ECONOMIC DEVELOPMENT AS SELF-DISCOVERY*

Ricardo Hausmann and Dani Rodrik

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John F. Kennedy School of Government
Harvard University
79 Kennedy Street
Cambridge, MA 02138
(617) 496-3740
ricardo_hausmann@harvard.edu

John F. Kennedy School of Government
Harvard University
79 Kennedy Street
Cambridge, MA 02138
(617) 495-9454
dani_rodrik@harvard.edu

ABSTRACT

In the presence of uncertainty about what a country can be good at producing, there can be great social value to discovering costs of domestic activities because such discoveries can be easily imitated. We develop a general-equilibrium framework for a small open economy to clarify the analytical and normative issues. We highlight two failures of the laissez-faire outcome: there is too little investment and entrepreneurship ex ante, and too much production diversification ex post. Optimal policy consists of counteracting these distortions: to encourage investments in the modern sector ex ante, but to rationalize production ex post. We provide some informal evidence on the building blocks of our model.

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Introduction

The theory and practice of economic development have converged in the last two decades on a remarkably simple view of growth fundamentals. Stated in its starkest form, this view is that economic growth requires two things: foreign technology and good institutions. This perspective is well grounded in the neoclassical model of economic growth, which predicts that poor countries will experience rapid convergence with advanced economies once they have access to state-of-the-art technologies and their governments respect property rights. From this perspective, failure to grow can be attributed two one or both of two pathologies. One is the "closed-economy" pathology, in which governments retard technological progress by reducing access to foreign investment and imported capital equipment and intermediate goods. The other is the "corruption" pathology, in which political leaders fail to respect property rights and screw things up deliberately in order to enrich themselves and their cronies. The natural remedies for these pathologies are economic openness and improved governance. With these remedies in place, economic growth should follow naturally. In the words of a recent paper on growth: "Once a developing country government establishes the rules to a fair game and ensures their enforcement, it would be well advised to stand back and enjoy the self-generating growth" (Roll and Tallbott 2001). Reforms in the areas of governance and openness have accordingly become the cornerstones of development strategy in virtually every country during the last fifteen years.

Actual development experience presents at best an awkward fit with this conception of growth basics. We point in particular to two important types of evidence that seem to us to run counter to the consensus view. The first of these relates to the economic performance of Latin

American countries during the 1990s. By the standards of the consensus view, the quality of policymaking in Latin America has been unmistakably and significantly better in the 1990s than it was two or three decades before. For example, Morley et al.'s (1999) index of structural reform[1]—measuring the degree to which government intervention has been reduced in trade, finance, taxation, and ownership—shows the Latin American average rising steadily from around 0.47 in the early 1970s (out of a maximum of one), to about 0.55 in the mid-1980s, and then rapidly to 0.82 in 1995. Yet these economies' response to the reforms has been extremely disappointing. Economic growth in the 1990s has been on average much lower than in the decades before 1980, even though the region was closed to trade and had poorer institutions by most benchmarks in the earlier period. In fact, only three Latin American countries (Chile, Uruguay, Argentina) have outperformed in the 1990s their record during 1950-1980. Of these three, only Chile remains a clear success. Uruguay's performance has hardly been exemplary, as its growth rate looks good only in relation to an even worse performance prior to 1980. And Argentina now lies in ruins. Why is growth so low in a region that has tried so hard to adopt the consensus agenda?

The other side of the coin, and the second strand of ill-fitting evidence, is presented by the experience of countries that have had greater success. Some of the most important among these countries—South Korea and Taiwan since the early 1960s, China since the late 1970s, and India since the early 1980s—have done extremely well under quite heterodox arrangements. All these countries have emphasized exports and none grossly violated property rights. But their strategies bear only passing similarity to today's consensus precepts. South Korea and Taiwan retained high levels of protection for a long time, and made active use of industrial policies.

[1] Morley et al.'s index (1999) is based on Lora (1997). See also Lora (2001).

When Korea was hit with the Asian financial crisis in 1997, its economy had so many institutional weaknesses by orthodox standards that many observers located the crisis' roots in Korea's "governance" problems. China achieved phenomenal growth rates without formally enacting private property rights—something that would have seemed impossible to many economists had the Chinese miracle not taken place. India barely reformed its incredibly cumbersome trade and industrial regime before its economy took off in the 1980s. And even after more ambitious reforms were enacted in the early 1990s, the Indian economy remained among the world's most protected. Of course heterodoxy did not produce payoffs everywhere. Most countries with protected economies and poor protection of property rights languished or retrogressed. But the fact that the world's *most* successful economies during the last four decades prospered doing things that are more commonly associated with failure is something that cannot be easily dismissed.

