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# Is There a Case for Industrial Policy? A Critical Survey

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*What are the underlying rationales for industrial policy? Does empirical evidence support the use of industrial policy for correcting market failures that plague the process of industrialization? This article addresses these questions through a critical survey of the analytical literature on industrial policy. It also reviews some recent industry successes and argues that public interventions have played only a limited role. Moreover, the recent ascendancy and dominance of international production networks in the sectors in which developing countries once had considerable success implies a further limitation on the potential role of industrial policies as traditionally understood. Overall, there appears to be little empirical support for an activist government policy even though market failures exist that can, in principle, justify the use of industrial policy.*

Many countries in recent years have encountered great disappointment with the results of pursuing the conventional economic policies that John Williamson (1990) crystallized and named the Washington Consensus. Although few countries ever followed the pristine form of this consensus, some countries in East Asia adhered to many (but hardly all) of its components and experienced extraordinarily rapid growth for three decades or more. Although there was a brief and sharp recession in some of these countries during the 1997–99 financial crisis, most have rebounded, with the exception of Indonesia. Yet other countries that have gotten their macroeconomic and trade regimes much closer to the idealized consensus than the Asian countries did have failed to experience comparable growth. In many Latin American countries and in some African countries, there is an understandable search for a magic solution, and many policymakers have expressed interest in some form of industrial policy.

Few phrases elicit such strong reactions from economists and policymakers as *industrial policy*. As Evenett (2003) notes, industrial policy means different things to different people. This article defines industrial policy as 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. It is not surprising that those who believe strongly in the efficient working of markets view any argument in favor of industrial policy as fiction or, worse, an invitation to rent seeking, whereas those who believe that market failures are pervasive think that economic development requires a liberal dose of industrial policy.

This article addresses arguments for and against industrial policy and asks whether empirical evidence helps to settle the debate. Although there are cases where government intervention coexists with success, there are many instances where industrial policy has failed to yield any gains. The most difficult issue is that relevant counterfactuals are not available. Consider the argument that Japan's industrial policy was crucial for its success. Because we do not know how Japan would have fared under laissez-faire policies, it is difficult to attribute its success to its industrial policy. It might have done still better in the absence of industrial policy—or much worse. Given this basic difficulty, only indirect evidence can be obtained regarding the efficacy of industrial policy. Direct evidence that can “hold constant” all the required variables (as would be done in a well-specified econometric exercise) does not exist and likely never will.

The following section analyzes the main conceptual arguments in favor of industrial policy. Because the infant industry argument for trade protection anticipates most of the rationales for industrial policy, this argument is discussed extensively. Next, India's successful software industry is examined in the context of industrial policy. The following section examines how the expansion of international production networks has altered the case for industrial policy. The final section considers the issue of policy space.

## Why Industrial Policy?

At a general level there is room for government intervention when there are market distortions (such as externalities or market power) or when markets are incomplete (for example, future markets for many goods simply do not exist). As is known from a basic theorem of welfare economics, under such market failures a competitive market system does not yield the socially efficient outcome. Any argument for industrial policy is a special case of this general argument.

Three specific arguments for industrial policy have received the most attention. One is derived from the presence of knowledge spillovers and dynamic scale economies, a second from the presence of coordination failures and a third from informational externalities. Before discussing these arguments in detail, it is useful to begin with the infant industry argument for trade protection because it is a precursor of modern arguments for industrial policy.

## *The Infant Industry Argument: A Precursor of Modern Industrial Policy*

The infant industry argument is one of the oldest arguments for trade protection and perhaps the only such argument that is not dismissed out of hand by economists. The most popular (and the simplest) version of the argument runs as follows. Production costs may initially be higher for newly established domestic industries than for well-established foreign competitors, which have more experience. Over time, however, domestic producers can reduce costs as they learn by doing (they enjoy dynamic scale economies), and they can eventually attain the production efficiency of their foreign rivals. However, if the fledgling domestic industry is not initially protected from foreign competition, it may never takeoff. Furthermore, if dynamic scale economies are strong enough, temporary protection of the domestic industry can be in the national interest.

A stronger version of the argument states that the domestic industry might even be capable of attaining production costs below its foreign rivals if it is given sufficient protection. In this version of the argument, true comparative advantage lies with the domestic industry, and temporary protection can be in the global interest, because consumers in the rest of the world also benefit from the eventual lower production cost of the domestic industry.

In an influential paper, Baldwin (1969, p. 297) provided an incisive criticism of the infant industry argument, contending that “if after the learning period, unit costs in an industry are sufficiently lower than those during its early production stages to yield a discounted surplus of revenues over costs (and therefore indicate a comparative advantage for the country in the particular line), it would be possible for firms in the industry to raise sufficient funds in the capital market to cover their initial excess of outlays over receipts.” If future returns indeed outweigh initial losses, capital markets would finance the necessary investment needed by the domestic industry. It is obvious, but worth stressing, that if future returns fall short of initial losses, the industry should not be established in the first place.

A frequently cited counter to Baldwin (and one that he acknowledged) is that capital market imperfections might prevent the infant industry from obtaining the required financing. For example, because of informational asymmetries investors, unlike producers, may not know that the industry will be profitable in the long run and therefore fail to provide the capital needed to cover the initial costs. However, such an argument defies credibility because it requires one to believe that firms that have not even begun production know more about their prospects than investors whose main objective is to find profitable uses for their excess capital and have previously analyzed and financed similar projects. And even if one grants the presence of asymmetric information, what prevents potential producers from conveying such information to likely investors? After all, entrepreneurs seeking funds for new businesses overcome this problem on a routine basis.

While the infant industry argument assumes that it is known with certainty that the industry in question will eventually be profitable, it seems more likely that the prospects for most new industries are uncertain and that *no one* really knows whether a particular infant industry will be profitable in the future. Under such circumstances capital markets would require compensation for the risks involved, and the resultant interest rates required might make the investment unprofitable. But efficiency requires that those bearing risks should be compensated, and there is no market failure if the underlying problem is that investors do not provide the necessary capital because they perceive the rewards not to be commensurate with the risks they are asked to bear.

Nevertheless, the assumption of omniscient financial intermediaries should be viewed with some skepticism. From early bubbles such as the tulip mania of the seventeenth century to the Internet bubble of the late 1990s, it is clear that financial actors are often deficient. In the Asian countries that suppressed the financial sector and directed loans to specific industries and firms as a part of industrial policy, the banking sector was itself in need of substantial improvement in operating procedures, much as industrial firms were. Thus, the belief that if there were opportunities investors would exploit them might be somewhat of a weak link in Baldwin's argument. On the contrary, it also implies that any selective economic policies would have to simultaneously address the weakness of the financial sector along with that of goods and other services. Indeed there might be an argument for initially strengthening the banking sector, perhaps by allowing foreign financial intermediaries into the country, before pursuing targeted sectoral policies. In any case, as Baldwin notes, if there is a problem with capital markets, policy ought to narrowly target that problem rather than resort to trade protection.

In today's world of global capital markets the simple version of the infant industry argument runs into another difficulty: Investors ought to be able to determine the prospects for the domestic infant industry from the experience of foreign producers. If domestic investors lack such information, surely foreign investors ought to have it. Why cannot the borrowing be international rather than local? One answer to this question may be that investors believe that an industry that has succeeded abroad will not necessarily succeed at home. But this explanation can be consistent with the very hypotheses underlying the infant industry argument only if investors are not fully rational.

