country. Economic independence required a country to have its own large-scale capital goods sector.”<sup>19</sup> A second notable difference, elaborated on in Section 3, is that India avoided military coups in contrast and was democratically governed by the Congress Party for most of its post-independence period, in contrast to most countries in Latin America.

The turn away from ISI, both in India and elsewhere, came in the context of the global debt crisis of the early 1980s and its aftermath. As developing countries borrowed heavily from international banks and international financial institutions in the aftermath of the 1970s oil crises, the lack of export competitiveness of countries pursuing ISI became readily apparent. In contrast to South Korea, which managed to export its way out of its debts in the early 1980s, one country after another in Latin America succumbed to a combination of higher interest rates and global recession (induced by Fed Chairman Volcker in 1981 in an effort to rid the United States of inflation). India escaped the debt rescheduling that faced Latin America and many Asian countries in the 1980s involving supervision by the International Monetary Fund (IMF). This difference between India and other countries following ISI has been remarked upon by Dani Rodrik, who in defending the success of ISI has suggested “it is clear that there was nothing foreordained about the debt crisis; some of the countries that adhered most rigidly to ISI—India being a chief example—were able to avoid protracted debt crises.”<sup>20</sup>

Notwithstanding Rodrik’s view, India’s ISI model did continue to face increasing problems, as its unsustainable debt could not easily be serviced in view of an uncompetitive export sector. By 1991, India neared economic collapse. In response, Prime Minister P.V. Narasimha and his finance minister, the economist Manmohan Singh (the

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<sup>19</sup> Bruton (1998), p. 906.

<sup>20</sup> Rodrik (1998), pp. 146-7.

current Prime Minister) also were forced to turn to the IMF for a loan. The government then implemented a host of reforms that deregulated the Indian economy and opened it up to foreign trade and investment.<sup>21</sup> This set of neoliberal policies, advocated by the IMF as well as parts of the U.S. government and academics, came to be known as the “Washington Consensus.” As John Williamson argued, primarily in response to the perceived widespread failure of ISI, governments should increase their fiscal discipline, move away from subsidies, promote a competitive exchange rate, liberalize trade and foreign direct investment (FDI), and privatize and deregulate their economies.<sup>22</sup>

But as is often the case, the view that ISI was a failure led to throwing out the baby with the bathwater. All forms of government intervention were seen to be bad, and many scholars began to argue that the claims that East Asian countries had successfully used industrial policy to grow rapidly through a state-promoted export oriented policy were fallacious.<sup>23</sup> Yet when revisiting the history of ISI in many countries, both economists and political scientists have countered that although it is clear that ISI ran into significant problems, it would be wrong to claim that such policies were an unmitigated failure. For example, Dani Rodrik notes: “ISI worked rather well for a period of about two decades. It brought unprecedented economic growth to scores of countries in Latin America, the Middle East, and North Africa, and even to some in sub-Saharan Africa.”<sup>24</sup> In his view, the problems with ISI stemmed more from poor macroeconomic policies social conflicts growing out the economic difficulties generated by the oil shocks of the 1970s. Political scientists as well, such as Peter Kingstone, who has extensively analyzed Latin American ISI

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<sup>21</sup> Kohli (1989).

<sup>22</sup> Williamson (2004).

<sup>23</sup> Noland and Pack (2003).

<sup>24</sup> Rodrik (1998), p. 144.

policies in a recent book, share this view. As he notes, “ISI almost certainly needed significant adjustments. It is not clear, however, that it needed to be discarded. As is much of the process of development in Latin America, the story is as much political as economic.”<sup>25</sup>

In short, the debate between ISI and the Washington Consensus of a heavily outward export orientation has yet to be resolved. Yet as disillusionment with the problems of a purely neoliberal approach became apparent, as China successfully experimented with different forms of market and state led approaches.<sup>26</sup> And as noted in Section 1, as the financial crisis has led to extensive intervention even in rich “market” economies, there has been growing interest on the suitable role for the state, manifested in a revival of thinking about industrial policy. By taking a more eclectic approach to policy making, leading scholars on industrial policy such as Rodrik have recently called for greater willingness to experiment in policymaking,<sup>27</sup> a view echoing others writing earlier in the 1990s such as Werner Baer, who called on economists to “engage in inductive type of work, i.e., observe changing institutional realities and incorporate them into their moral formal analysis.”<sup>28</sup>

This view on eclecticism applies to both efforts to understand the motivations for state intervention as well as the varying ability of states to successfully implement industrial policies. As Stephan Haggard argues,<sup>29</sup> many critics of industrial policy point to

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<sup>25</sup> Kingstone (2011), p. 20.

<sup>26</sup> As Dani Rodrik (2010, p. 40) notes, “The Washington Consensus of the 1990s has left lots of frustration and unrealized expectations in its wake.”

<sup>27</sup> As Rodrik (2010, p. 43) notes: “Development economists have too often fallen in the trap of believing in the “one right way,” a universal fix for underdevelopment or (more commonly these days) a single best way of learning about what works and what doesn’t.”

<sup>28</sup> Baer (1996), p. 377.

<sup>29</sup> Haggard (2004), p. 68.

government failure, claiming that governments do not have sufficient information and that rent-seeking by business groups is common, undermining any case for intervention. As a consequence, industrial policy should generally be eschewed.

To examine these questions, it is useful to consider the underlying motivations that various scholars have adduced, beginning with claims about market failures (the most influential view on possible rationales for state intervention, and thus the major focus of the discussion below) and then a focus on security and international issues, rent seeking by the private sector, and then in more iterative fashion, efforts by the state to address previous governmental intervention failures.<sup>30</sup> Table 1 provides an overview of this approach, focusing on several elements that help in better characterizing the essential aspects of each of these approaches and a guidepost for empirical exploration.

The first column considers the specific content of the overarching rationale for government policy. In view of these problems, column 2 considers how governments might respond to these specific concerns, with both a general approach and examples of instruments (not meant to be comprehensive in the table but only illustrative). Column 3 then looks at possible problems that might occur as a result of government intervention. The next two columns, under the category of “empirical indicators,” have a more empirically oriented focus. The first considers how one might differentiate among the rationales for intervention in a particular industry; the second one provides a gauge of the outcome of

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<sup>30</sup> Other explanations of government intervention could include a view of the state as “predatory,” with an interest in extracting resources from particular industrial sectors. Given that India is a democracy, the state is relatively weak, and the general focus on predatory states in extractive resources, this model is not developed here.

efforts to influence the market with government policy.<sup>31</sup> A detailed discussion of these elements tied to each motivation forms the basis of sections II-VI below.

**Table 1: Dynamics and Indicators of State Intervention**

		Dynamics of State Intervention			Empirical Indicators	
		1) <i>Specific concerns detailed</i>	2) <i>Government responses (approach and instruments)</i>	3) <i>Possible problems with intervention</i>	1) <i>Indicators to differentiate among motivations</i>	2) <i>Gauging intervention outcomes</i>
<b>Overall Rationale for Intervention</b>	<i>State with strategic intent to address market failures with industrial policy</i>	<ul style="list-style-type: none"> <li>• Imperfect market</li> <li>• Dynamic scale economies</li> <li>• Knowledge spillovers</li> <li>• Coordination failure</li> <li>• Incomplete information</li> <li>• Agglomeration effects</li> </ul>	Market following or leading with trade measures. SOEs, subsidies, tax benefits, regulation	Governmental failure owing to lack of knowledge or capture	Explicit or implicit government efforts to address market failures	Relate industry performance to intervention
	<i>State intervention for int'l security concerns</i>	Military or strategic value of industry	Tariffs, quotas, SOEs, subsidies, tax benefits, regulation	Capture in the name of "security"	Specific security concerns expressed by state officials (as opposed to lobbying)	Viable sector and some military connections of the industry
	<i>International negotiations considerations</i>	Responding to protectionist efforts in other countries	Direct negotiations with other states	Trade conflict with possible retaliation	Top or bottom up pressures to respond to int'l actions	Success in international negotiations and industry viability.
	<i>Rent seeking intervention because of regulatory capture (lobbying from private sector)</i>	Secure protected market to avoid competition, either foreign or domestic	Tariffs, quotas, SOEs, subsidies, tax benefits, regulation	Misuse of government intervention	Active lobbying and pressure from below for intervention	Relate industry performance to intervention
	<i>State intervention to address previous government policy failures</i>	Any of the motivations regarding market failure, security, or international concerns	Tariffs, quotas, SOEs, subsidies, tax benefits, regulation.  Removal of instruments	Further government failure  Transition difficulties to more open market	Explicit or implicit government efforts to address previous policy failures	Relate industry performance to changes in intervention

### **An Economic Perspective: Market Failure as State Motivation for Industrial Policy**

The dominant view on industrial policy among economists focuses on market failure. Standard economic theory on imperfect markets together with the summary of industrial policy by Howard Pack and Kamal Saggi provide exemplars of this approach, with often somewhat interrelated elements.<sup>32</sup>

<sup>31</sup> Note that the elements in the theoretical overview do not imply that all of these factors will apply in the Indian software case. The extent to which the different elements are relevant is taken up in Section 3.

<sup>32</sup> Pack and Saggi (2006). Their treatment is not entirely systematic and thus the discussion here incorporates ideas from Haggard (2004) and Lin and Chang (2009).

### *Different Types of Market Failure*

The first specific rationale for intervention to correct market failures focuses on imperfect markets. As economists have generally claimed, any deviation from a competitive market is likely to lead to a loss of consumer welfare and generates market inefficiencies.<sup>33</sup> Thus in the case of monopolies or oligopolies, state intervention to break up firms through legal measures, or regulatory efforts to lower barriers to entry to facilitate efficient functioning of the market by increasing competition may be called for.

Second, another important motivation for industrial policy, strongly related to the policies of ISI discussed above, focuses on the problems of infant industries, or, more technically, the problem of dynamic scale economies and capital market failures. This line of thinking argues that nascent domestic industries cannot bear the high cost of investment and international competition, so state-led help and protection against foreign imports are necessary to encourage development. The basic claim of this view is that through economies of scale that lower per unit costs with expanding production, these industries could be internationally competitive. Although it may appear that an industry lacks a comparative advantage at the time, there could be an advantageous endowment structure that would lead to success in the long run. Still, financiers may be unable to invest, leading to a lack of capital, and thus, a market failure.