We present here a different perspective on economic development, one that has more room for the Latin American and Asian "anomalies" noted above. Our focus is on a particular type of learning that we believe has not received enough attention in the literature on economic development: learning what one is good at producing.[2] We emphasize that this a key challenge in the process of transformation into a modern economy. Neither economic theory nor management science is of much help in helping entrepreneurs (or the state) choose appropriate investments among the full range of modern-sector activities, of which there could be tens of thousands, once one moves beyond broad categories such as "labor-intensive products" or "natural-resource based products." Yet making the right investment decisions is key to future

[2] For a paper that is focused on learning about the institutions that are appropriate to the local setting, see Mukand and Rodrik (2002).

growth, as it determines the pattern of specialization.[3] In these circumstances, there is great social value to discovering that cut flowers, soccer balls, or computer software can be produced at low cost, because this knowledge can orient the investments of other entrepreneurs. But the initial entrepreneur who makes the "discovery" can capture only a small part of the social value that this knowledge generates. As the cases we shall discuss in the empirical section of the paper reveal, other entrepreneurs can quickly emulate such discoveries. Consequently, entrepreneurship of this type—learning what can be produced—will typically be undersupplied, and economic transformation delayed.

This perspective differs from the standard view in an important way. In the neoclassical model, it is presumed that the production functions all extant goods are common knowledge. Our starting point is that this is not a good assumption for developing countries. Much technology is "tacit," meaning that it cannot be easily codified into blueprints that allow easy application (Nelson 1990, Evenson and Westphal 1995, Lall 2000). Moreover, even when the production techniques used in the advanced countries are transparent to outsiders, their transfer to new economic and institutional environments typically require adaptations with uncertain degrees of success.[4] This is an aspect of technology transfer that is amply documented in the literature. In their survey on technology transfer, for example, Evenson and Westphal (1995)

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[3] This kind of indeterminacy of specialization is different from the indeterminacy that originates from scale economies or learning-by-doing. The latter are the subject of Gomory and Baumol (2000): "Today there is not one uniquely determined best economic outcome based on national advantages. Today's global economy does not single out a single best outcome, arrived at by international competition, in which each country serves the world's best interests by producing just those goods that it can naturally turn out most efficiently. Rather, there are *many possible outcomes* that depend on what countries actually choose to do, what capabilities, natural or human, they actually develop." (Gomory and Baumol 2000, 5, emphasis in the original).

[4] For an important theoretical analysis of "learning to learn," and how its presence may be responsible both for lack of convergence across countries and for specialization in production, see Stiglitz (1987). Zeira's (1987) model of investment, in which a firm does not know its profit function and can discover it only through investment, come especially close to capturing the essence of our approach. In our model, unlike in Zeira's, knowledge acquired in the process of discovering one's costs spills over to other potential entrepreneurs.

emphasize the role of domestic tinkering in the successful adoption of foreign technology. They list such adaptations as "technological efforts related to raw material control, product and process quality control, production scheduling, repair and maintenance, changes in production mix, as well as others including episodic trouble-shooting to overcome problems encountered in the course of operations" (1995, 2249).[5] We shall discuss these issues at greater length when we turn to empirical evidence.

If learning what a country is good at producing requires an investment *and* the returns to that investment cannot be fully appropriated, the problem faced by potential entrepreneurs in developing countries is identical to the problem faced by innovators in the advanced industrial countries. However, the policy environments facing the "innovators" in the two settings are quite different. Typically, the intellectual property regime protects discoverers of *new* goods through the issuance of temporary monopolies, i.e., patents. But the investor in the developing country who figures out that an *existing* good can be produced profitably at home does not normally get such protection, no matter how high the social return.[6] Indeed, ease of entry by competitors (i.e., imitators) is normally judged to be an important indicator of how well markets function—the lower the barriers to entry, the better. Free entry makes the non-appropriability problem worse, and undercuts the incentive to invest in discovering what a country is good at producing. Laissez-faire cannot be the optimal solution under these circumstances, just as it is not in the case of R&D in new products.

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[5] Another source of uncertainty is about trading possibilities--whether there is adequate demand out there for a particular product, for example. This type of informational problem is discussed in Rauch and Watson (2001) in their model of "international trade intermediaries," and "network intermediation." Such entrepreneurship may be under-supplied because intermediaries may not have enough incentive to maintain and expand their informational networks.

[6] As Evenson and Westphal (1995) note, the kind of local adaptations that are normally required "are seldom associated with inventions that are patentable abroad. They do not yield improvements that are sufficiently inventive relative to the known state of the art" (1995, 2249).

We develop a general-equilibrium framework in the next section to clarify the analytical and normative issues. We begin with a small open economy that is initially specialized in traditional activities where there is no uncertainty. There also exist a large number of modern activities, as yet not exploited, all of which have an uncertain productivity. In the first period, entrepreneurs have the option of setting up a "firm" of a fixed size and discovering the true costs of production in the specific activity they have invested. In the second period, they can operate as a monopoly, and choose to do so if their costs turn out to be lower than the relevant world price. In the third period, costs of all active firms become common knowledge and there is free entry, eliminating (through adjustments in wages) all excess profits. We characterize in this setting both the laissez-faire equilibrium and the social optimum (in which the social planner can allocate resources at will, but has no more information than is available to the private sector). We highlight two failures of the laissez-faire outcome: there is *too little* investment and entrepreneurship in the first period (unless the second period is "very long"), and *too much* production diversification in the second. Optimal policy consists of counteracting these distortions: to encourage investments in the modern sector ex ante, but to rationalize production ex post.