What light has formal analysis shed on the infant industry argument? A seminal paper by Bardhan (1971, p. 1) noted that the infant industry argument is dynamic and that "any elaboration of this idea involves explicitly dynamic analysis, and it has hardly been integrated into the main corpus of trade theory which is mostly comparative-static in nature." Bardhan provides the first dynamic model of learning by doing in an open economy and derives the optimum extent and time path of protection to the learning industry. His model has two goods, *c* and *m*, and two factors of

production, capital and labor, with constant returns to scale in production of both goods. The learning effect is assumed to depend on the cumulated volume of industry output in good  $m$ , and it shifts out the production function for the good in a Hicks neutral fashion.<sup>1</sup>

Bardhan models learning by doing as a classic Marshallian externality: The higher the cumulative output of the industry, the more productive is the technology of each individual firm. When learning is unbounded, Bardhan shows that it is socially optimal to subsidize the infant industry and that the time profile of the optimal subsidy depends on initial conditions. However, his framework does not capture the idea that international spillovers may partially substitute for domestic learning because the learning effect function contains the stock of domestic and foreign outputs as separate arguments, and the relationship between the two is not really considered.<sup>2</sup>

Succar (1987) extends Bardhan (1971) analysis to allow the learning in one sector to generate spillovers for both sectors, thereby providing an interindustry spillover rationale for the infant industry argument. However, the presence of such economies is not sufficient to justify intervention. As Succar notes, the discounted stream of productivity gains generated by learning by doing in the infant industry should outweigh the discounted stream of subsidies or else intervention is socially undesirable.<sup>3</sup> The intuitive idea underlying Succar's model is that the production of capital goods can enhance growth by acting as an "informal learning center where technical skills are required" thereby contributing to a country's technical infrastructure (p. 523).<sup>4</sup> Such improvements in the skill base of workers complement investments in human capital and can advance industrialization in developing countries.

The distinction between firm- and industry-level learning by doing becomes quite important because firms are heterogeneous. Suppose that some firms are more efficient at learning than others. Optimal subsidies would have to be nonuniform, and the government is unlikely to possess the information needed to implement an optimal subsidy program. It might thus make sense for the government to adopt a uniform policy even though that might not be the first-best policy. While in theory, mechanisms could be designed that induce firms to reveal their learning capabilities, the practical relevance of such mechanisms is far from clear.

As might be expected, there is more to the infant industry argument than the simple version formalized by Bardhan and Succar. As Baldwin notes, there are four more nuanced versions of the infant industry argument. First, acquisition of knowledge involves costs, but knowledge may not be appropriable by an individual firm. This is the standard argument for subsidizing research and development (R&D). Second, firms may provide costly on-the-job training but may be unable to prevent the diffusion of such knowledge as workers move to other companies (a free-rider problem in worker training). While firm-specific training involves no potential externality,

general training can lead to externalities that would justify subsidies. Third, static positive externalities in the production of a good may justify trade protection. And fourth, determining the profitability of a new industry might require a costly investment, and the results could become freely available to potential competitors. In other words, investment in new industries might result in informational externalities that make it difficult for investors to earn a rate of return high enough to justify the initial investment. This argument has been formalized by Hausmann and Rodrik (2003), who call it the process of self-discovery, of determining what a company can produce profitably at world prices.

The infant industry argument does not really specify how learning occurs. It just assumes that dynamic scale economies will somehow be realized by the infant industry. Of course, learning is rarely exogenous, and it usually requires considerable effort and investment by firms (Pack and Westphal 1986). If such investments are made, firms need to be able to appropriate the benefits of the knowledge gained. Knowledge is a nonrival good and, once created, any number of agents can use it simultaneously. If firms cannot prevent the leakage of knowledge that is costly to create, they will have little incentive to create such knowledge. If property rights over knowledge are not enforceable, this can create a rationale for government intervention.

As Baldwin (1969) notes, many types of knowledge acquisition are not subject to the externality described above because entrepreneurs can often prevent the leakage of their knowledge to potential competitors. Similarly, if there are only a few firms in the industry, interfirm negotiations should help offset the externality problem (Coase 1960). But what if many rival firms benefit from the investment undertaken by a knowledge acquiring firm, and the firm can do nothing to prevent such diffusion? Is government intervention justified?

Trade protection is certainly not called for. A tariff does nothing to solve the basic externality problem and may well worsen it. A production subsidy to the entire sector will also fail to remedy the externality. What is needed are subsidies to initial entrants into the industry that help create new knowledge and discover better production technologies. As with R&D subsidies governments should target the marginal rather than inframarginal research. In the case of new firms it takes time to discover whether a new idea or technology is socially valuable, and the adoption of a novel technology by others is the strongest proof of its social value. Thus, a policy of rewarding early entrants requires an accurate forecast of the social value of their inventions and discoveries—a process that can be fraught with failure. Not only that, given the uncertainty associated with new technologies, a delayed pattern of adoption might even be socially optimal.

### *Knowledge Spillovers, Dynamic Scale Economies, and Industrial Targeting*

Ever since David Ricardo, it has been well known that under free trade a country can increase its national income (and welfare) by moving resources into sectors in which

its opportunity cost of production is lower than that of its trading partners. But is this prescription sufficient to generate economic growth? Perhaps not. Allocating resources according to comparative advantage can only ensure static efficiency and in no way guarantees dynamic efficiency. Succar (1987, pp. 533–34) argues that “the comparative advantage theory is a static construct that ignores [that] forward linkages exist between present choices and future production possibilities. Therefore it cannot guide the pattern of international specialization when there are asymmetric learning opportunities associated with the production of different goods, use of certain techniques, or both. Promotion of industries which generate substantial learning by doing economies should be an integral part of a strategy of human capital formation in [developing countries].” In other words, Succar argues for some sort of industrial targeting, although her model does not explicitly deal with this issue.

Even if one accepts the premise that certain industries are more likely to generate spillovers (based on knowledge diffusion or other factors), can policy be designed to encourage the “right” industries? The ideal but rarely attained goal of industrial policy is the development of a general-purpose technology. The Defense Advanced Research Projects Agency (DARPA), a small unit within the U.S. Department of Defense that generated and financed a portfolio of projects, is widely credited with having been the key contributor to the development of the Internet, in response to the need to maintain communications during an assault on the United States. This instance of success addressed a market failure, in that the social benefits of the research were much larger than the anticipated private benefits. Moreover, DARPA foresaw a potential need that private firms might not have. While the Internet was a main technological breakthrough and suggests the potential gains from such activity, it is useful to remember that the discovery of such general purpose technologies is a rare event and less likely in low innovation-intensity developing countries than in research-rich industrial countries.

The informational constraints facing policymakers pursuing industrial policy are severe and any realistic model of industrial targeting needs to account for them. In a recent paper Klimenko (2004) models industrial targeting as an optimal experimentation strategy for a government that lacks information about the set of industries in which the economy has a comparative advantage. He examines the set of industries in which a country will specialize as a result of such policy. In his model, for any set of targeted industries, it is possible to know with positive or zero probability whether a country will specialize in this set. He shows that an optimally designed industrial policy can lead a country to specialize in sectors in which it does *not* have comparative advantage. Depending on the beliefs of the policymaker, a country can end up abandoning the industries in which it has “true” comparative advantage.

Furthermore, Klimenko argues that policymakers may stop looking for better targets when the favored industries perform well enough. He interprets this outcome as a failure of industrial targeting policy even though it may not appear to be. He

goes on to show that despite the existence of market failures, the outcome of the learning process through private experimentation (without any assistance from the government) can yield outcomes that are closer to the full information social optimum. Klimenko's rigorous analysis underscores the intuitive argument that the relevant counterfactuals are unavailable, and what may appear to be a successful industrial policy may not be the first-best outcome from a country's perspective. Merely doing something well need not imply that one might not be better at something else.