Arguments about infant industries can be tied to knowledge spillovers through the formation of human capital—a third key concern. Here, the claim is that some industries may be particularly desirable because they lead to widespread diffusion to other sectors of the economy. The U.S. Defense Department's support to create the Internet is an example

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<sup>33</sup> See Glykou and Pitelis (2011) for a discussion of industrial policy and imperfect competition.



of “public goods” aspects of investment where private firms may not have a strong incentive to invest in light of possible free riding.<sup>34</sup> Concerns about the lack of investment in such cases can be linked more directly to the broader issue of technological innovation. New technological innovations can easily diffuse, deterring potential investors who fear that they will not be able to capture the sunk costs of innovation. As a result, there can be a lack of investment in highly technologically focused products as a result of this first-mover disadvantage. Moreover, more generally, because economic growth comes with greater capital requirements, increased scales of production, and increased market growth, such improvements must be accompanied by improved educational, legal, and financial institutions, as well as better infrastructure. As individual firms are unable to single-handedly bring about such changes, this may result in market failure.

Fourth is a coordination failure argument, which asserts that there may be failure on the part of upstream and downstream industries to coordinate their investments. Thus, for example, while it may be individually unprofitable to produce computers or software, if private firms in these two sectors invest somewhat simultaneously, both will benefit. But because there is informational uncertainty about the growth of complementary industries, both downstream and upstream, as well as directly networked, there may be under investment.

Fifth is an informational inadequacy argument, which has been espoused by Dani Rodrik, who argues that industrial policy is more about eliciting information from the private sector about a country’s comparative advantage than it is about creating the correct

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<sup>34</sup> Pack and Saggi (2006), p. 273.

government intervention.<sup>35</sup> Basically, the claim here is that it is difficult without complete information to ascertain which industries will have a positive future. Or in Pack and Saggi's terms, "at the microlevel, entrepreneurs may simply not know what is profitable and what is not."<sup>36</sup>

Finally, the sixth claim derives from the work of Paul Krugman on agglomeration effects.<sup>37</sup> As he notes, the importance of clusters, be they urban or regional, has been important in driving development. The externalities of agglomeration include concentrated labor markets, suppliers, and the role of university-industry complexes. The efforts by countries around the world to create "Silicon Valleys" speak to the widespread recognition of the benefits of such agglomeration.

#### *Responding To Market Failures and Possible Problems with Intervention*

How should one respond to market failures? Before focusing specifically on market following or market leading efforts by governments, it is worth examining the neoliberal claim that the medicine of intervention is worse than the disease. Or to put it differently, government failure that would be likely from intervention would be worse than the market failures noted to this point. Thus, even if some market failures do seem evident, this approach would argue that *laissez-faire*, or non-involvement remains a first best solution. As Martin Wolf states, "Bad government is the single most important cause of failure in developing countries."<sup>38</sup> Others suggest that when governments intervene in the market,

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<sup>35</sup> Rodrik (2004), pp. 2-3.

<sup>36</sup> Pack and Saggi (2006), p. 277. They refer to this problem as an information externality but a better label would appear to be incomplete or inadequate information.

<sup>37</sup> See discussion by Haggard (2004), p. 66-7 for a discussion.

<sup>38</sup> Wolf (2005).

they run the risk of derailing productivity through “allocating funds and support in an inept, or even worse, a counterproductive manner.”<sup>39</sup> Yet despite such concerns, Rodrik, a proponent of industrial policy, while accepting that “if government is too heavy-handed, it kills private entrepreneurship” argues that if a government is “too standoffish, markets keep doing what they know how to do best, confining the country to its specialization in traditional, low-productivity products.”<sup>40</sup> Rodrik finds that balance is key in mitigating both market and government failures.<sup>41</sup>

In arguing that state intervention can mitigate market failures, two approaches stand out. First, one strand of thought argues that that government action is necessary, but only to the degree that it encourages a country’s existing comparative and competitive advantage in the market. Second, another promotes a vision of state intervention wherein the government “leads” the market, encouraging policies that transform a country’s existing comparative advantage to promote long-term growth.

*Market following states.* Robert Wade refers to the first view on state intervention to conform to the market as “following the market,” where the government supports some of the bets of private firms.<sup>42</sup> Justin Lin, Chief Economist and Senior Vice-President of the World Bank, is in favor of industrial upgrading through the “facilitating state.” Such a state facilitates the private sector’s activity in areas of the country’s comparative advantage.<sup>43</sup> In

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<sup>39</sup> Lerner (2010).

<sup>40</sup> Rodrik (2010).

<sup>41</sup> This topic is taken up in detail below when rent-seeking intervention is discussed as a possible rationale for intervention.

<sup>42</sup> Wade (2010), p. 155.

<sup>43</sup> Lin and Chang (2009), p. 484.

a debate with Ha-Joon Chang, Lin discusses how by optimally tapping into a country's endowment structure (defined by the country's labor market, capital, and natural resources), the state can remove barriers to entry for firms in these industries. Removing externalities can help firms who have a comparative advantage grow naturally, instead of forcing growth in areas that may not be as internationally competitive in the long run.

Critiquing this view, Chang argues that the standard trade model (Heckscher-Olin-Samuelson, or HOS) that Justin Lin and other proponents of state intervention focus on is effective in short-term allocative efficiency, but not sufficient to explain medium or long run economic growth. In Chang's view, the HOS model fails to account for outcomes in the long run because it assumes perfect factor mobility—that there are no losers when trade patterns are impacted by external shocks. Throughout the process of trade liberalization, losers such as low-skilled laborers, specialized laborers, and many others are negatively impacted. This is particularly significant in developing countries, where there are few welfare measures to account for the trade-adjustment process by providing unemployment benefits, healthcare, or education.

Another weakness with the HOS model is that it assumes that there is one superior technology for producing a certain product that can be attainable once capital needs are met. This simplification does not account for the difficulty in acquiring better technology. Even if a country has the endowment structure (the labor, capital and the like) that is suitable for a certain industry, it is difficult to attain success without suitable technical and knowledge innovation to sustain a country's efforts in such an industry.

*Market leading states.* Ha-Joon Chang argues against Lin that state intervention must be about defying comparative advantage to upgrade a country's industry.<sup>44</sup> Wade refers to these policies as "leading the market." States make investment decisions that private firms would not make, rather than supporting already successful industries.<sup>45</sup>

Ha-Joon Chang discusses how comparative advantage-defying policies are necessary to promote long-term growth. He argues that it is impossible for a country to follow the market and smoothly follow comparative advantage industries. Uncertainty over industrial prospects must be overcome, and firms encouraged and protected to achieve future industrial upgrading.<sup>46</sup>

In turn critiquing Chang, Lin describes efforts to lead the market as "comparative-advantage-defying," with high costs. In his view, implementing such a strategy requires significant protection and subsidization for firms that are not necessarily viable without government help. As a result, these firms may not provide any surplus, which can lead to greater difficulties in facilitating improvements in necessary capital and skilled labor over the long run.<sup>47</sup> In addition, supported firms that may not currently have a competitive edge in the market may lead to a loss of resources from firms that are currently successful, which slows development in these areas for the sake of an uncertain future payoff.

*Instruments.* Whether market following or leadings, instruments of intervention could include tax holidays for firms producing specific products or accelerated depreciation.

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<sup>44</sup> Ajit Singh (2011) research supports Chang's arguments. He notes that policies that simply follow the market limit firms from finding their global competitive advantage in the long run, instead promoting industries that may only be profitable in the short run.

<sup>45</sup> Wade (2010), p. 155.

<sup>46</sup> Lin and Chang (2009), p. 501.

<sup>47</sup> Lin and Chang (2009), p. 487.

Wade advocates incremental support, described as avoiding “open economy industrial policy,” which can lead to developing economies losing their manufacturing industry. He cites China as an example of a country that refuses to level the playing field, instead, keeping its currency undervalued to stay competitive. Other measures that might be used include directing funding toward certain research priorities. Although this decreases researcher autonomy due to set outcomes and time constraints, such a shift may be beneficial for promoting or leading comparative advantage.<sup>48</sup>

Strategic investments also can be used to promote innovation through providing and stimulating the availability of venture capital. Methods to promote the availability of such capital include financial incentives to VC providers (tax breaks and guarantees) or direct government funding.<sup>49</sup> In addition, government procurement can be utilized as a tool to create national champions and support domestic producers, or as a lever to entice foreign suppliers to comply with national development efforts.<sup>50</sup> States seeking early project development opportunities often provide incentives that would eventually benefit the industry it is championing. As a result, governments that attempt to lead the market often utilize government procurement.

Finally, governments may use a host of other measures including the creation of government led companies or State Owned Enterprises (SOEs), direct subsidies to industry or trade measures such as tariffs and quotas. Each of these measures has a set of potential problems including inefficiencies as in the case of SOEs that do not have to meet a bottom

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<sup>48</sup> Weiss (2006), p. 733.

<sup>49</sup> Weiss (2006), p. 735.

<sup>50</sup> Weiss (2006), p. 735.

line, or excessive coddling of industries with a closed markets to foreign goods that diminishes their incentives to become competitive.

### *Empirical Indicators*

Two other elements in Table 1 that focus on empirical indicators to differentiate among the different motivations discussed to this point (and others that are discussed below), as well as the impact of intervention are important, particularly for the analysis in Section 3. Gauging the motivation for intervention is often empirically difficult, since government intervention measures may not explicitly address a specific market failure in the same theoretical terms as noted by analysts. Still, to the extent that decision-makers point to problems, for example, such as an underdeveloped industry where more investment is needed, or where state or local governments attempt to build up a region or city, one can *infer* that they are concerned about dynamic scale economies and agglomeration effects, respectively. Moreover, to the extent that the one sees top down policy making or concerns about security, one can also infer that rent seeking is not driving decision-making.