Let us now return to the anomalies that we used to motivate this paper. What does our framework have to say about the possible causes of the disappointing Latin American performance? Our model offers three clues as to why the investment response may have been anemic despite increased openness and improved institutions. First, and most significantly, the binding constraints to growth may have been elsewhere. Entrepreneurship may have been constrained by inadequate inducements to discover costs in new activities (given that the private returns to such investments lie far below social returns), and not by inadequate property rights or lack of access to imported technologies. Second, to the extent that market-oriented reforms have increased the mobility of firms, they may have actually reduced incentives to invest in new activities. Ease of entry speeds up emulation, and reduces the appropriability of cost discoveries. In fact, if this is the case, reforms have a bigger payoff in the short run than in the long run: new entrants exploit the benefits of past cost discoveries, but once these are exhausted, the economy is dragged down by the lower efforts in innovation.[7] Third, to the extent that the reforms have increased productivity in traditional sectors alongside potential new activities, they may have increased the resource cost of entrepreneurship in the modern sectors. What we can say, at the very least, is that the reforms of the 1980s and 1990s have paid scant attention to the problem of spurring investment in non-traditional activities when returns to entrepreneurship in such activities are subject to non-appropriability for reasons that we highlight in this paper.

With regard to Asia, our framework helps us understand why the provision of rents by governments (through trade protection, temporary monopolies, subsidized credits, and tax incentives) has gone hand in hand with industrial growth and diversification. These rents may have been needed to stimulate the cost discovery process. Detailed accounts documenting these rents in South Korea and Taiwan (see for example Amsden 1989, Wade 1990, and Evans 1995) are otherwise impossible to square with the conventional understanding of what constitutes desirable economic policies. At the same time, our framework highlights how rents can backfire if governments do not complement them with policies that rationalize industries and discipline firms that end up with high costs. We would hypothesize that the absence of such discipline was

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[7] This is consistent with the evidence from Latin America. Initial estimates of the growth effects of reforms (Easterly, Loayza and Montiel 1997, Lora and Barrera 1997, and Fernandez-Arias and Montiel 1997) found relatively large and permanent effects. Using more recent data, Lora (2002) finds that the growth payoff to reform is smaller and more transitory than originally estimated.

a hallmark of import substitution policies (ISI) in Latin America. We will come back to this distinction after we develop our analytical framework.

The outline of the paper is as follows. We describe and analyze the formal framework in the next section. Following a policy discussion, we then turn to some suggestive empirical evidence. We provide evidence on three aspects of our framework in particular. First, we show that there is a large element of uncertainty at a disaggregated level as to what a country will be good at producing. Second, we discuss evidence relating to the difficulties entailed in importing technology off-the-shelf. Third, we summarize some case studies of domestic technology diffusion from successful incumbents to emulators.

Conceptual framework

We embed our policy analysis in a model of a small open economy with two sectors, modern and traditional. We distinguish between these two sectors according to whether costs of production are known. The modern sector is made up of n goods that are not currently produced, and the costs of which are discovered only after production is attempted. Letting c_i denote unit costs of production of good i, we assume that costs depend on unobserved productivity parameter θ_i in the following manner:

$$c_i = \frac{bw}{\theta_i}, \qquad (1)$$

where w is the wage rate and b/θ_i is the number of workers needed to produce a single unit of the good i. We have in mind many different types of uncertainty: producing a good that has not been locally produced previously requires learning about how to combine different inputs in the right way, figuring out whether local conditions are conducive to efficient production, and discovering the true costs of production. We use uncertainty over θ_i as a proxy for all this. We assume that the ex-ante distribution of θ_i is uniform over the interval [0, 1] and that the θ_i are i.i.d. across the *n* sectors. Note that modern-sector production uses only labor and has constant-returns to scale technology once productivity is known.

The unobserved productivity parameters θ_i is a property of the individual goods, and not of entrepreneurs: all entrepreneurs who run firms producing good *i* will operate with productivity θ_i. We shall assume that each modern-sector firm is of a given size, fixed (by appropriate choice of units) to one unit of good *i*'s output. Each entrepreneur can run one, and no more than one, modern-sector firm.

Discovering θ_i requires setting up the firm, which in turn entails the hiring of *b* units of labor. In this initial stage (period 1), the firm produces nothing. Let *m* denote the number of entrepreneurs who choose to establish firms in period 1. The total amount of (sunk) investment in the first period is correspondingly *mbw*. We will refer to *m* interchangeably as the quantity of "investment" or "entrepreneurship."

In period 2, θ_i become known for those *m* goods in which investments have been made. Entrepreneurs have the option of producing a unit of the good and earning *p* (an exogenous price fixed on world markets[8]), or, if unit costs bw/θ_i turn out to be larger than *p,* to close the firm at no extra cost. In this period, there is no entry into the modern sector so that entrepreneurs who produce will earn excess profits. (Even though *p* is fixed, so is output thanks to the assumptions that firm size is fixed and an entrepreneur cannot run more than a single firm.) This transitional period of monopoly profits can be motivated in one of two ways. It could be that it takes time

[8] Note that these are goods that are already being produced in other, more advanced countries. So saying that there are well-known, fixed prices is not at odds with the assumption that none of them are being produced at home currently.

for the θ_i to become common knowledge. Alternatively, θ_i can be immediately known, but it could take time for an "imitator" to set up a firm. We denote the length of period 2 as T.