### *Coordination Failures as a Rationale for Industrial Policy*

The idea behind the coordination failure argument for industrial policy is that many projects require simultaneous investments to be viable, and if these investments are made by independent agents, there is little guarantee that each agent, acting in its own self-interest, would choose to invest.<sup>5</sup> As Scitovsky (1954) noted, reciprocal pecuniary externalities in the presence of increasing returns can lead to market failure, because the coordination of investment decisions requires a signaling device to transmit information about present plans and future conditions, and the pricing system is not capable of playing this role.

Pack and Westphal (1986) argue that such pecuniary externalities related to investments in technology are pervasive during industrialization. They provide an example of two infant industries, where industry A produces an intermediate that is required in industry B and neither industry is profitable if it is established alone. However, if both industries are established together, both are profitable, implying that it is socially optimal to establish both. Of course, the problem is that without explicit coordination of investment decisions, this outcome would not be obtained.

Okuno-Fujiwara (1988) presents a formal model of such interdependence between industries and the coordination failure that can result. He considers an economy with three goods,  $x$ ,  $y$ , and  $z$ , where good  $z$  serves as a numeraire and is produced under perfect competition with constant returns to scale. Good  $x$  is produced by a competitive industry and requires good  $y$  as an intermediate. The technology for good  $y$  exhibits large economies of scale, and the industry is assumed to be oligopolistic with the number of firms endogenously determined to ensure zero profits in equilibrium.

A coordination problem arises in the industry because the derived demand for the intermediate good  $y$  depends on its price, which in turn determines incentives for entry into the intermediate sector. If  $y$  producers anticipate low demand for their good, given the fixed costs of entry, few new producers would want to enter, implying a higher price for the intermediate. This could make industry  $x$  unsustainable. The key assumption here is that the intermediate good  $y$  must be locally supplied. On the contrary, if  $y$  producers are certain of high demand for their product, more would



enter, lowering its price and allowing the high demand for the intermediate to be sustained.<sup>6</sup> Okuno-Fujiwara (1988) shows that there is no unique equilibrium in a small open economy with the above production structure. In the bad equilibrium the economy ends up specializing in good  $z$  whereas in the good equilibrium it produces both goods  $x$  and  $y$  and exports good  $x$  to the rest of the world (where the good equilibrium is welfare superior to the bad).

Turning to policy analysis, Okuno-Fujiwara (1988) suggests that three types of traditional government intervention can help ensure that the good equilibrium is realized: The government can provide a production subsidy to industry  $x$  or industry  $y$  or both, causing the two sectors to expand; it can provide an export subsidy to industry  $x$ ; or it can shutoff international trade. However, he notes that trade protection can be effective only if the autarkic equilibrium production of good  $x$  is sufficiently large—something that is less likely to be true of small developing countries. In addition to traditional industrial policies (the first two options), Okuno-Fujiwara (1988) also suggests that the government can play a coordinating role between  $x$  and  $y$  producers by facilitating information exchange.<sup>7</sup> However, he argues that only repeated information exchanges can resolve the coordination failure. It is difficult to believe that policymakers can effectively execute such information exchanges between industries about whose day-to-day business they likely know little. Furthermore, this policy prescription suggests a massive role for government intervention in industrialization. Okuno-Fujiwara himself is skeptical of whether the mechanisms captured by his model and the policy prescriptions that emerge from his analysis had any practical analog in the Japanese experience.

In a paper along the lines of Okuno-Fujiwara (1988), Rodrik (1996) argues that for coordination failures to exist between upstream and downstream industries there must be some type of scale economies in production and imperfect tradability must hold across national borders for some of the goods, services, or technologies associated with manufacturing. In his model the intermediate good sector is characterized by monopolistic competition rather than oligopoly. He suggests that the non-tradable intermediate goods sector should be viewed as representing different categories of specialized skill labor. The idea is that a worker's decision to acquire a skill depends on demand for that skill and that it is costly or simply infeasible to import labor services should certain skills be in short supply locally. Like Okuno-Fujiwara (1988), Rodrik (1996) is hesitant to offer strong policy recommendations based on his analysis and concludes that government intervention designed to resolve such coordination failures is a risky strategy. The World Bank's (1993) well-known report on the East Asian miracle argues that East Asian efforts to coordinate investment decisions led to a number of inefficient industries.

While the theoretical rationale for redressing coordination failure appears to be sound, the argument rests on certain key assumptions, particularly that the organization of production activity is exogenously given. Why would industries whose

profitability is so intimately intertwined not find ways to help coordinate decisions, as is the case in the many international supply networks (Sturgeon and Lester 2002, 2003; Gereffi and Memedovic 2003)? For example, vertical integration between intermediate and final goods producers can help resolve some coordination problems, although there are clearly limits to the extent to which organizations can adjust their scale and scope to solve coordination problems. At some point all firms have to interact with others in the market. But long-term contracts between firms have been used to solve problems of relation-specific investments in many industries. It is not clear why contracts could not play the same role for coordination failures.

Perhaps the biggest problem with the coordination failure argument is that it relies heavily on the assumption of nontradable intermediate inputs, partly reflecting the fact that much of the early literature was based on the example of the steel and automobile industries of the 1960s rather than products for which transportation costs for intermediates are likely to be low. Virtually all the models make this assumption although most international trade is in intermediate goods. Thus, the coordination failure argument runs up against the central fact about which much of the “new” trade theory has been built (see, for example, Ethier 1982).

This is no small contradiction, and if the coordination failure story is to be rescued, it needs to appeal to nontradable services as in Rodriguez-Clare (1996b). But the problem then is that the case for industrial policy on the basis of coordination failures is quite thin if inward foreign direct investment (FDI) is feasible. If local firms do not produce sufficient intermediates because of coordination failures, why could intermediates not be produced by foreign multinationals that are surely not dependent on the production structure of any one economy? In small developing countries a large-scale investment by a multinational can create sufficient demand for intermediates and easily resolve the coordination problem. This is partly what the literature on the backward linkage effects of FDI argues (Rodriguez-Clare 1996a; Markusen and Venables 1999).

It is unlikely that multinational firms would experience the type of coordination problems that confront small producers in developing countries. Indeed, the huge growth in international supply chains established by multinational firms has become one of the most visible features of industrial growth in the last decade (Sturgeon and Lester 2002). The role of multinational firms in determining the overall case for industrial policy is discussed in more detail below.

### *Informational Externalities*

In a recent paper Rodrik (2004) argues that the traditional view of industrial policy (based on technological and pecuniary externalities) does not capture the complexities of industrialization. He argues that industrial policy is more about eliciting

information from the private sector than it is about addressing distortions through first-best instruments. He envisions industrial policy as a strategic collaboration between the private and the public sectors with the primary goal of determining the areas in which a country has comparative advantage. The fundamental departure of this viewpoint from classical trade theory is that entrepreneurs may lack information about where a country's comparative advantage lies. Or more to the point, at the microlevel, entrepreneurs may simply not know what is profitable and what is not.

In the presence of informational externalities, a free-rider problem arises between initial and subsequent investors. Suppose no one knows whether activity  $x$  is profitable and that the uncertainty can be resolved only by making a sunk investment. By definition the investment cannot be recovered if the outcome turns out to be unfavorable. If there is free entry ex post, no entrepreneur may be willing to make the required investment ex ante: If the activity indeed turns out to be profitable, other entrepreneurs will be attracted to it, thereby eliminating all rents.