In terms of gauging impact, “proving” that a particular intervention led to success (or failure) has stymied analysts, thus leading to an ongoing unresolved debate about the efficacy of government intervention. The goal in the empirical analysis in Section 3 based on the theory developed here is to simply find some indications that government intervention influenced the path of the industry in some fashion.

## **International Considerations in State Intervention**

The importance of international factors as a basis for state intervention is a long-standing theme in the literature on trade and industrial policy. Moreover, governments have also been concerned about international protectionist efforts that might adversely affect specific industries. These issues are addressed in turn below, as they can also provide a basis for industrial policy efforts.

### *Types of International Concerns*

Economists, while generally skeptical of deviations from free trade, have almost always agreed that some industries must be protected for reasons of national security.<sup>51</sup> At the same time, industries lobbying groups have often framed their claims for protection in national security terms, knowing that the government may be more amenable to protection in such instances.<sup>52</sup> Some industries such as defense or the oil industry can make more valid claims about their importance. But even these claims can sometimes be suspect. For example, in the 1950s, the U.S. domestic oil industry argued that imposing quotas on the import of Middle Eastern oil would increase American national security. Yet, the Head of the Petroleum Division in the State Department was skeptical, and wrote:

We want the operating policies of the British private petroleum companies to be in reasonable conformity with our general policy objective of effecting an increase in the rate of exploitation in the Eastern Hemisphere (particularly Middle Eastern) petroleum reserves, and a relative decrease in the rate of exploitation in the Western Hemisphere. This is an objective which cannot be stated in precise or quantitative terms without provoking acute international political controversy here.<sup>53</sup>

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<sup>51</sup> See the discussion by Mastanduno (1991) who examines arguments about national security and industrial policy in the context of responding to Japan's economic policies.

<sup>52</sup> The textile industry among others has often made national security arguments.

<sup>53</sup> Quoted in Keohane (1984), p. 154.



Yet by 1958, the industry had secured quotas on oil imports based on a national security argument, claiming that this trade policy would lead to energy independence for the U.S. While in the short run this may have been the case (although at this time the United States was sufficiently powerful and had control of international oil through its multinationals), the long-run effect of this policy was disastrous, since it led to the use of American over foreign oil reserves.

In terms of a second set of international considerations, governments have often responded to intervention by countries to favor their industries with either direct negotiations or by working through international institutions such as the WTO.<sup>54</sup> Thus, although we might expect industry groups to press for government support, governments on their own may also be interested in ensuring that their industries face a level playing field.

#### *Responding to International Concerns and Possible Problems with Intervention*

In terms of approaches to dealing with national security, governments have often attempted to bolster specific sectors that are seen to be essential and tied to defense related concerns. Instruments that they use include the subsidization of specific industries, or the use of trade measures (such as quotas on oil, as noted above), and government procurement. As noted, as in the oil case, the government may end up helping industries to the detriment of national security despite industry claims to the contrary.

In terms of international negotiations, the U.S., among others, has often aggressively use trade instruments to help particular sectors. For example, in 1986, both because of

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<sup>54</sup> See the discussion by Mastanduno (1991) who examines U.S. negotiations with Japan in response to its industrial policies in the high tech sector.

pressure from the Semiconductor Industry Association and widespread concerns about the security implications of this sector, the U.S. signed a semiconductor agreement with Japan. This accord guaranteed U.S. producers a 20 percent market share in Japan, and came in the wake of U.S. antidumping actions against Japan.<sup>55</sup> More recently, the EU has contemplated bringing trade cases to the WTO against China in view of its industrial policy efforts to bolster its solar and wind power industries. As the head of EU Trade Commissioner Karel De Gucht's cabinet noted "They want their industry to grow. They invite US and EU companies in. They loosely interpret intellectual property rules, then they produce the technology more cheaply themselves and close the market."<sup>56</sup>

Intervention to help specific industries, be they for defense industries or other sectors, is thus likely to create conflicts with trading partners. Although the countries can take international actions through unilateral, bilateral, or multilateral approaches, there is always the danger of retaliation. Particularly in dealing with large trading partners, both the state and industry lobbies must weigh the costs and benefits of aggressive action.

### *Empirical Indicators*

In terms of indicators, one would expect to see expressions of concern by either government official or interest groups that link intervention to security concerns. If the pressures are coming from below, then one might assume that this is more of a rent seeking effort by industry groups (see the next section below), rather than a state led efforts. In terms of outcomes, some growth of the industry with clear connections to

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<sup>55</sup> See Irwin (1996) on this case.

<sup>56</sup> EurActiv (2012), p. 1.

military applications would at least provide some evidence that intervention had an effect on the industry.

With respect to international negotiations, here the focus is both on top down or bottom up pressures to address the behavior of trading partners. This could take the form of policy statements, testimony, or other such actions, which would reflect either government led or industry led calls for action. Subsequent negotiations over dealing with specific industry issues and the outcomes of any possible ruling in a multilateral forum or bilateral accord would point to the importance of a government role in the industry in view of international considerations.

### **Rent Seeking**

As already indicated, although the focus to this point has emphasized state led efforts to intervene (with the exception of international negotiations), it is common for industries to attempt to lobby the government to secure benefits that may have little to do with market failures or security considerations. This type of behavior has generally been referred to as “rent seeking” behavior, as firms are able to decrease competition by undermining possible competitors.

#### *Rent Seeking as a Motivation for State Intervention*

Firms are generally eager to avoid competition. The motivation is simple. With fewer competitors, either domestic or international, profits are likely to increase. Thus, firms are likely to use a host of non-market strategies to benefit themselves as opposed to solely

focusing on market strategies to improve their competitiveness.<sup>57</sup> In terms of tactics, the most common approach has been to lobby by framing the debate in terms of national security (as noted previously), or health and safety concerns and also use a grassroots approach to generate pressure. The Korean agricultural sector has publicized these health problems by appealing to the press, summoning images of infected Pul-Kogi, a common Korean dish of barbecued beef. In addition, a candlelight vigil held in May of 2008 drew 2,500 protesters after the ban on beef was lifted.<sup>58</sup> Other tactics include direct lobbying of the government, testimony at hearings, legal strategies, and electoral efforts. These kinds of approaches can result in policies that have little to do with market failure or genuine security considerations, and the outcome can be trade, regulatory, or other such measures.

#### *Responding to Domestic Lobbying and Possible Problems with Intervention*

In reviewing different motivations for state intervention to assist particularly industrial sectors, time and again analysts have noted the importance of understanding state structures. Put succinctly, state intervention *per se* is less controversial than questions about the varying ability of countries to design and implement such policies. Here, there is a vast literature that examines the abilities of state to resist being captured by lobbies. Some have distinguished between strong and weak states,<sup>59</sup> arguing that the former are better able to resist lobbies because of the nature of their bureaucracies or their insulation from political pressures. Haggard summarizes many of the debates on state ability to resist

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<sup>57</sup> On non-market strategies and tactics, see Baron (2011).

<sup>58</sup> Fox News (2008), p. 1.

<sup>59</sup> Katzenstein (1977), p. 879-920.

lobbies, focusing on the so-called “varieties of capitalism literature.”<sup>60</sup> For example, focusing on the work of Chalmers Johnson, he notes that ideology may help drive state interests and also as a consequence, make such officials more resistant to rent seeking lobbies. Another line of thought focuses on the importance of external threat in ensuring that governments do not simply become captured easily. The case of South Korea and the existence of a threat from North Korea allowed the South Korean state to ensure economic efficiency. Finally, he points to the possibility of business-government partnerships that may provide some specific benefits to industry in exchange for efficient market behavior and a willingness to eschew excessive rent seeking.

### *Empirical Indicators*

In ascertaining whether government responses are driven from below or above (or some combination), simply looking at actual instruments used by the government such as tariffs, quota, or the like is not helpful. As Table 1 shows, the instruments that are used *do not* directly correlate with the motivation for intervention. Thus one cannot work backwards from the intervention observed to ascertain the driving forces for state policy. Instead, the key here is to consider the policymaking process, and look at the strategies and tactics used by industry groups as they attempt to secure favorable outcomes. In terms of outcomes, one might be more likely to see poorer performance in terms of efficiency if the pressure for intervention comes from below and is mainly driven by rent seeking behavior than such motivations as market failure or security considerations.

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<sup>60</sup> Haggard (2004), pp. 70-74. This work summarizes the work of several scholars writing on these issues.

## **State Intervention to Address Previous Government Failures**

Intervention is generally not a one-shot deal. Even under the ISI “License Raj” in India, the government made efforts made at times to adjust its policies in light of perceived government failures. As governments revisit the outcomes of their policy efforts, they may choose to change the forms of intervention or remove previous instruments that they had utilized to favor a particular sector. For example, a policy failure that the state faced in the Indian software industry was high import tariffs on hardware products, which led to higher costs for software developers. To respond to this failure, the state could have removed the tariffs, but faced endangering India’s hardware manufacturing industry. The other solution was to offset the price distortion caused by such tariffs, and either make software firms exempt from paying these tariffs or create tax breaks to reduce costs in other areas.

### *Government Policy Failures as a Motivation for State Intervention*

The broadest criticism of government failure in efforts to promote industrial policy has generally focused on the problems of ISI.<sup>61</sup> As countries attempted to develop their industrial sectors, their agricultural sectors became increasingly uncompetitive. In addition, with an inward focus, and an uncompetitive exchange rate, countries ran into balance of payments difficulties. In addition, the fostering of SOEs often led to inefficiencies and a major financial sinkhole as these large companies were able to engage in political action to secure ongoing funding, rather than meet market criteria to succeed. The most critical concern with ISI was despite Prebisch’s view that firms should only be given

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<sup>61</sup> Kingstone (2011) provides an overview of the problems generated by ISI.

temporary protection, the political dynamic led to lobbying by these companies to retain their protection to avoid facing global competition.