Finally, in period 3 (which lasts until infinity), there is free entry into the modern sector, and excess profits are eliminated. The latter happens in our case via upward adjustments in the wage rate w.

The model is closed by describing production in the traditional sector. We assume that the traditional sector operates under constant returns to scale, and employs labor and a fixed factor. It will be convenient to use a specific functional form, so we write the production function in the traditional sector as $y = (\bar{l} - s)^{\alpha}$, where $\bar{l}$ is the total labor force of the economy, s is employment in the modern sector, and α is the factor share of labor in the traditional sector. The diminishing marginal returns to labor in the traditional sector implies that the modern sector faces a positively-sloped labor supply curve. Adjustments in wages will therefore play an important equilibrating role for our economy. We assume that n is small relative to $\bar{l}$, so that we do not have to keep track of the implications for the labor force as the number of entrepreneurs, m, varies. The price of the traditional sector is fixed at 1 as the numeraire.

<u>Social optimality: The full-information case</u>. Consider first the case of an omniscient social planner, who not only can allocate production at will, but also has full knowledge of the θ_i for all the sectors without any prior investment. The full-information social optimum is easy to describe. Rank modern-sector goods by their θ_i, and let θ^{max} denote the highest θ_i. Let $h(s)$ denote the value marginal product of labor in the traditional sector ($h(s) = \alpha(\bar{l} - s)^{\alpha-1}$). Then the optimum is characterized by the following three conditions:

(2a) $$\frac{p\theta^{\max}}{b} > h(\bar{l}) \Rightarrow s = \bar{l} \text{ (full specialization in good with } \theta_i = \theta^{max}\text{);}$$

(2b) $$h(\bar{l}) \geq \frac{p\theta^{\max}}{b} \geq h(0) \Rightarrow 0 \leq s \leq \bar{l}\ ;$$

(2c) $$\frac{p\theta^{\max}}{b} < h(0) \Rightarrow s = 0 \text{ (full specialization in the traditional sector).}$$

For modern-sector production to be viable, labor productivity in the good with θ^{max} must be high enough that condition (2c)—value marginal product of labor in the traditional sector exceeds that in the modern sector even when the economy is completely specialized in the former sector—can be ruled out. We assume this is the case. This leaves the other two possibilities, where the economy either fully specializes in the θ^{max} sector (2a), or is diversified between this and the traditional sector (2b). Note that due to constant costs in the modern sector, it never pays for the social planner to operate any modern-sector good with $\theta_i < \theta^{max}$. If the modern-sector is active, the optimal thing to do is to concentrate all resources in the θ^{max} sector until either wages rise sufficiently to equate the marginal value product of labor in the traditional sector or all labor is exhausted.

Social optimality: Incomplete information. Now turn to a more realistic social planning problem, where the planner can still allocate resources at will, but has to incur the same learning costs as private entrepreneurs do. The planner has to decide how many investments, m, to undertake in period 1. Each modern-sector good is ex-ante identical with an expected $\bar{\theta} = ½$. However, once the productivity parameters of m of the goods are revealed, only the one with the highest θ_i will matter: as before, the social planner will never want to produce a modern good with a lower θ_i than the maximum that is already known. So what matters to the planner is not the expected θ_i (which is independent of m), but the maximum of m draws (which does depend on m). Let the latter be denoted by $\theta^{\max}(m)$. Since the ex-ante distribution of θ_i is uniform over

[0, 1] and the draws are independent, the expected value of the rank statistic $\theta^{\max}(m)$ has the simple form $E(\theta^{\max}(m)) \equiv \widehat{\theta}(m) = m/(1+m)$. We note that $\widehat{\theta}(m)$ is increasing in *m*, but at a decreasing rate ($\theta'(m) > 0, \theta''(m) < 0$). So the social planner gains by increasing investment in first period learning, but there exist diminishing returns.

In period 1, *mb* units of labor are allocated to "investment" ($s_1 = mb$, where a subscript denotes the time period). First-period output is therefore:

(3) $$y_1 = (\bar{l} - s_1)^{\beta} = (\bar{l} - mb)^{\alpha}$$

Productivity in the modern sector on periods 2 and 3 is not known for sure ex ante, so a risk-neutral social planner will use the expected productivity $\widehat{\theta}(m)$ to anticipate the future labor market equilibrium. Labor allocation will be determined by setting the value marginal product of labor equal in the two sectors in expected terms:

(4) $$\frac{p\hat{\theta}(m)}{b} = \alpha(\bar{l} - s_2)^{\alpha-1}$$

Since the social planner will allow free entry starting from period 2 (and not period 3, as in the decentralized case), there is no distinction between periods 2 and 3 in the social planning problem, so we use the subscript "2" denote outcomes in both periods. Note also that we are assuming a diversified equilibrium (corresponding to case 2(b) above). Equation (3) implicitly defines s_2 as an increasing function of *m*. Using (3), the (expected) outputs of the modern (*x*) and traditional (*y*) sectors can be expressed in turn by