It is worth noting that Baldwin's (1969, p. 302) classic paper anticipates Rodrik's argument almost exactly: "suppose, for example, that a potential entrant into a new industry, if he could provide potential investors with a detailed market analysis of the industry, could borrow funds from investors at a rate that would make the project socially profitable. However, should this information become freely available to other investors and potential competitors, the initial firm might not be able to recoup the cost of making the market study....under these circumstances the firm will not finance the cost of the study, and a socially beneficial industry will not be established." Similarly in the context of the adoption of high yielding varieties of crops by farmers in developing countries, Besley and Case (1993, p. 399) note that late adopters may learn from early adopters: "[when] a technology is of uncertain profitability, some potential adopters may wait until they observe whether others have fared well by using it" and that such "externalities are potentially important in agricultural technology adoption."

Given the importance of this argument for the debate on industrial policy, it is useful to examine the framework presented in Hausmann and Rodrik (2003) in some detail. They consider a small open economy with two sectors, traditional and modern. The production technology in the traditional sector is constant returns to scale, and the presence of a fixed factor generates diminishing returns. In the modern sector, which consists of many goods, there are constant returns to scale in production, but the cost of production of a good depends on an unobserved productivity parameter,  $\theta_i$ , that becomes known only when the production of a good is attempted. This requires a time period in which resources must be used but no production takes place—what Baldwin called a "market study." Entrepreneurs lack information about the profitability of production of various goods in the modern sector, and this information can be obtained only by undertaking a sunk investment.

After uncertainty regarding  $\theta_i$  is resolved, entrepreneurs compare their production costs with world prices and produce goods for which they make monopoly profits, which accrue for length of time  $T$ —call this the monopolization period. Of course, once information becomes public, which it does in period three when the monopolization period has elapsed, there is further entry into goods that yield positive profits until all profits are competed away to zero.

Hausmann and Rodrik (2003) analyze the laissez-faire equilibrium of the above model and compare it with the social planner's problem to derive the market failures that result from the presence of informational externalities. They argue that the market equilibrium is deficient in two respects. First, the level of investment and entrepreneurship delivered by the market does not coincide with the social optimum, because the entrepreneurs care only about profits and not about the economy-wide benefits of their investment. If the monopolization period is long, the market economy can actually deliver too much investment in the modern sector rather than too little. This suggests that in economies where firms face substantial entry barriers, the underinvestment problem noted by Hausmann and Rodrik (2003) is not likely to be serious. For example, the industrial licensing regime pursued by India during the first 40 or so years after independence made it difficult for firms to enter new markets. And the recent literature on the business climate emphasizes other factors that discourage investment in the modern sector, such as the time to obtain business permits, telephone lines, and other utility hookups (World Bank 2006). Such barriers should have helped protect rents for those that did manage to enter profitable markets.

The second market failure identified by Hausmann and Rodrik (2003) is that the market equilibrium yields too little specialization—all activities that turn out to be profitable are sustained whereas optimality requires that only the one activity with the highest return be pursued. In other words, while it is optimal in their model for the small open economy to produce only the good for which the profit margin is the highest, the market solution allows all those that make positive profits to stay in business during monopolization period.

This result reflects the general equilibrium nature of their model and the fact that they consider a small open economy. To see this, first note that the modern sector draws resources out of the traditional sector and that optimality requires that these resources be used where they generate the largest profits, which happens to be in the modern good for which the productivity parameter ( $\theta_i$ ) is the highest. Second, because the country's output of a good does not affect the world price, one can never have a situation where the markups across different goods are equalized. Clearly, if world prices changed with a country's exports or output, complete concentration in the modern sector need not obtain. A more likely scenario would be that a country should produce higher quantities of modern goods for which it has a more favorable productivity draw and lower quantities of other goods.

Hoff (1997) argues that if initial producers benefit subsequent producers, the case for subsidizing initial producers hinges much on the assumption that the externalities operate in a deterministic fashion (do not involve any uncertainty). She constructs a model in which initial entrants provide information that is socially valuable by reducing uncertainty for potential followers regarding production conditions. In her model factors that increase the informational barrier to entry can actually imply a lower optimal subsidy for the infant industry. By contrast in most models the externalities are assumed to remove all uncertainty rather than simply reducing it. Because Hoff's model is clearly more realistic, it is notable that her results weaken the case for subsidizing an infant industry.

### *The International Dimension: Role of Exports and FDI*

For small developing countries the case for industrial policy is rarely a purely domestic one. International considerations are fundamental, and the role of exports (on the part of domestic firms) and inward FDI has received considerable attention. A potential rationale for industrial policy in the context of exports arises when product quality is unknown to foreign consumers. The information asymmetry can lead to market failure that can then potentially justify some form of intervention. Adding an explicit process of reputation acquisition may be an objective of policy. Grossman and Horn (1988) focus on reputation acquisition at the firm level, whereas Mayer (1984) focuses on the country level. In the view of Grossman and Horn, Toyota can affect only its own reputation in foreign markets whereas in Mayer's model, experience with Toyota also influences how foreign consumers view other Japanese companies, such as Honda. The difference matters because returns to reputation acquisition are appropriable in the Grossman and Horn model whereas they are not in the Mayer model.<sup>8</sup>

Policy intervention with respect to FDI has a long history. The rationale has frequently been the effects of FDI on the productivity of local firms through technology transfer and linkage effects. The literature on FDI, technology transfer, and linkages is extensively surveyed by Saggi (2002). The review here is limited to aspects of FDI that relate intimately to local industrial development and its linkage effects, because these correspond quite well to the coordination failure rationale for industrial policy.

There is a voluminous informal as well as empirical literature on backward linkages. For example, the *World Investment Report 2001* (UNCTAD 2001) was devoted entirely to the effects of FDI on backward linkages in host countries. However, analytical models that explore the relationship between multinationals and backward linkages in the host country are hard to come by. Two examples of such models are Markusen and Venables (1999) and Rodriguez-Clare (1996a). Both models emphasize the demand-creating effects of FDI on the host economy: Multinationals generate derived demand for intermediate goods, thereby promoting industrial development

of the intermediate goods sector in the host country.<sup>9</sup> As noted, a common problem with analytical models in this area is the assumption that intermediates are nontradable. These models assume no trade in intermediates and then use FDI as the channel that provides some intermediates or increases demand for local intermediate goods producers. As a result, the models are likely to overstate the impact of multinationals on industrial development.

Mexico's experience in the automobile industry is illustrative of how FDI can contribute to industrial development in the host country (Laderman, Maloney, and Serven 2003). Initial investments by U.S. car manufacturers into Mexico were followed by investments by Japanese and European car manufacturers and automobile parts and component manufacturers. As a result, competition in the automobile industry increased at multiple stages of production, efficiency improved, and Mexican automobile industry exports boomed. The pattern of FDI behavior in Mexico—investment by one firm followed by investment by others—probably reflects strategic considerations involved in FDI decisions. Most multinational firms compete in concentrated markets and are highly responsive to each other's decisions. An important implication of this interdependence among competing multinationals is that a host country may be able to unleash a sequence of investments by successfully inducing FDI from one or two important firms. However, the concentration of inward FDI into a handful of developing countries suggests that only a few countries can benefit from this process—Egypt and Tanzania are not China.

A recent case study of the effects of Intel's investment in Costa Rica by Larrain, Lopez-Calva, and Rodriguez-Clare (2000) finds evidence that local suppliers benefited substantially from Intel's investment. Similar evidence exists for other sectors and countries and is discussed in Moran (1998, 2001). For example, in the electronics sector in Malaysia, Moran (2001) notes that foreign investors helped their local subcontractors keep pace with modern technologies by assigning technicians to the suppliers' plants to help set up and supervise large volume automated production and testing procedures. In a broader study Batra and Tan (2002) use data from Malaysia's manufacturing sector to study the effect of multinationals on interfirm linkages and productivity growth during 1985–95. Their results show that not only are foreign firms more involved in interfirm linkages than domestic firms but also that such linkages are associated with technology transfer to local suppliers. Such technology transfers were found to have occurred through worker training and the transmission of knowledge that helped local suppliers improve the quality and timeliness of supply.