A second motivation for changing the form or intervention (or removing it altogether) comes from Pack and Saggi. They note that their “review of arguments suggests the enormous difficulties of implementing industrial policies quite apart from the possibilities of rent-seeking.”<sup>62</sup> Essentially, they argue that while in principle addressing market failures (their primary focus) may be useful, in practice governments simply do not have the knowledge to deal with the host of possible problems and choosing the correct industries to promote. As they critically note, “the sheer knowledge and skill requirements would exceed that possessed by any institution, including the best consulting firms.”<sup>63</sup>

Part of the reason for the liberalization efforts, then, were driven not just by the evident debt problems that Latin American faced in the 1980s, and India and others faced in the 1990s, but also an evolving ideological consensus that ISI had reached its limits and that economic liberalization would be a far more beneficial approach to promote economic growth. Still, as the neoliberal approach of the Washington Consensus faced its own set of economic challenges, scholars such as Dani Rodrik, Robert Wade, and others advocated a more nuanced approach to state intervention than heavy-handed ISI.

### *Responding to Government Failure and Possible Problems with Changing Intervention*

Proponents of market intervention such as Robert Wade recognize the danger of clientelism as a form of government failure. To respond to these concerns he notes that the state should impose performance conditions on industries in which it intervenes. These

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<sup>62</sup> Pack and Saggi (2006), p. p. 281-2.

<sup>63</sup> Pack and Saggi (2006), p. 282.

conditions can range from success in export or import replacement, reducing the gap between international and domestic prices, or increasing the ratio of local content in products.<sup>64</sup> More specifically, Wade outlines four conditions for ensuring effective state-business alliances. He goes on to argue that state and business groups should be evenly balanced to prevent corruption or from one institution taking advantage of the other. The second is for public officials to operate with “an activist, public service oriented mindset,” rather than the pervasive “do no harm” attitude that leads to indifference. Wade’s third condition for ensuring effective state-business development policy is to bifurcate political and administrative structures. The purpose of this separation is to allow political patronage to be provided through those channels without interfering with economic agencies. The final condition is that the state officials involved in promoting private firms must not have significant discretionary control over public resources.

Dani Rodrik agrees with Wade on the need to reduce government failure in industrial policy by ensuring a collaborative environment between government and the private sector. Such collaboration can include “deliberative councils, supplier development forums, investment advisory councils, sectoral round-tables or private-public venture funds.” Rodrik echoes Robert Wade’s condition of a performance-based industrial policy, stating that both carrots and sticks must be present. Rodrik goes one step further than Wade in arguing that these principles must apply to all state efforts to promote new industries, and that government incentives “need to be temporary,” as well as based on performance. Should periods of heavy state involvement be understood to be short-term, firms will have incentives to pursue internal long-term growth or perish once such policies

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<sup>64</sup> Wade (2010), p. 157.



end. Finally, Rodrik addresses the argument that governments may fail to pick winners. As he notes, however, is not a problem—after all, mistakes are always made. The key is to let the losers go and withdraw support before these firms or industries take a toll on the government.<sup>65</sup>

As noted, while some advocate a different approach to government intervention, others call for a transition to a more market based economy and removal of government support for industry to allow firms to become globally competitive. But transition has not been easy. Threats to remove protection from firms encourage them to engage in active non-market strategies to block such change.<sup>66</sup> Even if strong governments are able to remove protection, the rapid influx of foreign goods can undermine firms that have not yet been able to become competitive. Privatization of state assets also comes with a set of dangers, as politically connected entrepreneurs are able to secure state assets at well below market prices. Indeed, this has been the experience of Russia in many sectors where state assets have been privatized, and the result has often been a creating of private oligopolies instead of genuine market competition. Russia is hardly along on this score. In March 2012, the Congress Party (the ruling party) faced criticism for having sold coal assets to favored industrialists for well under market prices, an action that some estimated to be a cost of US\$210 billion in foregone revenue for the government.<sup>67</sup>

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<sup>65</sup> Rodrik (2010).

<sup>66</sup> See the discussion of the problems of neoliberal transition by Kingstone (2011).

<sup>67</sup> *The Financial Times* (2012), 1.

### *Empirical Indicators*

Gauging the extent to which government failure provides a motivation for subsequent intervention is somewhat easier than discerning the specific motivations for initial policy choices. Generally, some over criticism of existing policies is likely to be noted widely, either by academics, industry lobbies, or by government officials who wish to promote change themselves. Further gauging the effect of liberalization policies, however, is fraught with some of the same difficulties that one faces in ascertaining the benefits of intervention. Any effort to specifically relate policy changes to industry performance can always be challenged by an inability to create a fully controlled counterfactual experiment. Still, it may be possible to related particular changes in industrial performance to policy changes, taking into account these concerns.

### **Conclusion**

The goal of this section has been to survey and systematically categorize analytical approaches to understand industrial policy. To this end, the first section considered the broad scale intervention efforts of ISI, an effort to fundamentally shift developing country's economic structures from an agrarian or commodity focus to an industrial one. The underlying motivations of this policy, as well as the instruments used, the problems that ISI faced, and the difficulty of transition to a neoliberal model or a different type of intervention has been the subject of voluminous writing. Using this literature as a starting point, the section then focused on the newer industrial policy literature.

To categorize and make the many theoretical elements analytically tractable for the exploration of the government intervention in India's software industry that follows, Table

1 sought to categorize four major approaches to understanding intervention, discussed seriatim in each section. These include a market failure rationale, national security and international concerns, rent seeking, and state intervention to address perceived previous governmental failure. By looking at the claims of each approach with respect to the specific elements that constitute the overall rationale for intervention, as well as attention to the instruments and possible problems that intervention might generate, this overarching schemata clarifies the key differences among contending approaches. Finally, a key task for empirical analysis is to allow one to distinguish among these approaches—although in many cases more than one motivation is likely to be at work.

### **III. THE INDIAN SOFTWARE INDUSTRY**

Section 2 developed a discussion of theoretical rationales for government intervention, focusing on possible motivations, instruments, potential conflicts that may arise from the use of such instruments, and empirical methods of gauging different motivations and outcomes in terms of industry impact. This section examines the rationale and approach to state intervention in the Indian software industry, with an eye to ascertaining the role of the government in the evolution of this sector.

To this end, Section I begins with an overview of the origins of the global software industry as well as an examination of different types of products within the software sector. In subsequent sections, the section provides a decade-by-decade analysis of state intervention in this industry. Each section is structured similarly. First the specific rationale for state intervention is detailed to differentiate among possible driving forces. Then the policymaking process (to the extent that this can be determined) is examined.

Before considering potential problems that might arise with such policies, the section considers the impact that each policy choice had on the industry.

To anticipate the findings, of the different rationales for state intervention adduced in Section 2, market failures and government policy failures appear to be the most common underlying rationales for intervention. Security concerns also were an important issue at the beginning of the 1960s as the state promoted the IT and software industry to develop a competitive military, an important concern in view of the ongoing hostilities that India faced with Pakistan. International concerns become a greater area of interest in the 1980s and 1990s as India began to feel pressure from the WTO and the United States to liberalize its economy as well as to adhere to international intellectual property rights standards. Finally, private sector lobbying remained minimal until the 1980s, when the National Association of Software and Services Companies (NASSCOM) was founded. Subsequently, NASSCOM played an increasing role in representing private interests and lobbying the state for greater liberalization in certain areas as well as in encouraging intellectual property reform.

### **The Origins of the Global Software Industry**

In 1969, IBM became the first independent software vendor. It decided to separate its mainframe operating system, hardware, and application-based software.<sup>68</sup> Previously, companies had designed both mainframe computers as well as the programs that went along with the hardware. Firms moved from developing their own software to outsourcing system integration and customization to increase their internal efficiency.

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<sup>68</sup> Dossani (2005), p. 9.

By the 1980s, software became fully independent from hardware, allowing buyers to purchase a computer designed by one firm and software designed by another. Because of this separation, programming was no longer concentrated in areas where hardware was manufactured, but could be designed and purchases from anywhere in the world.

To clarify the industry segment examined here, a few notes on the various classifications that exist in the software industry are useful. There are three types of software, classified by usage: system-level software, which encompasses programs that manage the internal operations of a computer, tools software, which increase the effectiveness of applications, and applications themselves, which deliver solutions (for instance, word processing programs or data entry programs).<sup>69</sup> System-level software manages the interfaces with hardware as well as higher-level software, and is often the most complex. By contrast, applications and tools software are relatively uncomplicated because of their singular purpose.

These various types of software can either be used in their original forms across a broad user-base, defined as a “software product,” or can be customized for an individualized purpose, which is classified as “custom software.” Examples of customized software include salary software for specific firms, individualized data entry programs, and many others. The analysis here focuses on all types of software.

### **Indian Software and Government Policy: 1960s**

The decade of the 1960s was marked by the origins of India’s technology industry, which emerged after the global electronics revolution and in the context of the 1962 war with

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<sup>69</sup> Dossani (2005), p. 7.

China. Following this conflict, the government played an active role, initially because of security concerns, and then in an effort to address perceived market failures.

### *Security Concerns*

The Indian government encouraged the development of the computer industry initially for defense industry needs, and sponsored research in astrophysics, space, artificial intelligence, basic sciences, computer simulation, and mathematical modeling.<sup>70</sup> The precipitant for government interests came from the border war with China in 1962, which shocked Indian elites. The Chinese successfully overran Indian positions and could have continued with ease, but chose not to do so, instead declaring a unilateral ceasefire.<sup>71</sup>

Following the war, the Government of India sought to develop a strong indigenous electronics base for security and national development. It created an Electronics Committee, chaired by renowned nuclear scientist Dr. Homi J Bhabha. In 1966, the Bhabha committee called for using computers as a means to “develop a new outlook and a new scientific culture” and called for creation of a National Computer Centre and five regional centers. By 1970, the government had a Department of Electronics to foster further development of this sector.<sup>72</sup> In its efforts, India specifically sought to create a self-sufficient electronics and then computing industry, but one that would be able to glean the latest techniques and research—a reaction to the view that foreign companies were providing India with obsolete technology.<sup>73</sup>

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<sup>70</sup> D’Costa (2009).

<sup>71</sup> Global Security (2012), p. 1.

<sup>72</sup> Grieco (1984), Section 2.

<sup>73</sup> Grieco (1984), Section 2.