(5) $$x_2 = \frac{s_2\hat{\theta}(m)}{b} = \frac{\hat{\theta}(m)}{b}\left[\bar{l} - \left(\frac{p\hat{\theta}(m)}{\alpha b}\right)^{\frac{1}{\alpha-1}}\right]$$

(6) $$y_2 = (\bar{l} - s_2)^{\alpha} = \left(\frac{p\hat{\theta}(m)}{\alpha b}\right)^{\frac{\alpha}{\alpha-1}}$$

Since the social planner faces an intertemporal trade-off, we need to specify a discount rate. For reasons that will become clear later, it is convenient for our purposes to specify the discounting in the following way. Let the discount factor between period 1 and 2 be given by δ, while the instantaneous discount rate is ρ. We shall express the present discounted value from the vantage point of period 1 of a stream of continuous payments K that are received during period 2 and 3 as $\delta K/\rho$. (Obviously, δ is a function of both ρ and the "length" of period 1. Since we treat both of the latter as constants, there is no harm in treating δ as a constant as well.)

The social planner's maximand can now be written as the present discounted value of production evaluated at world prices:

(7) $$\max_{m} \; W = y_1 + \frac{\delta}{\rho}\left(y_2 + px_2\right)$$

with y_1, y_2, and x_2 as defined in (3), (5), and (6). The associated first-order condition is given by:

(8) $$\frac{\delta}{\rho}\frac{p}{b}s_2\hat{\theta}'(m) - \alpha b(\bar{l} - mb)^{\alpha-1} = 0,$$

where s_2 is as defined implicitly by (4). The first term in this equation expresses the marginal benefit of first-period investment: an increase in m increases expected future productivity in the modern sector, a gain that is spread over the equilibrium level of future employment in the modern sector (s_2). The latter feature introduces an element of increasing returns to scale to investment, since s_2 is itself an increasing function of m. The countervailing forces are the diminishing return to $\hat{\theta}(m)$ and the rising marginal cost of drawing labor away from the traditional sector (captured by the second term in (8)). We assume these countervailing forces dominate, so that the second-order condition is satisfied and we have an interior solution. It is easy to verify, under these conditions, that the social planner's choice of m, as defined implicitly by (8), is increasing in p and decreasing in b.

Decentralized equilibrium. We now characterize the market equilibrium under the conditions discussed previously, namely that the entrepreneurship decision is decentralized and there is no entry ("imitation") during period 2. That means that any entrepreneur who decides to produce in period 2 earns a monopoly profit during the length T of the second period. Since the expected productivity is $\bar{\theta}$ = ½, expected profits equal $\pi = p - \frac{bw_2}{\bar{\theta}} = p - 2bw_2$, where w_2 is the (expected) equilibrium wage that prevails in period 2. The present discounted value of these profits, since they accrue only for a time of length T, equals $\frac{\delta}{\rho}\left(1-e^{-\rho T}\right)\pi \equiv \frac{\delta}{\rho}R(T)\pi$, with $R(0)=0$, $0<R(T)<1$, and $R'(T)>0$. Under free entry, expected profits are just offset by the investment cost that each entrepreneur incurs in setting up a firm in period 1. The condition for zero-profits ex ante is therefore given by:

$$\frac{\delta}{\rho}R(T)(p-2bw_2)-bw_1 \leq 0, \tag{9}$$

with the equation holding as an equality whenever $m>0$. Even though m does not appear explicitly here, this equation determines the quantity of aggregate investment since m affects the level of wages in periods 1 and 2 through the labor-market constraint.

The labor-market clearing equation for period 1 is:

$$w_1 = \alpha(\bar{l} - mb)^{\alpha-1}. \tag{10}$$

To determine the corresponding equation for period 2, we need to know the proportion of investments that actually lead to production. Once bw is sunk, an entrepreneur will choose to remain in the modern sector as long revenues cover variable costs. Denote by $\tilde{\theta}$ the limit productivity such that this is true, i.e. $\tilde{\theta} = \frac{bw_2}{p}$. All entrepreneurs who draw $\theta_i \geq \tilde{\theta}$ will choose to produce in the second period. Therefore the expected level of employment in the modern sector in period 2 is $s_2 = (1-\tilde{\theta})mb = (1-\frac{bw_2}{p})mb$. The labor-market equilibrium in this period can then be written as

$$w_2 = \alpha\left(\bar{l} - [1-\frac{bw_2}{p}]mb\right)^{\alpha-1}. \tag{11}$$

Equations (9), (10), and (11) determine the three endogenous variables in the system, *m,* w_1, and w_2.

Outcomes in period 3 can be determined separately, but are not needed for our purposes. We just note that with free entry in the third period, all but the highest productivity firm close down, and imitation drives profits in that activity down to zero. The mechanism that achieves rationalization of production is this: lower productivity activities are driven out as wages get bid up by the entry of more firms into the highest-productivity activity. Since entrepreneurs make zero profits in period 3, the investment level is determined only by outcomes in periods 1 and 2.