Javorcik (2004) examines backward linkages and technology spillovers using data from the Lithuanian manufacturing sector during 1996–2000. She finds that firm productivity is positively affected by a sector's intensity of contacts with multinational customers but not by the presence of multinationals in the same industry. Thus, her results support vertical spillovers from FDI but not horizontal spillovers.

Furthermore, she finds that vertical spillovers occur only when the technological gap between domestic and foreign firms is moderate. Blalock (2001) uses a panel data set from Indonesian manufacturing establishments to check for the same effects. He finds strong evidence of a positive impact of FDI on productivity growth of local suppliers, showing that technology transfer does take place from multinationals. He also plausibly suggests that because multinationals tend to source inputs that require relatively simple technologies relative to the final products they produce, local firms that manufacture such intermediates may be in a better position to learn from multinationals than those that compete with them.

If one accepts the optimistic view of the effects of FDI—and some of the evidence discussed above suggests reasonable grounds for doing so—does this have implications for industrial policy? The answer is a qualified yes. Basic economic theory tells us that it is optimal to subsidize an activity if it generates positive externalities—if the activity benefits agents other than those directly involved in the activity. The potential surely exists for positive externalities from FDI, and evidence exists that this potential is often realized. Incentives to attract FDI may be justified on the grounds of such externalities from inward FDI, but the magnitude of some of the incentives being used seems difficult to justify (Moran 1998), and such policies are not typically what proponents of industrial policy have in mind. Indeed, the thrust of such arguments is typically in favor of encouraging the development of indigenous firms. Investment incentives and tax breaks to multinational investors work against their local competitors. Thus, if there are local firms that could potentially compete with multinationals, the adverse effect on such firms of tax incentives to multinationals needs to be taken into account. The efficacy of investment incentives is also unclear—such policies could easily end up transferring rents to foreign investors without affecting their investment decisions.

### *Government Knowledge Requirements*

This review of arguments for industrial policy suggests the enormous difficulties of implementing industrial policies quite apart from the possibilities for rent-seeking. The range and depth of knowledge that policymakers would have to master to implement successful policy is extraordinary. They would have to be accurately informed about an enormous range of complex questions, understand their relevance, and be able to accurately evaluate subtle differences. Some of the issues on which policymakers would have to be knowledgeable derived from the preceding discussion include:

- The firms and industries that generate knowledge spillovers.
- The firms and industries that benefit from dynamic scale economies—the precise path of such learning and the magnitude of the cost disadvantage at each stage of the learning process.

- The sectors that have a long-term comparative advantage.
- The size of scale economies of different firms and sectors, to facilitate investment coordination.
- An ability superior to that of individual firms to learn about their potential competitiveness.
- The nature and extent of capital market failures.
- The magnitude and direction of interindustry spillovers.
- The relative amount of learning by individual firms from others and from their own experience.
- The extent to which early entrants generate benefits for future entrants.
- The extent of heterogeneity of firms' learning abilities.
- Whether consumers learn the quality of a good after consuming rather than by inspecting it.
- Whether firms that are trying to reduce production costs also begin a simultaneous effort to improve their product's quality to obtain a better reputation.
- The potential effects of FDI or international trade on coordination problems, including a detailed knowledge of which of tens of thousands of intermediates are tradable.
- A forecast of which firms can create new knowledge and discover better production methods.
- The spillover effects of FDI and the likely intensity of foreign purchase of domestic intermediates.

It is possible that government officials might be this omniscient, but the performance of the portfolio managers in industrial country stock markets suggests that few of the well-trained (and remunerated) equity analysts can evaluate even much more certain and grosser characteristics of existing firms and industries with long track records. Nor do industrial firms themselves have the ability to successfully forecast such developments. Acknowledging that a first-best policy would argue for the government to address such market failures or externalities, the task is daunting. Quite apart from the dangers of optimal policy being subverted by industries and firms that would benefit, the sheer knowledge and skill requirements would exceed that possessed by almost any institution, including the best consulting firms. On a far more circumscribed set of tasks, measuring and explaining the sources of lower total factor productivity for a small number of sectors in Brazil and the Republic of Korea relative to the United States, McKinsey & Co., a preeminent consulting firm, spent several years and employed dozens of people with qualifications exceeding those of officials in most developing countries (McKinsey Global Institute 1998a,b).

No study has attempted to assess whether governments have mastered these 15 areas (or others that can be derived from the discussion here) that have to be addressed. The efficacy of industrial policy has to be evaluated on the basis of the



realized results of the firms or industries that have been encouraged. The underlying market failures or externalities that contributed to the decision to foster a firm or sector cannot be identified from the policy (such as subsidized directed credit). Only the effects of the policy can be assessed. This task is taken up next.

## Does Industrial Policy Work?

As noted, it is impossible to offer a single agreed counterfactual to evaluate the success of industrial policy targeted to individual industries. Thus there have been a number of research strategies to provide an empirical evaluation of industrial policy. These are reviewed in Noland and Pack (2003). Among other issues, researchers have examined the impact of trade protection, subsidies to R&D, general subsidies, and preferential lending rates on the evolution of productivity, capital accumulation, and sectoral structure. Few of the empirical analyses find that sectoral targeting has been particularly effective.

Consider some of the evidence. In Japan more than 80 percent of on-line budget subsidies were devoted to agriculture, forestry, and fisheries in 1955–80, the peak of Japan's industrial policy efforts.<sup>10</sup> Implicit tax subsidies for investment were highest in the mining sector and low in the high technology sectors. Government subsidies to R&D were also small. Unless elasticities of investment and R&D with respect to subsidies were implausibly high, their effect was limited. Industries that were encouraged did not experience significantly faster rates of total factor productivity growth than others, and R&D subsidies were largely ineffective.

Beason and Weinstein (1996) examine the connection between industrial policy and sectoral total factor productivity growth in Japan. Working with a 13-sector sample for 1955–90, they fail to uncover evidence that preferential policies (measured by the effective rates of protection, taxes, or subsidies) targeted sectors with increasing returns to scale or contributed to the rate of capital accumulation in targeted sectors or to their total factor productivity growth. They do find some evidence that before the first oil shock, industrial policy targeted sectors with high labor usage. Employing a slightly different data set, Lawrence and Weinstein (2001) extend this research and find that differential corporate tax rates had an impact on sectoral total factor productivity growth, whereas direct subsidies and subsidized loans did not. Moreover, they find the paradoxical result that the effective rate of protection was negatively associated with sectoral total factor productivity growth and that imports, not exports, were positively associated with total factor productivity growth.

There are at least two channels through which imports could contribute to increasing productivity. First, imports allow domestic producers to use new, improved, or specialized intermediate inputs to which they would not otherwise

have access. Second, imports compete with domestic products, and their availability acts as a constant spur to domestic producers to cut costs and improve quality. Lawrence and Weinstein (2001) divide imports into “competitive” and “noncompetitive” and find evidence for Japan to support this second channel. From this they conclude that Japan’s growth would have been even faster if it had cut tariffs and exposed a greater share of its domestic producers to foreign competition.<sup>11</sup>

Following a method broadly similar to that of Beason and Weinstein (1996), Lee (1996) finds a similar lack of impact of Korean industrial policies on sectoral capital accumulation or total factor productivity growth. Pack (2000) follows a different strategy, assuming that total factor productivity increased in favored manufacturing sectors in both Japan and the Republic of Korea and estimates how much of an impact even an *assumed* successful policy could have had on the growth of gross domestic product. The most favorable estimate is a roughly 0.5 percentage point increase in total gross domestic product growth rate of roughly 10 percent over the relevant periods. While this is significant, it is hardly the magic key to accelerated growth.