### *Market Failure: Dynamic Scale Economies*

Given the relatively undeveloped software and IT industry in the 1960s, the state worked to promote technical industries. In order to create a labor force to encourage the growth of such sectors, the state established seven Indian Institutes of Technology (IITs). Several of the IITs were set up with foreign collaborating institutions. These institutes, which were highly competitive engineering institutions based on national competitive examinations. The IITs focused primarily on undergraduate training, creating a highly educated workforce based on a combination of excellent students and an intensive educational curriculum. These students went on to help India's comparative advantage in the software industry.<sup>74</sup> The institutes were heavily subsidized and merit-based.<sup>75</sup>

Even scholars who argue that India's software dominance was in no part due to the state's involvement acknowledge that the industry's competitiveness was a result of a low cost, highly educated engineering workforce with strong English abilities.<sup>76</sup> State subsidization of tertiary educational institutions included not only these IITs, but also local engineering colleges that would later be crucial in creating a labor force well versed in mathematics and engineering.<sup>77</sup> Whether or not these educational programs were intentionally designed to promote the software industry specifically is unclear, but such programs would later prove essential as the software industry developed further.

India's intention to lead to the market through nurturing its infant software industry can be seen from the 1968 Electronics Committee Group recommendations to promote the IT and software industry in exports. Such goals were hindered by the state's import

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<sup>74</sup> Patibandla, Kapur and Peterson (2000), p. 1263.

<sup>75</sup> Balakrishnan (2006), p. 3870.

<sup>76</sup> Patibandla and Petersen (2002), p. 1561.

<sup>77</sup> Patibandla, Kapur and Petersen (2000), p. 1265.

controls on hardware. Although these two policies may seem contradictory, the intentions behind each was to develop India's IT and software industry without creating competition through cheaper, more developed imports from multinational corporations. As this strategy was later shown to have harmed the software industry, the government slowly reined back these policies as the software industry became stronger in exporting overseas, and therefore, became better prepared for international competition.

### **Indian Software and Government Policy: 1970s**

India's economic policy in the early 1970s, which is when the software design industry began to emerge, was largely protectionist and highly regulated. The first Indian software firm, Tata Consultancy Services (TCS), though founded in 1969, began producing software for export in the early 1970s.

The state became the greatest producer of products and services in the software industry, and created several early monopolies in product production to address the dearth of software production firms. The result of these "national champions" was insignificant output and a labor force "of dubious quality." Given India's relative lack of experience in IT marketing and product design, products made by Indian engineers were unsuccessful. Despite failure in the product arena, Indian software engineers became globally renowned because of their high level programming skills that were offered at a low cost.

Early protectionist policies hindered innovation within the software industry, but high-level skills entered the industry because of programmers who completed overseas jobs. Indian engineers went abroad to work "bodyshopping" projects, came back with new



education/technology.<sup>78</sup> The primary tasks of these newly established firms were simple and required low project finance. These firms included software engineers who were sent out of India to client bases, returning Indian engineers who had advanced engineering skills and often founded these new firms, and foreign companies that were some of the first offshore clients.<sup>79</sup> The advent of workstation-based programming and standard operating systems replacing mainframe-based programming and manufacturer-specific operating systems led to an increased interest in outsourcing software design.

The reasoning behind such protectionist policies was the state's desire to foster India's nascent software industry, which led to the Foreign Exchange Regulation Act (FERA) of 1973, in one of the major policies that impacted the development of the software design industry. By 1974 Burroughs asked Indian company Tata Consultancy Services for programmers to install system software. Programmers would leave India and work for global IT firms, and by 1980, there were 21 Indian software firms with an average annual export revenue of US\$4 million.<sup>80</sup>

Despite the success of early software firms in India, many argue that the state was hostile toward the industry. In attempting to protect India's nascent software industry, the Indian government imposed a 100 percent import tariff on software, and refused to allow any overseas sales offices until 1979.<sup>81</sup> Protectionist policies hindered the development of the domestic software industry, which led to several highly skilled Indian engineers leaving the country to work on-site for overseas projects and not returning home, seeking foreign

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<sup>78</sup> Balakrishnan (2006), p. 3868.

<sup>79</sup> Dossani (2005), p. 15.

<sup>80</sup> Dossani (2005), p. 19.

<sup>81</sup> Dossani (2005), p. 19.

work instead. In addition, several Indian workers simply emigrated to the United States, avoiding Indian firms altogether.

### *Responses to Government Policy Failures*

Due to the tedious foreign exchange procedures that hindered export growth, the Indian state worked to liberalize its software policies at the beginning of the 1970s.<sup>82</sup> Through providing faster clearance of software export applications, as well as establishing export incentives such as Export Processing Zones, the government promoted greater growth within the industry to target foreign markets, and software exporters were able to take advantage of such initiatives.<sup>83</sup>

### *Dynamic Scale Economies*

One of the primary obstacles faced by domestic firms was the lack of financing for small firms.<sup>84</sup> To respond to this lack of investment, which hindered access to technology, the 1972 Software Export Scheme was launched, which allowed hardware imports at low tariffs for software exporters.<sup>85</sup> The availability of such goods enabled new software firms to gain access to the means to develop their products at a lower cost, which aided early growth in the software industry. These initiatives additionally ensured that the software industry was not subject to industrial licensing policies, which reduced additional potential costs that such firms would have faced.<sup>86</sup>

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<sup>82</sup> Athreye (2005), p. 9.

<sup>83</sup> Athreye (2005), p. 10.

<sup>84</sup> Dossani (2005), p. 19.

<sup>85</sup> Patibandla, Kapur and Petersen (2000), p. 1265.

<sup>86</sup> Patibandla, Kapur and Petersen (2000), p. 1265.

*Infant industry protection.* One of the most notable policies of the 1970s designed to address the failure of dynamic scale economies and foster India's infant software industry was the Foreign Exchange Regulation Act of 1973. FERA limited foreign firms from operating in India by demanding that these companies could only have a minority interest—less than 40 percent of ownership. This act drove out several major firms such as IBM, and resulted in the end of product software development by multinational corporations in India. The rationale behind FERA was to regulate foreign exchange outflows and to protect infant industries, limiting import dependence.

Although these efforts were generally ineffective across the board for Indian manufacturing, the software industry was an exception under FERA. Through targeted public funding and policymaking, the Indian software industry was able to avoid the clientelist pitfalls experienced by the automobile and textile industries.

FERA additionally led to the establishment of the Computer Maintenance Corporation (CMC), a public sector company that developed software and hardware for local and overseas markets.<sup>87</sup> Several thousand Indian engineers were employed by the company, which led to growth in the home market.<sup>88</sup> Domestic firms also began manufacturing hardware to address domestic demand, and had to develop the software for these goods themselves, which created a substantial domestic skill base for software.

CMC also created an extremely capable base of workers who often migrated to the United States to seek better employment opportunities in an open market. This led to a brain drain—software engineers who had previously worked for IBM left India because they felt that there were few domestic employment options. Others achieved the original

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<sup>87</sup> Lakha (1994), p. 391.

<sup>88</sup> Patibandla, Kapur and Petersen (2000), 1265.

intentions of FERA—the creation of domestic industry—and founded and developed their own firms, focusing on domestic clients. The Department of Electronics, as noted, which was created in the early 1970s by the Indian government, encouraged software vendor firms to serve the public sector. The department invested in public sector projects that were given to private firms, focusing on projects that had elements of software development. These public works projects would give priority to Indian software companies, fostering greater growth.<sup>89</sup>

Despite efforts from the state to provide work, however, the domestic market was difficult to access because of the wide income disparity in India that resulted in very limited access to computers, and thus, few domestic clients. As a result, these firms found greater success in exports instead.<sup>90</sup> These efforts also encouraged increased domestic R&D.<sup>91</sup>

One perspective is that the software industry flourished in spite of FERA, rather than because of it. Rafiq Dossani argues that although IBM's departure from India resulted in thousands of programmers who were free to work in smaller domestic firms, a forced exit was an extreme measure to promote India's own industry. In fact, IBM's exit may have hurt the software industry by precluding India from being a source of low cost labor when the software industry emerged in the mid to late 1980s. Additionally, the state's protectionist policies were purportedly intended not to foster growth in India's nascent industries, but to benefit state-owned enterprises.

Despite the common conception that government policies hindered the software industry's development, there has been much debate regarding the validity of these claims.

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<sup>89</sup> Basant (2006), p. 5.

<sup>90</sup> Basant (2006), p. 6.

<sup>91</sup> Balakrishnan (2006), p. 3868.

Arora and Athreye<sup>92</sup> discuss how state policies facilitated growth within the industry by implementing a *lassiez faire* approach to new firms. Others also argue that earlier government intervention policies that helped domestic firms without controlling each industry fostered a period of incubation for the software industry.<sup>93</sup> Indian firms had the benefit of protectionism, which allowed for software firms to develop without highly industrialized competition, while also not suffering from highly statist policies, which would have reduced the industry's autonomy.

Providing labor to overseas clients led to the development of a strong domestic labor force as well as expanded India's software brand power through starting at the lower end of the production process that grew more complex over time.<sup>94</sup> Although these positions were originally perceived as an under-utilization of Indian engineering abilities (these engineers referred to themselves as "cyber coolies"), the state viewed such an arrangement as a chance to increase Indian export earnings while protecting its infant industries.<sup>95</sup> Bannerjee and Duflo argue that this process was the most effective method of achieving client confidence, as reputation plays a major role in software contracting, even when considering the factor of cost.<sup>96</sup> As a result, India's early involvement in overseas contracting was a method of climbing up the value chain while procuring new information through work with multinational corporations without sacrificing domestic insulation.

Another method of addressing the issue of dynamic economies of scale and the lack of firm investment in human capital was the state's increased involvement in education.

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<sup>92</sup> Arora and Athreye (2002), p. 253-273.

<sup>93</sup> As discussed in Dossani (2005).

<sup>94</sup> Balakrishan (2006), p. 3868.

<sup>95</sup> Balakrishan (2006), p. 3868.

<sup>96</sup> Cited in Balakrishan (2006), p. 3868.