We now discuss the salient features of the decentralized equilibrium. First, note from (9) that m=0 for T sufficiently close to zero. The interpretation is straightforward: entrepreneurs earn monopoly profits only during the duration of the second period. If the length of this period shrinks to zero, there is no incentive to invest in discovering costs. If imitation is immediate, the equilibrium level of investment and entrepreneurship is zero. Second, over the range of T for which m>0, m, w_1, and w_2 are all increasing in T. That is, investment increases as the monopoly period is extended. Third, as long as monopoly prevails, modern-sector production is diversified and does not specialize in the good with the highest (known) productivity. Once imitation kicks in with free entry, production in the modern sector is rationalized and only highest-productivity activity survives.

Compared to the social optimum discussed previously, therefore, the decentralized equilibrium suffers from two distinct inefficiencies. First, the level of investment and entrepreneurship in the market equilibrium (call it m^c) does not coincide with that required for social optimum (call it m^*). This can be verified easily by comparing the first-order condition of the social planner (eq. 8) with the free entry condition of market equilibrium (eq. 9). Note that the second term is the same for the two equations (substitute (10) into (9)), but that the first, capturing the benefits of investment, differ. The planner cares about the economy-wide benefits, while the entrepreneur cares about monopoly profits. Where m^c stands in relation to m^* is ambiguous in general. If monopoly profits are short-lived (T is small), then $m^c < m^*$, and there is too little investment and too few entrepreneurs in the market equilibrium. This is the case that motivates the analysis of this paper. On the other hand, if free entry is delayed for very long (T is large), then $m^c > m^*$, and there is over-investment motivated by the pursuit of monopoly profits.

The second source of inefficiency is the existence of monopoly power in period 2. In our framework, the costs of monopoly arise not from price-setting behavior (which is constrained by the small-open economy assumption), but from the fact that restricted entry yields too little specialization within the modern sector. Monopoly prevents the flow of resources into the highest-productivity activity, and allows activities that will not eventually survive to do so.

The bottom line of the framework is that as long as T is non-zero but not too large, the laissez-faire equilibrium delivers (a) *too little* investment and entrepreneurship, and (b) *too much* production diversification in the modern sector.

Policy issues

The key policy recommendation that comes out of our framework is that governments need to play a dual role in fostering industrial growth and transformation. They need to encourage entrepreneurship and investment in new activities ex ante, but push out unproductive firms and sectors ex post. This is of course easier said than done. The specifics of how this can be managed is likely to differ considerably from country to country, depending on administrative capability, the prevailing incentive regime, the flexibility of the fiscal system, the degree of sophistication of the financial sector, and the underlying political economy. Governments without adequate capacity to exercise leadership over their private sectors are likely to mess things up rather than do better. But there are examples to suggest that the job can be done.

In attempting to promote innovation, governments have used a variety of instruments such as trade protection, public sector credit, tax holidays, and investment and export subsidies. Clearly, all appropriate policy interventions need to increase the expected pay-off to innovation. However, interventions typically create other distortions. For example, they may lower $\widetilde{\theta}$ by making less productive activities privately profitable, inefficiently increasing the heterogeneity of the modern sector. Moreover, if the instrument does not adequately discriminate between innovators and copycats, it will promote early entry, thus limiting the benefits to innovators while increasing the social cost of the intervention since copycats will get part of the resources transferred.

Interventions can be further classified in two groups, depending on whether they compensate innovators in case they fail (i.e. in case they draw a low θ), or increase the payoff in case they successful. The first type of interventions is likely to create moral hazard, but the second type will not help those who lack the resources to finance activities in period 1.

Thus, for example, temporary trade protection is far from an ideal instrument. It may increase expected profits of innovators, but it does so only for firms selling in the local market. Moreover, since it does not discriminate between innovators or copycats, it promotes early entry, thus lowering the expected payoff to innovation while inefficiently channeling resources to copycats. Moreover, as protection gets extended to intermediate goods, innovation will tend to focus on domestic markets, instead of new export activities. Since domestic markets are small relative to world markets, the social returns to innovation are likewise smaller. Hence, trade protection is not an efficient way of promoting self-discovery.

Export subsidies avoid the anti-export bias of trade protection, but do not discriminate between innovators and copycats. They also lower $\widetilde{\theta}$, promoting excessive diversification. One advantage of exports subsidies is that they can be relatively good at discriminating between successful and unsuccessful performers ex post. Low-cost producers are more likely to incur the sunk costs of exporting. Therefore providing subsidies contingent on exporting can allow policy makers to sort out firms and sectors that are high productivity from those that aren't. This strategy was actively used by the South Korean and Taiwanese governments during their industrial drives in the 1960s and 1970s.

By contrast, public sector credit or guarantees operate by transferring part of the risk of failure to the government: if the project is successful, the loan gets repaid; if it is not, then the firm will default. Credit has the advantage that it can be made discretionary and thus, it can be targeted on innovators and not to copycats. In fact, in Latin America during the heyday of industrial policy, it was common for development banks to require that no other domestic supplier existed before granting financial support. When market reforms were introduced in the early 1990s, this policy was seen as particularly inadequate: it limited entry and competition.

However, in the context of our model, this is precisely what is needed: public resources should be concentrated on the first entrants. Moreover, judgment can be used in choosing ideas that promise the greater social benefits. However, with discretion come problems of political influence, corruption or at least moral hazard.