It is possible that the impact of industrial policy is manifest largely in sectors that purchased inputs from the promoted sectors, even if the promoted sectors did not themselves benefit. However, Pack (2000) finds that sectors that were encouraged in Japan and the Republic of Korea had few linkages with nonfavored sectors through input–output relations, and there is little evidence of labor flowing from favored to neglected sectors, a likely mechanism for the transmission of knowledge.

Nevertheless, as noted at the beginning of this article, the difficulty of constructing a single agreed on counterfactual precludes a robust conclusion. Moreover, all the empirical analysis examines the contemporaneous impact of policies—for example, did Korean industries that were encouraged experience greater total factor productivity growth in the period when main promotion occurred, 1973–85? Someone doubting these results could point to the performance of Korean firms such as Samsung and LG in the following two decades in such diverse product lines as plasma televisions, RAM chips, and cellular phones and attribute these later successes to the earlier stimulation the firms received for other product lines. These more recent successful efforts by the firms could be attributed, in this interpretation, to their earlier growth in other product categories. In this view learning to perform R&D on microwaves had future carryover effects on plasma televisions. Fully resolving divergent views is impossible, but detailed firm histories by Kim (1997) or Hobday (1995) do not suggest such carryover.

Even if it could be shown that the success of a few firms is attributable to earlier encouragement by the government, the aggregate effects cited above suggest there was not a major impact at the national level during the main period of growth acceleration. And any such effects would have to be weighed against the negative long-run impacts in the financial sector cited by those skeptical of industrial policy. For

example, the Asian financial crises of the late 1990s and Japan's stagnation since 1990 can be interpreted as partly the result of earlier government directed lending that minimized the need for banks to learn modern techniques of evaluating individual projects and managing the riskiness of their overall portfolio.

## New Industrial Policy

Recent discussion of "new" industrial policy including the desirability of fostering learning and obtaining benefits from agglomeration economies offered by industrial clusters has received little systematic empirical evaluation. Rodriguez-Clare (2004a,b) provides an extensive discussion and a formal treatment of clusters. Humphrey and Schmitz (2002) provide an extensive survey of the empirical literature on clusters and discuss whether they offer a locally controlled alternative to participation in networks.

### *Export Processing Zones and Other Clusters*

In principle, the development of clusters could boost productivity through the provision of overhead services by the organizers plus the interaction of the firms entering the cluster. Clusters could offer an alternative to dependence on either buyer- or manufacturer-led networks.

The benefit of clusters may arise from face-to-face interactions that are productivity enhancing (interactions between software writers and chip manufacturers, for example), a pool of workers with the relevant skills, or reduced transportation costs. Individual market agents may not be aware of the externality they generate for others, and this provides an additional market failure that could in principle be addressed by public intervention. The main example usually cited is that of Silicon Valley in California, which most accounts suggest arose spontaneously. Similarly, the rapid development of the software industry in Bangalore and other cities in India, discussed below, appears to be the outcome of the combination of a large group of well-educated English-speaking students, the entrepreneurial abilities of a small group of residents, and the activities of a large Indian expatriate community, particularly in Silicon Valley. While publicly financed education institutions generated the fundamental resource, educated workers, there was no explicit effort to galvanize the agglomeration economies that developed. Texas Instruments financed a critical communications satellite. Positive government efforts followed the takeoff of the sector.

There are interesting descriptions of a number of clusters in high-income countries, but few normative evaluations of their success employing social cost-benefit analyses or even grosser measures such as growth of exports relative to firms outside

the cluster but in the same sector. However, some insights can be obtained about whether recent success stories in Asia conform to the contours of the new industrial policy.

Development of the Indian software sector reflected a complex set of interactions between domestic and foreign responses to perceived opportunities. The evolution of the Indian software industry centered in Bangalore is explained in detail in the following section. Many of the same patterns, with different details, can be documented for other success stories, such as the Hsinchu Science Park in Taiwan, China (Saxenian 1999, 2001), the special economic zones in China (Rosen 1999; Huang 2003), and Bangladesh's rise as a clothing exporter (Rhee 1990). In the Indian software sector and the Bangladesh garment sector, the initiating force was private, with the government playing almost no role except for the fundamental one in India of providing good education.

The establishment of a science park in Taiwan, China, and legislation in China to allow special economic zones to attract FDI resulted from an initial government stimulus. A critical input for success was foreign participation that dealt with some of the roles cited above as components of industrial policy (source of new technology, facilitation of learning, source of new product ideas, centralized marketing allowing economies of scope, and coordination of entry of complementary firms). In China, the special economic zones mimicked the effects of a free trade policy, neutralizing adverse public policies. The zones did not discriminate among sectors. The decision by Taiwan, China, to foster a science park comes closer to a proactive industrial policy, but the experience at Hsinchu has not been systematically evaluated.

Many countries have attempted to use export-processing zones to attract FDI and perhaps generate agglomeration economies. Evaluation suggests that while potentially useful, they have had indifferent results (for references, see World Bank 2005). There have been a few success stories, such as the Republic of Korea and Taiwan, China, in the 1950s and early 1960s and the special economic zones of China. But there have been more than a thousand such efforts. There are few clues in the existing literature about why some export processing zones have been successful, while most have failed (for a review and an evaluation of the Philippine experience, see Calanog 2006).

### *The Indian Software Industry*

In India a precondition for the development of the software industry was high-quality education in junior colleges and universities financed by the government. University graduates went abroad for further training, remained as expatriates in the high-technology sector, and later returned home or interacted intensively with newer Indian firms. The lamented brain drain became, with a lag, a source of strength and a critical catalytic input to development of the Indian software industry.

**Large numbers of English-trained programming graduates.** In the 1980s there were a growing number of programming graduates at levels ranging from postsecondary technical schools to those trained at the Indian Institutes of Technology, and many were underemployed. Almost all of them had been educated in English. The government's continuing investments in education had resulted in more than 1,800 educational institutions and polytechnics producing 70,000 to 85,000 computer science graduates every year (James 2000).<sup>12</sup> Many Indian graduates also had a second university degree or postgraduate degree from schools in the United States or the United Kingdom, often in computer technology (Deshmukh 1993). Other Indian software programmers received training in private software institutes to keep abreast of developments in the industry and acquired a breadth of software skills. Hence, many were familiar with main computer hardware systems (Lakha 1990), computer-aided software engineering tools, object-oriented programming, graphical user interface, and client networking (Lekshman and Lal 1998).

**Series of serendipitous events.** The main impetus to demand came from abroad from a series of serendipitous events. In the 1990s the ratio of world prices for programming services relative to those in India rose because of a global shortage of programmers and the demands for solutions to the anticipated Y2K problem. Enterprising businesses in India capitalized on this opportunity by setting up firms that were essentially employment agencies. Indian software programmers were hired on behalf of clients in the United States on short-term contracts to provide onsite services. "Bodyshopping," as this practice was called, became the predominant mode of Indian software exports. The development work was performed on the client's premises, saving software firms the high costs of acquiring computer hardware. The National Association of Software and Service Companies, the software trade association, reported that the software sector earned \$2.5 billion from Y2K billing from 1996 to 1999, a critical period in the growth of the industry (Software & Information Industry Association 2001). As late as 1988 software exports had been less than \$200 million. By 1998 they were \$3.6 billion, accounting for more than 10 percent of total Indian exports.