The government began offering software training courses at the IITs.<sup>97</sup> The government also sponsored several regional computer centers and subsidized tertiary education, emphasizing computer education.<sup>98</sup>

### *Agglomeration Effects*

Due to the dynamic scale economy obstacles facing the industry, such as a lack of capital and difficulties in procuring the resources necessary to develop firms to promote export, the state began implementing more incubatory policies to foster growth. One method to do so was through the promotion of greater educational resources, access to start up capital, and most notably, through Software Technology Parks (STP). In 1976, the Indian state of Karnataka established the Karnataka State Electronics Development Corporation, which promoted private enterprises through providing marketing, testing and development centers, and also through operating training centers. Karnataka also created the first STP, which created an early model of an incubation center for new software firms. The federal government later followed this model, and launched the Software Technology Parks of India Scheme in the late 1980s.<sup>99</sup>

### **Indian Software and Government Policy: 1980s**

Throughout the 1980s, under new Prime Minister Rajiv Gandhi, India reduced its import tariffs on software to 60 percent, allowed foreign firms to enter the Indian market, and created a chain of software parks to reduce infrastructure costs under his 1984 New

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<sup>97</sup> Patibandla, Kapur and Petersen (2000), p. 1265.

<sup>98</sup> D'Costa (2011a), p. 7.

<sup>99</sup> Basant (2006), p. 7.

Computer Policy. Foreign firms remained small due to high communications costs and expensive regulations, while domestic firms expanded and supplied modular software services, which led to software engineers working in India as opposed to going abroad. These employees were made up of graduates trained at the Indian Institutes of Technology. Educated in English, these software programmers were familiar with “main computer hardware systems, computer-aided software engineering tools, object-oriented programming, graphical user interface, and client networking.”<sup>100</sup>

### *Responses to Policy Failures*

Rajiv Gandhi’s 1984 New Computer Policy deregulated import licensing in India, which coincided with increased demand for software programming services. The state encouraged the import of hardware for the purpose of Indian software development, and took an export-oriented stance when it came to foreign investment. The result of focusing on software development was that Indian software engineers learned to program for PCs on operating systems that were popular across the world such as Microsoft and UNIX, which was based on Intel and Motorola chips. These systems were encouraged by the CMC and the Department of Electronics, which imported Unix source code.<sup>101</sup>

Ashok Soota of MindTree Consulting, a software firm in Bangalore, has remarked that the closed Indian economy was a plus because domestic firms emerged as hardware producers for Indian markets, and because of Indian government restrictions on imports, Indian firms had to develop their own software. The Indian industry began developing compilers, device drivers and operating systems and developed a strong domestic labor

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<sup>100</sup> Lekshman and Lal (1998).

<sup>101</sup> Basant (2006), p. 6.

base to produce software.<sup>102</sup> Indian software engineers' history of onsite services led to an ability to offer services from India.<sup>103</sup> After over ten years of onsite services, Indian firms had developed client confidence in their products, and were able to move up the value chain as the state slowly opened the market.

The Indian government further reduced tariffs on imported hardware and software to encourage foreign firm entry into the Indian market.<sup>104</sup> This policy further removed limits on capacity, which allowed greater foreign investment, liberalized imports, and provided incentives to computer manufacturers. Within a year of these policy changes, computer production rose by 100 percent in physical terms, and by 65 percent in monetary value.<sup>105</sup>

Multinational corporations began requesting in-house programming for software products, and although these projects were sometimes coordinated overseas, they began to be moved to India, which would lead to infrastructure costs, later addressed by the state. Because of increasingly liberalized imports, Texas Instruments and several other MNCs gradually entered India and utilized its strong work base.<sup>106</sup>

The 1984 New Computer Policy also made it easier to access foreign exchange and halved income tax exemptions. It also improved access to foreign exchange for software firms. Gandhi initiated deregulation for private business and liberalized imports and foreign investments, which led to an influx of multinational corporations who would often

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<sup>102</sup> Balakrishnan (2006), p. 3865

<sup>103</sup> Balakrishnan (2006), p. 3869.

<sup>104</sup> Dossani (2005), p. 4.

<sup>105</sup> Lakha (1990), p. 50.

<sup>106</sup> Basant (2006), p. 7.



partner with smaller Indian firms.<sup>107</sup> The Department of Electronics also allowed 100 percent FDI into the IT industry, which increased international investment in the industry.

Other policies included the foundation of Indonet, a government-sponsored project that was established to link cities through telephone lines as well as to create international gateway links to overseas networks. This program's objective was to create easier access to foreign markets. Similarly, Nicnet connected over 400 district capitals through an integrated government computer network in 1994.

The Indian government further established its commitment to promoting software in its November 1986 policy document "Policy on Computer Software Export, Software Development and Training." This document outlined the Indian government's goals, which included promoting software exports to gain greater global market share, creating an integrated development network, encouraging domestic growth through imports on computer hardware by encouraging foreign collaboration and investment. The basic objectives were to integrate the development of software for both national and export markets. In addition, the state sought to simplify procedures in order to accelerate growth, to establish a national software firm base, and finally, to increase the utilization of computers in creating more efficient government processes.<sup>108</sup>

The Indian state's initiatives on foreign collaboration and investment had previously been outlined in economic liberalization policies in 1984, but this policy also removed equity limits for fully export-oriented projects as to encourage multinational corporations to use domestic Indian engineering labor for these products.<sup>109</sup> The impact of these

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<sup>107</sup> D'Costa (2011a), p. 16.

<sup>108</sup> Lakha (1990), p. 49.

<sup>109</sup> Lakha (1994), p. 388.

policies was greater growth as liberalization enabled firms to have greater access to foreign markets as well as to foreign capital. In addition, the increase in hardware imports led to cheaper materials for software engineers, though the state had promoted policies that encouraged such imports for software developers for over a decade.

### *Agglomeration Effects and Coordination Failures*

Throughout the 1980s, several localized software industries emerged. Mumbai became the center of business, with seven of the eight top exporters headquartered in Mumbai with a 90 percent market share.<sup>110</sup> Domestic firms began creating modular software programs developed in India, focusing on programming. The relocation of work to India as goods were exported, rather than programmers sent overseas, led to greater domestic firm entry. As a result, the number of software firms in India jumped from 35 in 1984 to 700 in 1990.<sup>111</sup>

As the number of domestic firms grew, greater need for a developed physical infrastructure emerged. The Indian government promoted Bangalore as the center of software development because of its cheaper real estate (as compared to Mumbai). Bangalore was also chosen to be the center of the software industry in view of its low labor costs and its lack of union issues. Moreover, Bangalore already had established several educational institutes after independence from the British, and is well known for its Indian Institute of Science (established in 1909) as well as the engineering colleges in the

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<sup>110</sup> Dossani (2005), p. 19.

<sup>111</sup> Dossani (2005), p. 24.

surrounding four southern states (Karnataka, Kerala, Tamil Nadu and Andhra Pradesh), which altogether make up over half of India's engineering graduates.<sup>112</sup>

The region's high concentration of engineers enabled developing software firms to take advantage of research laboratories and institutes, which have since provided new ideas to improve product design. These linkages have been established primarily in the past decade, but still contributed to the region's dominance in the mid-1980s. Other advantages to Bangalore's geographical concentration are the creation of linkages and knowledge flows as a result of proximity between customers and suppliers.

In 1988, several software technology parks were established under the Department of Electronics of the Government of India under the Software Technology Parks of India Scheme. These parks were set up in Bangalore, Pune (adjacent to Mumbai), and Bhubaneswar, and were intended to attract small and medium sized enterprises through providing centralized air-conditioning, financial and marketing support, as well as loans on computers.<sup>113</sup> They provided 100 percent export-oriented firms a tax-free status for five years. These parks provided state-of-the-art facilities for software production, with expensive necessities such as high-speed communication channels that minimized the infrastructure costs that often hinder developing industries.<sup>114</sup> They also provided office space and computer equipment, access to high-speed satellite links, and uninterrupted electricity.<sup>115</sup> In addition, the Department of Electronics installed telecommunications equipment that allowed software firm clients to expedite export delivery, such as dedicated

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<sup>112</sup> Dossani (2005), p. 24.

<sup>113</sup> Pack and Saggi (2006), p. 288.

<sup>114</sup> Balakrishnan (2006), p. 3869.

<sup>115</sup> Athreye (2005), p. 10.

satellite links.<sup>116</sup> Foreign equity was also permitted for STP firms, with no restrictions on where the foreign firm was based.<sup>117</sup>

As a result of permitting foreign equity participation in the industry, FDI ) became a leading contributor to the growth of the software industry, particularly in Bangalore. The improved infrastructure led to Texas Instruments becoming the first foreign firm to establish an offshore base, and Bangalore continued to improve its telecommunications infrastructure. These improvements led to Bangalore becoming a more popular technology base, and several foreign companies established software sectors in the state. Small Indian firms also benefited from this software hub, as they had greater access to an “established distribution network and knowledge of recent trends in the software market.”<sup>118</sup> By establishing partnerships with major firms and selling packages through foreign collaborators, these small firms reduced their marketing costs, and were able to profit from such alliances. As Bangalore became a hub for domestic software firms, it also drew in Hewlett-Packard, Oracle, General Electric, and Dell.

Howard Pack and Kamal Saggi argue that because of the role that multinational corporations played in the development of technology in the software industry, the Indian government promoted India’s comparative advantage in the software industry, never needing protection. The establishment of Bangalore as a software hub did, however, involve the state, and although foreign contractors provided “the basis for international

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<sup>116</sup> Athreye (2005), p. 10.

<sup>117</sup> Basant (2006), p. 21.

<sup>118</sup> Pack and Saggi (2006), p. 289.

exploration of markets,” they were not the impetus behind the establishment of greater infrastructure in Bangalore.<sup>119</sup>

### *Private Sector Lobbying*

In May of 1988, the Indian government formed an IT task force to increase greater competitiveness in response to the creation of the National Association of Software and Services Companies (NASSCOM).<sup>120</sup> The IT task force also encouraged preferential procurement for Indian firms on major projects and additionally imposed a duty on imported software.<sup>121</sup> The impact of this legislation was unclear, as several liberal reforms took place in the early 1990s in regards to the software industry.