Policy instruments can also differ with respect to elements that are required to impose discipline. For example, tariff protection and export subsidies need to be taken away at some point in time. The latter will be under fiscal and international pressure to disappear. The former may require more political effort. Firms used to government loans need to be let go: at some point in time loans cannot be rolled over forever and the firm needs to be required to return the loan or declare default. A brief summary of the costs and benefits of these different types of policies is presented in the table below.

	Trade protection	Export subsidies	Government loans and guarantees
Increases pay-off to innovation by…	…increasing the returns to success and lowering $\widetilde{\theta}$	…increasing the returns to success and lowering $\widetilde{\theta}$	…lowering the losses in case of failure and lowering $\widetilde{\theta}$
Can discriminate between innovators and copycats	No	No, but better at rewarding high productivity activities	Yes
Other distortions to innovation	Biased against export activities		Distorts risk assessments (moral hazard)
Action required to impose discipline	Lowering tariffs	Lowering subsidies	Cut funding

What stands out in many discussions of East Asia is how governments in the region were unusually good at supplying the requisite discipline:

> Where Korea differs from other developing countries in promoting big business was the discipline the state exercised over these *chaebols* by penalizing poor performance and rewarding only good ones… The government as the controller of commercial banks was in a powerful position to punish poorly managed firms by freezing bank credit. As a result only three of the largest 10 *chaebols* in 1965—Samsung, Lucky-Goldstar, ans Ssangyong—remained on the same list 10 years later. Similarly, seven of the largest 10 in 1975 remained on the same list in 1985." (Kim 1993, 363).

The Korean government was quick to shelve its plans for supporting particular firms or industries when new information suggested that productivity would lag (Westphal 1981, 34). The development of textile industry in Taiwan in the 1950s provides a particularly clear example of the strategy suggested by our framework. The Taiwanese government subsidized entry into the industry by supplying inputs and spinning mills, providing working capital, imposing import restrictions, and buying up the resulting production. Local production grew spectacularly as a result. But the government also subsequently restricted entry and tried to prune the non-productive firms (see Evans 1995, 57, and Wade 1990, 79). Japan used a similar combination of state promotion/protection followed by rationalization in the computer industry (Evans 1995, 101).

Consider on the other hand Latin America during its import-substituting industrialization (ISI) period. Latin American ISI produced many successful firms, but also an industrial structure that was too diversified—too many low productivity firms alongside the high performers (see for example Dahlman and Frischtak 1993, 424-5). Discipline was to come to Latin America in the 1990s in the form of trade openness, and many of the low-productivity firms were eventually driven out. Countries such as Argentina, Brazil, and Chile deepened their specialization in capital-intensive, natural resource based industries, while others like Mexico and the smaller Central American countries increased their focus on assembly industries servicing the U.S. market (Katz 2001). But, as our framework suggests, openness and institutional reform were not enough to spark a significant new wave of entrepreneurship and investment in non-traditional activities.

A crude, but useful characterization of the policy environments in East Asia and Latin America, as viewed from the perspective of our framework, would be as follows. East Asian governments provided their firms during the 1960s and 1970s with both promotion (the carrot) and discipline (the stick). Against this benchmark, Latin American industrial performance has fallen short because of varying shortcomings. Under ISI, Latin America was marked by plenty of promotion, but too little discipline. In the 1990s, Latin America has considerable discipline (provided through competitive markets and open trade), but too little promotion.

Empirical evidence

It is difficult to provide direct empirical evidence for the model we have developed here because much of our story has to do with outcomes that are not observed: the failure to develop non-traditional activities because of inadequate incentives to invest in learning what one is good at producing. Our argument rests on the idea that the returns to entrepreneurship of this particular kind are easily competed away by free entry. Looking for systematic evidence that successful investments are rapidly copied is a self-defeating strategy because there shouldn't be much evidence of this sort to the extent that our model does capture an important part of reality. Entrepreneurial initiatives of this kind should tend to remain episodic, almost random events—not systematic ones. We shall discuss a number of such cases below. Similarly, if we were to learn that many successful new firms from developing countries operate with technologies that are hard to copy or have devised successful strategies of product differentiation (with protection against entry imitative entry)[9], this apparently contradictory finding may in fact be quite consistent with our model. After all, a direct implication of our argument is that only investments that provide such protection will be undertaken in equilibrium.

So we are forced to take an indirect route to the empirical evidence. We proceed by providing support separately for three propositions that we consider to be building blocks for our argument. First, there is a large element of uncertainty as to what a country will be good at producing, once we move beyond broad aggregates such as "labor-intensive manufactures" to specific products. Second, there are significant difficulties entailed in importing technology off-the-shelf, with successful local adaptation requiring considerable domestic tinkering. Third, domestic imitation often proceeds quite rapidly when the first two difficulties are overcome, bidding away the rents of the early incumbents. None these propositions is individually controversial. As we highlight below, it is easy to find broad support for all of them in the literatures on international trade, technology transfer, and economic history.