Indian software firms also benefited from another fortuitous event, the European Union's move to the euro. Many Indian software professionals were involved in adapting computer systems and databases to accommodate the euro. Between 2000 and 2002 India earned an estimated \$3 billion in revenues from euro-related information technology projects. A contributing factor was the level of programming costs in India, which conferred a Ricardian comparative advantage in some subsectors of software. As late as 1995, after substantial wage increases because of a rising demand for Indian software services, the annual wages of Indian software professionals were only 14–59 percent those of their counterparts in Canada, Switzerland, the United Kingdom, and the United States. This combination of skills and cost

savings led firms in some industrial countries to outsource their software development requirements to India.

Thus random events—the Y2K problem and the shift to the euro—exerted positive feedback and generated a succession of mutually reinforcing benefits. As for industrial policy, of whatever form, it seems unlikely that any government could have foreseen and acted on these serendipitous demands.

**The foreign role.** A main contributor to development of the Indian software industry was the large number of expatriate Indian information technology professionals in Silicon Valley. In 1998, 774 (9 percent) of the high-technology firms were led by Indian chief executive officers (CEOs) (James 2000). Many Indian expatriates helped to convince large firms such as Oracle, Novell, and Bay Networks to establish operations in India (Saxenian 1999). Aware of the obstacles some Indians faced in raising capital for their software start-ups in India, they actively raised venture capital from U.S. investment firms and organized conferences in the United States to heighten awareness of the potential of India's software industry (Kripalani 2000). Finally, some of these expatriates lobbied the Indian government to revamp its telecommunication policies and other regulations that had impeded growth of the Indian software industry (Kripalani 2000).

FDI accounted for a large share of early investment in the sector—70 percent in Bangalore in 1996, for example (*The Economist* 1996). And this contribution understates the true impact. Texas Instruments, the first foreign firm to establish an offshore software facility in Bangalore in 1984, augmented Bangalore's inadequate land-based telecommunication infrastructure by investing in its own satellite communications network. Some of its lines were later leased to other software firms, enabling them to expand their India-based operations instead of relying solely on onsite services abroad. Until the government built software technology parks in the 1990s linked to earth stations and other telecommunications infrastructure, Texas Instrument's satellite network remained an important driving force behind the offshore development of software exports.

Once U.S.-based firms became interested in India, Bangalore's reputation for technical excellence and its abundant supply of information technology graduates made it a natural choice for foreign companies to locate their software business there (Stremlau 1996). With FDI came much of the infrastructure and international knowledge that allowed Indian firms to exploit international opening. Indian software firms also benefited from foreign joint ventures and partnerships, which created markets for Indian software exports. Partnerships with foreign firms added to the credibility of Indian firms, serving as an endorsement of its quality and reliability without government encouragement. Thus, other foreign firms looking to outsource their software development would invariably choose a software firm with a proven track record with another foreign company. And for small Indian firms attempting to move out of the low-end of the software business by venturing into software

packaging, having foreign partners gave them access to an established distribution network and knowledge of recent trends in the software market (because of proximity to demand in the United States). It also significantly lowered marketing costs. Because marketing costs account for as much as 70–80 percent of the final price of a software package (Lakha 1994), small Indian firms without a known brand, an extensive sales network, or sufficient revenue found it more profitable to sell their packages through a foreign collaborator.

***The Indian software industry and the new industrial policy.*** How does this experience of a successful sector square with the many strands of new industrial policy? All of it was privately initiated. Governments at various levels became involved only after the success of the sector was evident, ratifying the success rather than catalyzing it. The industry expanded on the basis of comparative advantage and never needed any protection. Indeed, one advantage of the software sector was that its inputs, largely downloads from satellites, and its output, uploaded to satellites, could not be easily taxed by the Indian authorities. A symbiosis of foreign and domestic firms was critical. Although there was clearly an agglomeration of firms in Bangalore, this was achieved spontaneously without government direction. Foreign contracts rather than government subsidies provided the basis for international exploration of markets. There is no evidence of government initiation or preference.

## Is Industrial Policy Still Relevant?

From Hamilton and List to contemporary discussions of industrial policy, the implicit framework has been that of a firm producing tradable goods at an initial cost disadvantage because of the limited industrial history of the country, learning to become more efficient, and then competing with imports in the local market or successfully exporting. Marketing of the efficiently manufactured product was implicitly assumed to be routine. Reduction of production costs, whether through internal learning by doing or through spillovers within industrial clusters, was viewed as paramount. In discussions of postwar Asian experience, some attention was given to the catalytic role of Japanese, Korean, and Taiwanese trading companies in assembling large quantities of goods and achieving scale economies in marketing, but this activity was not given center stage (Lall and Keesing 1992). Even if countries today could pursue the export-oriented policies of the Republic of Korea and Taiwan, China, of four decades ago, it is not clear that they would be efficacious, given the changed nature of both retailing and production networks.

In the last two decades there has been a shift in the institutional mechanism of international trade, as two types of organization have evolved. One is international production networks in which a producing firm organizes large numbers of suppliers

in several locations. The other is buyer-led networks, in which large retail chains provide specifications for the desired final product and encourage suppliers in developing countries to organize their own production system, which most often include large numbers of local subcontractors.<sup>13</sup> These networks have become increasingly important and are dominant in clothing and electronics and are growing in importance in products such as automotive components. In East Asia, in recent years, components “constitute at least a fifth of manufacturing exports and ... have typically grown 4–5 percent faster than overall trade in East Asia” (Yusuf and others 2003, p. 272).

One effect of the growing importance of international product networks is their efficiency at organizing production and continuously reducing costs so that the global price that nonmember firms must compete with shifts down rapidly. Infant firms undergoing learning face other hurdles: rapidly improving quality, changing characteristics of products, and an array of new goods that compete with existing ones (Ernst 2002). For firms attempting to enter export markets, it cannot be assumed that simply achieving low cost is sufficient to realize foreign sales. There is no guarantee that lead firms will be able to identify one or two firms in a small African country. The existence of supply networks imposes a significant challenge for developing-country firms that are not embedded in such a network, because the lead firms usually succeed in generating higher performance in design, engineering, effective use of information and communication technology, and ability to coordinate production in several locations (Yusuf and others 2003).

Further militating against the classical view of infant industries is the change in the nature of retailing. Consider a mundane product such as socks that can be produced efficiently with relatively labor-intensive technology. Huge retailers such as Wal-Mart and Target buy socks in quantities that exceed the production capacity of small (by international standards) companies. The special economic zones in China have become a series of clusters that produce enormous quantities of socks, ties, and other clothing. Retailers and wholesalers place large orders that are well beyond the production capacities of smaller firms, even if they have quickly learned to become cost-competitive in relatively small quantities. “These days buyers from New York to Tokyo want to be able to buy 500,000 pairs of socks all at once, or 300,000 neckties, 100,000 children’s jackets” (Barboza 2004, section D, p. 1). European firms buy smaller, more varied products but expect local suppliers to provide “in-house design and sample making capabilities that would allow them to translate and adapt the design from Europe” (Sturgeon and Lester 2002, p. 49).

In textiles, clothing, electronics, automotive parts, and other sectors being part of an international product network is critical to exporting and quality upgrading. Firms that are not part of such networks may not succeed even if they are as efficient as members in production costs. Local participants in the network must “label, track, respond to product orders in real time on the basis of style, color, fabric, and



size; exchange information on an ... electronic basis, provide goods to a retailer's distribution center that can be efficiently moved to stores ... including containers with bar codes concerning contents" (Yusuf and others 2003, p. 283). These requirements, now fairly standard in many product areas, suggest that successful penetration of high-income markets will become increasingly difficult for countries that have not yet industrialized.