### **Indian Software and Government Policy: 1990s**

By the early 1990s, foreign software outsourcing firms established Indian bases, and began commissioning design and engineering work. Intellectual property reforms led to more foreign venture capital entry into increasingly sophisticated product development firms, which led to greater product differentiation.<sup>122</sup>

The catalyst for growth in the Indian software industry was the Y2K crisis at the dawn of the new millennium. There was a global shortage of programmers, so Indian software engineers were hired by U.S. firms to provide short-term services. From 1996 to 1999, the Indian software sector earned US\$2.5 billion as a result of Y2K programming

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<sup>119</sup> Pack and Saggi (2006), p. 289.

<sup>120</sup> Moitra (2001), p. 79.

<sup>121</sup> Athreye (2005), p. 13.

<sup>122</sup> Dossani (2005), p. 5.

alone. In 1988, Indian software exports were under US\$2 million, but by 1998, exports had increased to US\$3.6 billion and made up over ten percent of all Indian exports.<sup>123</sup>

The European Union's move to the Euro in 1999 further benefited the Indian software industry, and many Indian engineers were commissioned to help adapt databases and computer systems to the euro. The Indian software sector made US\$3 billion alone from Euro-related IT projects.<sup>124</sup>

From the 1990s to the early 2000s, the Indian government further liberalized its economy under new Prime Minister Narasimha Rao. Further legislation standardized foreign ownership, which led to more companies moving their offices to India, particularly in Bangalore. By 2000, India's software export share for total exports was 16.3 percent, over eight times the 1.9 percent it had been in 1995.

### *Responses to Policy Failures*

Under Narasimha Rao, import tariffs, which had previously been disproportionately high compared to other countries, dropped to nearly nothing. Duties on imports dropped from 110 percent before liberalization to ten percent in 1995, and were finally eliminated in 1997. Software exporters were also exempt from income taxes, which led them to a greater focus on the international market.

Prime Minister Rao initiated domestic economic reforms in 1991, which created greater opportunities for Indian exports. The openness policies reduced Indian dependency on domestic hardware, which led to even greater competitiveness as Indian

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<sup>123</sup> Pack and Saggi (2006), p. 287.

<sup>124</sup> Pack and Saggi (2006), p. 287.

engineers were able to rely on cheaper material imports.<sup>125</sup> The ensuing increase in the use of an offshore model led to client confidence, which increased the caliber of software programs in India as more companies relocated under the new economic policies.<sup>126</sup> The devaluation of the rupee further benefited Indian software exports by making them more competitive with international products. Finally, in 1995, the state liberalized hardware import duties and loans, which encouraged foreign firm entry, which led to higher demand for Indian software engineers and ultimately increased their wages.

### *Dynamic Scale Economies*

Small software firms struggled to compete internationally because they were unable to afford high-speed communication links to transmit packages and communicate with clients aboard. This critical failure was the result of a market breakdown in which these firms lacked the means to create a communicative infrastructure. In order to address these conflicts, the state increased low-cost access to Internet through expansion of STPs throughout the 1990s.<sup>127</sup> They provided high-speed Internet, facilities, and electricity, as they had previously.<sup>128</sup> Firms based in technology parks continued to receive a 100 percent tax holiday if they are primarily exporters.<sup>129</sup> The state also set up an exclusive satellite international gateway for export-oriented software firms in 1992.<sup>130</sup>

Small firms also lacked the domestic investment necessary to promote exports due to inexperienced and conservative Indian venture capitalists, and the lack of firm experience in attracting foreign investors. Private financial institutions have been slow to

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<sup>125</sup> Patibandla, Kapur and Petersen (2000), p. 1266.

<sup>126</sup> Balakrishan (2006), p. 3869.

<sup>127</sup> Athreye (2005), p. 8.

<sup>128</sup> Balakrishan (2006), p. 3869.

<sup>129</sup> D'Costa (2009), p. 639.

<sup>130</sup> Basant (2006), p. 7.

enter the software industry, which led to a lack of capital within the industry.<sup>131</sup> To address this dilemma, the Indian government provided venture capital through public-sector financial institutions.

*Human Capital.* The gamble that India had taken on developing its educational institutions in the 1960s paid off by creating a strong workforce that had grown immensely successful worldwide. In 1998, Indian engineers were running over 775 tech companies in the United States. A great number of these engineers returned to India after economic liberalization, and more importantly, outsourced software projects back to India, thus building up the domestic Indian software job market.<sup>132</sup> Many of these immigrants also returned to India to head MNC operations in Bangalore and other areas. Given the high number of Indian workers at these firms, companies such as Yahoo, General Electric, and others have relied on Indian engineers because of their faith not only in Indian offshore workers that completed projects in the 70s and 80s, but also because Indian immigrants now worked for them, and had shown themselves to be extremely competent.

To perpetuate such successful policies and target the software industry through cultivating human capital, three new Indian Institutes of Information Technology were set up,<sup>133</sup> and the government created IIIT Bangalore and Hyderabad, two key IT cities.<sup>134</sup>

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<sup>131</sup> Patibandla, Kapur and Petersen (2000), p. 1265.

<sup>132</sup> Basant (2006), p. 8.

<sup>133</sup> Athreye (2005), p. 21.

<sup>134</sup> D'Costa (2009), p. 636.



### *International Considerations/Market Failure: Coordination Failure*

One of the most effective steps in attracting foreign investment has been the state amendment of its copyright act in 1994, which led to NASCOMM taking an active role in enforcing heavier intellectual property legislation.<sup>135</sup> The enforcement of such legislation led to growth in the domestic market, resulting in 120 new software products in India from 1998 to 1999 alone.<sup>136</sup> In addition, as India became a member of the World Trade Organization in 1995, it shifted its policies to comply with the Trade- Related Aspects of Intellectual Property Rights (TRIPS). Although the Indian Patent Act of 1970 covered IT products, such policies were not effectively enforced. By complying with international standards, India's increased intellectual property protection not only aided the growth of domestic firms, but also increased venture capitalist recruitment from foreign firms.

#### **IV. WHAT IS NEXT FOR THE INDIAN SOFTWARE INDUSTRY?**

This section examines the current state of the software industry in India. It begins with a discussion of the policies that have impacted the Indian software industry for the past ten years with a focus on the motivations for state intervention. It then turns to current challenges that face both the government and the Indian software industry on both an international and domestic level, and considers potential solutions to these problems.

#### **Current State of Software in India**

In the past decade, the advent of the Internet has played an important role in the development of the software industry, revolutionizing the personal computer, and

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<sup>135</sup> Patibandla, Kapur and Petersen (2000), p. 1268.

<sup>136</sup> Patibandla, Kapur and Petersen (2000), p. 1269.

resulting in the need for a greater variety of software programs. In addition, having a connected system leads to lower data storage costs, as well as lower transaction and transportation costs for software design and development. The prevalence of smart phones has also created a new market for unique software programming, which has led to a great deal of innovation by software companies to cater to the needs of a broadening clientele.

India's software services export crossed the US\$4 billion mark in 2000, and went on to triple to US\$12 billion in 2005.<sup>137</sup> Indian exports have continued to expand, rising from 74.5% of revenues in the 2000-01 year to 78.9% in the 2008-09 year.<sup>138</sup> Total Indian software export revenues made up US\$46.3 billion in 2009.<sup>139</sup>

Of the 316 software companies in India, 85 software companies were assessed as SEI-CMM Level 5, the highest level,<sup>140</sup> compared to the 42 others worldwide.<sup>141</sup> The Indian software and services sector has grown to employ an estimated 2.2 million people as of 2008-09, as compared to the half million in 2001-02. The software industry also indirectly employs eight million people, which has resulted in an increased share of total employment.<sup>142</sup>

The Indian government has continued to liberalize its economy as well as to improve its infrastructure and educational programs.

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<sup>137</sup> Balakrishnan (2006), p. 3865.

<sup>138</sup> NASSCOM, (2009), Overall Performance.

<sup>139</sup> NASSCOM, (2009), Overall Performance.

<sup>140</sup> CMM (Capability Maturity Model) is a classification developed by the Software Engineering Institute at Carnegie Mellon University that considers maturity levels, and is used by the U.S. Department of Defense. Level Five firms are capable of controlling, managing, and improving software developing practices. (Arora and Athreye (2002), p. 261.)

<sup>141</sup> Balakrishnan (2006), p. 3865.

<sup>142</sup> NASSCOM, (2009), Employment.

### *Response to Past Policy Failures*

The Ministry of Information Technology, formed in 2001, has worked to simplify policies and procedures as well as improve infrastructure.<sup>143</sup> The government has further eased regulations and created greater mechanisms for raising and accessing capital, which has led to even lower barriers of entry for software firms.<sup>144</sup>

### *Dynamic Scale Economies*

The state has continued to sponsor tax exemptions for software firms, which has provided the industry with a strong global competitive advantage and additionally reduced operating costs. In fact, N. R. Narayana Murthy, founder of the Indian software giant Infosys, has recommended that the tax be lifted as the industry has matured past the point of requiring such benefits.<sup>145</sup>

The state has also worked to increase the flow of capital to new firms, both within India and internationally. The Ministry of Information Technology along with the Small Industries Development Bank of India has additionally created a US\$50 million fund to provide capital to Indian entrepreneurs in Silicon Valley.<sup>146</sup>

### *Market Failures*

*Agglomeration effects.* India's southern states have dominated the Indian software market due to greater human capital investments. This uneven development has led to concerns over income and educational inequalities. Although educational institutions have

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<sup>143</sup> Moitra (2001), p. 79.

<sup>144</sup> D'Costa (2002), p. 220.

<sup>145</sup> D'Costa (2011a), p. 7.

<sup>146</sup> D'Costa (2002), p. 220.

expanded throughout the past several decades, the majority of the population remains unable to access higher education. Interestingly, northern India has faced greater conflict in transitioning to a more industrialized area because of the caste-based and predominately Hindi-only-speaking population. In the South, “anti-Brahmanical social and political movements have broken the stranglehold of dominant caste monopoly on modern education.”<sup>147</sup>

*Imperfect information.* India’s focus on exports to the U.S. market has led to the Indian software industry being tied to U.S. demand. These ties led to a drastic drop in demand after of the dot-com crash in the early 2000s. Following this demand crisis, the Indian government created policies allowing private investment in telecommunications passed so firms could tap in to European, Japanese and African markets.

*Information externalities.* One of the greatest challenges that the Indian software industry has faced, particularly when it comes to product design, is the lack of incentive to innovate. Given the low enforcement of intellectual property, Indian software developers often focus more on leveraging their skills rather than creating new products. This is becoming particularly common given the “public goods” perspective of several software tools, as many programs are available online for free, and thus, do not create profits. As a result, Indian software firms devote a relatively low proportion of revenues to research and development as compared to U.S. firms. Microsoft, Novell and SAP allegedly spend 14-19

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<sup>147</sup> D’Costa (2002), p. 217.

percent of revenue on R & D,<sup>148</sup> while Indian firms spend about 3 percent of revenue on the same.<sup>149</sup>

### *International Considerations*

Since the 2005 ratification of the WTO Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement, India has increased legislation to control intellectual property violations. Although this was a minor setback for firms that focused on copycat products, such as the pharmaceutical industry, it has aided the Indian software industry in increasing the value-added of their products and services. Such legislation has not only fostered the development of innovation within India, but also led to greater international investment into the Indian software market.

## **Challenges for the Indian Software Industry**

### *International*

Currently, the Indian software industry faces several new challenges. First, India has come under fire internationally for several years for its failure to uphold WTO regulations in intellectual property and in reducing barriers to trade through the elimination of tariffs and quotas. Such criticism has been quelled in the past few years given India's 2005 ratification of TRIPS, as well as the gradual liberalization of the Indian economy. Yet going forward, if the government chooses to actively intervene in some fashion, the measures it sues will come under scrutiny. Second, with respect to labor issues and outsourcing, in 2010, the United States implemented a visa fee for short-term stays to fund increased costs under the Border Security Act. This law has impacted Indian

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<sup>148</sup> Kumar (2001), p. 4288.

<sup>149</sup> Moitra (2001), p. 79.

software firms who send engineers overseas to the United States on short-term contract, and resulted in India launching a complaint against the U.S. in the WTO.<sup>150</sup> The two governments are currently in “consultations”—the last step before a full-fledged legal case in the WTO. Third, one of the greatest international challenges that will face the Indian software industry is the rise of China, and possibly Russian and Ukraine. China has started investing in their engineers’ English skills, which could challenge India’s strong human capital force. India still has the advantage of strong ties to foreign markets, however, particularly given the rise of Indian entrepreneurs in Silicon Valley.<sup>151</sup>

### *Domestic*

At the domestic level, the industry also faces a host of new challenges, some a legacy of the industry’s and government’s development strategy. Although the state has made efforts to improve Indian infrastructure, software firms still face challenges when attempting to expand their businesses. Given the relative lack of availability to power and telecommunications, firms have struggled to increase the complexity of their projects due to such high costs—in fact power is the second highest expenditure for software firms, many of which generate their own power.<sup>152</sup>

The high volume of Indian software engineers who migrated to the United States played a major role in the development of the industry in India. By 1998, nine percent of high-tech firms had Indian CEOs, which led to greater awareness of Indian talent in software as well as led to increased venture capital investment for India. Currently, a large

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<sup>150</sup> *Zee Business* (2012), p. 1.

<sup>151</sup> Arora and Athreye (2002), p. 260.

<sup>152</sup> Arora and Athreye (2002), p. 259.

proportion of Indian engineers are still interested in emigrating to the United States, which has led to an increasing shortage of software engineers in India. This is in part due to the fact that salaries for engineers remain relatively low compared to those in the United States. Still, the average revenue per employee has risen from US\$16,000 per year throughout the 1980 and 1990s to US\$32,635 in 2000 in India.<sup>153</sup> As salaries continue to increase, there may be a reduced brain drain from India.

One of the greatest challenges that the government will face in the next several decades is the widening economic gap in India. Despite increased urbanization, 70 percent of the Indian population lives in rural areas. Although software engineer salaries have increased dramatically, an estimated 70 percent of the Indian population lives below the poverty line, and India's literacy rate remains far behind other industrializing countries at around 50 percent.<sup>154</sup> If India's software success can diffuse to increase the competitiveness of other industries, the industry may be able to in improving the lives of the broader population. One example of such possible help has come in the initiative taken by Nandan Nilekani, one of the founders of Infosys, a major software company, who has successfully undertaken a project to provide Indians with ID cards that will help the government improve its delivery of social services and allow Indians to more easily open bank accounts.<sup>155</sup> Currently, the government is on course to have delivered 600 million Indians such ID cards, with an enormous database to keep track of them.<sup>156</sup>

The uneven regional and sectoral development in India's economy is one of the causes of poverty, but also will remain a challenge in justifying government investment in

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<sup>153</sup> Heeks (1996) and Nascomm (2004), p.23, 26, 64.

<sup>154</sup> D'Costa (2011a), p. 2.

<sup>155</sup> *New York Times*, June 26, 2009.

<sup>156</sup> *Times of India*, April 12, 2012.

the software industry. Because the software industry is made up of engineers who are predominately middle-class and well-educated, it creates greater social conflict within the country due to the relatively poor educational institutions in impoverished regions. State driven-liberalization has additionally dismantled “the few social safety nets that exist for the poor,” without endowing upon them the necessary skills to compete in an increasingly open market.<sup>157</sup>

The issues of poverty and uneven development are closely tied to another major problem facing the software industry, which so far has been a relatively smaller domestic market. This has led to further challenges for small and medium sized firms to increase the value-added to their products and services, particularly given India’s high dependence on exports.<sup>158</sup> Indian software firms’ reliance on the United States as an export market has led to lost opportunities in other arenas. In 2004, the United States was the recipient of two thirds of India’s software exports.<sup>159</sup> In addition many Indian students have gone overseas to the United States (100,000 annually), and many have elected to stay and work for American companies.<sup>160</sup> This focus on the United States has prevented India from taking advantage of other burgeoning IT markets. For instance, Japan’s largest IT segment is “customized software services,” which is the Indian industry has specialized in. Yet the two countries are reluctant to “conduct international outsourcing in general due to high transaction costs.”<sup>161</sup> This is also due, in part, to India’s unfamiliarity with Japanese language and cultural barriers.

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<sup>157</sup> D’Costa (2011a), p. 4.

<sup>158</sup> Arora and Athreye (2002), p. 257.

<sup>159</sup> D’Costa (2011a), p. 5.

<sup>160</sup> D’Costa (2011a), p. 6.

<sup>161</sup> D’Costa (2011a), p. 6.



The software industry, though strongly related to the growth of the IT industry, traditionally had few linkages with other sectors in the Indian economy.<sup>162</sup> As the software industry continues to grow, however, it will lead to an increase in the demand for marketing personnel and greater development in other service sectors, of which the recent ID card example noted above is positive example.<sup>163</sup> In fact, the salary for marketing executives has risen over the past several years, and created greater development in other service-based industries such as banking, finance, hotels, and retail trading.<sup>164</sup> The mobility of the software industry model could arguably be applied to other service industries, especially given the lower barriers to entry in these fields.

## **V. CONCLUSION**

This paper set out to determine the degree to which the state has played a role in the dramatic growth of the Indian software industry. Existing literature in the field has discussed state involvement, but by creating a unique framework in which to examine the impetus behind and the efficacy of state intervention, this paper presents a more systematic method of assessing the impact and necessity of disciplined state intervention.

After determining the four key rationales for government intervention that have been adduced in the literature, Section 2 classified the instruments and empirical indicators with which to determine the reason behind such involvement. From there, a systematic examination of government policy and its outcomes revealed state motivations to act in light of market failures, security concerns, international negotiations, and previous

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<sup>162</sup> Arora and Athreye (2002), p. 267.

<sup>163</sup> D'Costa (2011a), p. 9.

<sup>164</sup> Arora and Athreye (2002), p. 269.

policies that had become cumbersome. Based on the empirical evidence, it would appear that the state has played a major role in two areas. First, it has addressed the market failure of dynamic scale economies, where Indian firms were unable to raise start-up capital or improve human capital. Second, the state has addressed protectionist policy failures, but slowly enough to give Indian firms enough time to adjust without falling prey to clientelism.

The state's greatest contribution to the software industry is arguably its development of human capital. Not only did the Indian government create the means of a highly trained workforce, but it also created opportunities for this workforce through the creation of software technology parks and infrastructure development specifically targeted to the industry.

Throughout the past fifty years, several public sector firms have contributed to increased software research and development, which developed the domestic industry and increased linkages between various sectors of the Indian economy. Liberalization policies from the 1980s onwards led to the software industry being highly export oriented, particularly with the state facilitation in reducing import tariffs as well as through state provision of venture capital. N. R. Narayana Murthy, one of the founders of Infosys, acknowledges that public sector financial institutions provided the seed capital for the firm after Murthy was turned down by private banks.<sup>165</sup> The ability of the state to identify weaknesses in the market and address them has led to the Indian software facing very little stagnation in growth despite the rapid changes the market has undergone.

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<sup>165</sup> Patibandla, Kapur and Petersen (2000), p. 1265.

The state's disciplined approach in intervening in the Indian software market, particularly in the light of this paper's highly structured framework, can be replicated both for various national software industries such as China or Israel, but also in India's other service-based industry. Through creating a systematic method of reducing protectionist policies while bolstering Indian firms by sponsoring education and infrastructure growth, the Indian government has created an effective model for state action. As Indian software firms continue to move up the value chain, additional government policies may also become necessary, particularly to address the challenges discussed in the previous section. The Indian government is likely to continue deregulating the economy while encouraging Indian software firm growth through innovative methods such as Software Technology Parks, easier access to venture capital, and tertiary education programs. As a result of such practical policies, Indian firms are unlikely to lose their advantage in the software industry for several years.

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