In electronics, an important labor-intensive growth sector in the past for many Asian countries, much of the production is now carried out by contract manufacturers that have grown enormously in the last decade. The activities of firms such as Solectron and Flextronics, formerly undertaken by main industrial country firms, are now outsourced. Sturgeon and Lester (2002) examined the location of several activities of Solectron—headquarters, manufacturing, materials purchasing and management, new production introduction centers, and after sales repair centers—and found that most of these activities take place in industrial countries or in the more advanced semi-industrial countries contiguous to them, such as Mexico, Puerto Rico, Romania, and Turkey. Ernst (2002, p. 24) confirms these results and points out that specialized clusters in countries such as the Nordic countries, France, Germany, and the United States are main sources as are Hungary, Israel, the Republic of Korea, Singapore, and Taiwan, China. Poorer countries even if they have a potential cost advantage after a long learning period will have trouble breaking into these existing networks.

Moreover, China and India present formidable competitors, as demonstrated by the concern over the termination of the Multifiber Arrangement and the Agreement on Textiles and Clothing and the potential losses incurred by countries that formerly had guaranteed access to Organisation for Economic Co-operation and Development markets. While it might be argued that the two giant countries will encounter rising wages and thus will enter more capital- and technology-intensive sectors, making room for new countries, both still have hundreds of millions of workers, largely in the rural sector, who remain poor and will keep a lid on real wages faced by industrialists over the next decades, implying a continuing supply of low-cost products in many sectors. While in principle poorer countries can find niches in which they have a comparative advantage, finding them is likely to require skills that are best nurtured by membership in a production network or direct interaction with large retailers.

What does the growing importance of production networks imply for potential government interventions? The Republic of Korea and Taiwan, China, had numerous trading companies that aggregated the orders of local manufacturers, following the Japanese model of the *shosha soja*. Most of these arose spontaneously from private efforts. Governments could encourage the development of trading companies where there are market failures—setup costs may be high whereas the marginal costs of adding firms to the network may be small. Such trading firms would operate

across clusters of manufacturing firms. Again, this assumes that there are capital market failures that preclude a nascent trading firm from obtaining finance.

Other policy questions arise. Will government-sponsored clusters be as effective in generating continuing improvements in product development, quality upgrading, and efficiency to sustain competition on the world market or will firms within clusters improve faster by becoming part of networks? There is some anecdotal evidence that international networks attempt to limit the extent of upgrading, especially in higher value-added segments of design. If so, the question once again is whether to promote specific activities within the entire production nexus, but this is beyond the capacity of all but the most competent of governments (Humphrey and Schmitz 2002). Taiwan, China's experience in the Hsinchu Science Park may be an exception, but it is so far unconfirmed by systematic evidence.

## Concluding Remarks

Does the current policy landscape of the multilateral trading system even permit developing countries to pursue industrial policy? Should it? Developing countries have to contend with several multilateral agreements that were not in existence when the rich countries of today were developing. Have the constraints and disciplines imposed by World Trade Organization (WTO) agreements such as Trade-Related Aspects of Intellectual Property Rights, and Trade-Related Investment Measures become too restrictive to allow developing countries to chart their preferred course to economic development? This is a difficult question, but it cannot be dismissed out of hand. Certainly, the international policy environment today imposes constraints on the use of national policies that were absent even 15 years ago, and the constraints are backed by the potent dispute settlement procedure of the WTO (Noland and Pack 2003, chapter 5).

The experience in several countries in the last two decades suggests that private firms have often been successful in pursuing learning strategies that earlier analysts had advocated. The growth of the Indian software sector, Bangladesh's clothing industry, and China's special economic zones was driven primarily by private-sector agents (often from abroad). In Bangladesh and India the main role of the government was benign neglect, whereas China imitated the earlier success of Singapore by enabling the location of foreign investment in enclaves that were well provided with infrastructure. Much of the earlier investments came from overseas Chinese.

In none of these cases was there a government policy that singled out individual firms or industries with high learning potential and likely spillovers. In Bangladesh and China foreign firms brought standard technology but important extensive marketing networks. Standard comparative advantage can explain the pattern of sector choice. Compared with the exceptionally complex process of either picking sectors

(or firms) or allowing firms to identify their own competitive advantage, it seems much more efficient in the current state of intensifying world competition and the growing importance of extensive and complex supply networks to allow foreign firms to facilitate cost reduction in the host economy.

This suggests a change in focus from even the new industrial policy to one that focuses on negotiation with multinational firms on issues ranging from environmental regulation and taxes to efforts to ensure local learning. The difficulty with this approach is the limited amount of FDI going to developing countries—many countries in Africa, the Middle East, and Latin America continue to receive little. This may be because of their weak overall economic prospects given their poor policies. But in these economies hewing to some of the main tenets of the Washington Consensus (while recognizing some of its weaknesses) might prove a better investment of limited government competence and legitimacy than the extraordinarily complex strategies required by either the new or the old industrial policy.

## Notes

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1. Bardhan’s model is in the spirit of the original learning by doing model of Arrow, which posited learning that occurred in the machine-producing sector. Some of the endogenous growth literature also posits such effects. However, the literature on technological innovation summarized in Evenson and Westphal (1995) and Ruttan (2001) shows that learning can occur in all sectors, a fact that would enormously complicate the results of much of the literature.

2. Pack and Saggi (2001) explore the implications of the provision of free technology by the purchasers of a firm’s exports, a further complication.

3. It is not likely that this criterion has been satisfied by the European Airbus effort, widely considered a main example of a successful industrial policy. Furthermore, one also needs to account for the cost of distortions that are generated by the taxes needed to finance the subsidies.

4. Succar’s emphasis on the capital goods sector is similar in spirit to Arrow’s learning by doing model and endogenous growth models such as Romer’s (1986), which employed it as a building block.

5. Rodriguez-Clare (1996a) has shown that coordination failures can lead to “development traps.”

6. As will be discussed below, good  $x$  could be produced by multinationals that establish local production, thus obviating the coordination problem.

7. Much of the effort of the Ministry of International Trade and Industry and the Ministry of Finance in Japan can be described as the interchange of information among firms and interaction with the government to reduce any obstacles to the realization of consistent plans. The same is true of French indicative planning of the 1950s and 1960s. As noted earlier, it is difficult to assess whether such sector-specific targeting was successful. For an extensive review of the empirical evidence on Japan, see Noland and Pack (2003).

8. The complexity of these issues is underlined by the fact that Bagwell and Staiger (1989) reach still other conclusions. They argue that if asymmetric information blocks the entry of high-quality firms,

export subsidies can improve welfare by breaking the entry barrier facing high-quality firms. Thus, whether an export subsidy is desirable hinges on the nature of the distortion that is caused by the presence of asymmetric information.

9. It is worth noting that if production is intended primarily for a protected domestic market, local suppliers, especially if there are local content requirements, may have costs above world prices, raising the possibility that greater linkages may lower the value of domestic output.

10. The following paragraphs are based on Noland and Pack (2003, chapter 2).

11. Japan's Ministry of Finance apparently agrees. In a June 2002 report issued by its Policy Research Institute, it maintains that "the Japanese model was not the source of Japanese competitiveness but the cause of our failure" and specifically argues that sectors sheltered by Ministry of International Trade and Industry became bloated and inefficient, whereas those exposed to international competition tended to be more market-aware, efficient, and profitable (Morita 2002).

12. Some observers feel this was an incorrect allocation of education funds and that the returns would have been greater to more extensive and higher quality primary and secondary education. The success of the software industry does not disprove this view. For example, the favorable effect of the adoption of the green revolution package on the income of Indian farmers of elementary school education is well established.

13. A good description of these alternatives and evidence on their quantitative importance is given in Gereffi (1999); see also Yusuf and others (2003, chapter 7). UNCTAD (2001) and Sturgeon and Lester (2002) provide evidence on the empirical importance of the international production networks.

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