Predicting comparative advantage

The factor-endowments model is reasonably good at predicting the broad structure of comparative advantage for developing countries. Leamer's (1984) classic work, for example, shows that the pattern of global commodity trade is well explained by the distribution of resource endowments across countries. In this work, Leamer aggregates traded products into 10 commodities (petroleum, raw materials, forest products, tropical agriculture, animal products, cereals, labor intensive, capital intensive, machinery, and chemicals) and factors of production into 11 resources (capital, three types of labor, four types of land, coal, minerals, and oil). Wood

[9] See for example the discussion of Spain's sparkling wine and publishing industries in Guillén (2001, chap. 4).

and Mayer (1999) and Mayer and Wood (1999) show that the developing countries' pattern of specialization--labor-intensive manufactures versus natural resource-based products--depends critically on their ratio of human capital endowment to land.

However, for entrepreneurs trying to decide what they should invest in, these kinds of findings are hardly helpful. Consider the information technology sector in India, which represents a shining example of technological success in a low-income country. The industry has grown from a very modest base in the early 1980s to export more than $6 billion of software by 2000. Yet India is a country that one would have hardly expected to have a comparative advantage in a technology-intensive sector (Kapur 2002). India ranks low in terms of conventional indicators of IT penetration, has failed to develop leadership in other high-tech sectors, and is relatively well endowed in unskilled (rather than skilled) workers. Until recently, government policies have not been particularly friendly to investors in that sector. Yet Bangalore-based companies like Infosys and Wipro have managed to create successful business models that have been widely emulated not only by other local entrepreneurs, but also by foreign companies investing in India.

After the fact, it is not difficult to enumerate some of the features that account for this success: the time-zone difference that allows the processing to be done in Bangalore before the West Coast of the U.S. is back at work in the morning, the linkages with the Indian diaspora in Silicon Valley, the facility with the English language, the establishment of the Indian Institutes of Technology, and even the departure of IBM in the late 1970s which gave Indian engineers a head-start with UNIX-based software development (Kapur 2002). Ex ante, however, few of these advantages were as visible. As Narayana Murthy, who founded Infosys with six other software professionals in 1981, once put it to an interviewer, "[our] objective was to conduct an *experiment* …." (Nasdaq International Magazine 1999, emphasis added).

Even if we consider IT in India as an anomaly, the predictions of the factor-endowments are too coarse to have much operational value. Knowing that Bangladesh's comparative advantage lies in labor-intensive manufactures and not in high-tech machinery is useful for sure, but that still leaves hundreds, if not thousands, of different types of activity up for grabs. The six-digit Harmonized Schedule (HS), which most countries use to assess customs duties, comprises around 5,000 different commodity groups. The United States reports its trade statistics in an even more detailed form, using a 10-digit system resulting in about 8,000 commodity groups. These statistical conventions reflect the tremendous variety of products that are "out there" and which newcomers could in principle invest in. Neither trade theorists nor management consultants can be good guides as to whether Bangladesh should produce hats or it should produce bed sheets instead. There is much randomness in the process of discovering what one can be good at. Evenson and Westphal (1995) summarize the firm-level studies thus:

> ...the body of case study research and anecdotal evidence includes numerous cases of failure to achieve the minimum mastery needed to attain the levels of productivity expected when the physical investment was undertaken. It also includes numerous cases of unforeseen success in achieving sufficient mastery to exceed the expected levels of productivity. In the former cases there is no technological development to benefit from subsequent investments in implementing the same or similar technology. In the latter cases there is technological development so that subsequent investments are implemented with increasing efficiency due to the spillovers from previous experience. (1995, 2262-63)

As it turns out, Bangladesh is very good at producing hats—more specifically "hats and other headgear, knitted or from textile material not in strips" (HS 650590)—which constitute Bangladesh's third most important export item to the U.S. after men's cotton shirts and trousers. And it is not very good at producing bedsheets—specifically "bedsheets, pillowcases and bed linen (incl. sets) – woven, not printed – cotton" (HS 630231)—of which it exports only a miniscule amount. Is this a predictable result of innate comparative advantage? Consider Pakistan, which is not too dissimilar to Bangladesh in its economic circumstances. Pakistan exports a large quantity of bedsheets, but few hats. Since these commodities are fairly standardized and labor-intensive, it is difficult to believe that the resource endowments and cost structures of the two countries predispose them in any predictable way to specialize in one but not the other. More likely, existing patterns of specialization are the consequence of historical accidents and serendipitous choices by entrepreneurs.

The case of hats and bedsheets constitutes not the exception but the rule. Table 1 lists the top 25 export items for Bangladesh and Pakistan in the U.S. market, to make the point that the export structures of these two similar countries are surprisingly different at the level of 6-digit HS categories. In fact, only six products are in the top 25 for both countries (these are identified by bold letters). Among Pakistan's major exports, curtains (HS 630392) and soccer balls (HS 950662) are some others that Bangladesh exports either very little or none at all.

We repeat the exercise in Tables 2 and 3 for two other pairs of countries in different parts of the world and at different levels of incomes: Honduras versus the Dominican Republic and Taiwan versus South Korea. Once again, these are pairs of countries that would be expected to have fairly similar patterns of specializations. At a sufficiently aggregated level, that is certainly true. Honduras and the Dominican Republic concentrate on garment exports, while Taiwan and Korea focus on computer products. But at the level of individual products, there are again striking differences. In 2000, the Dominican Republic exported $119 million worth of footwear uppers (HS 640610) to the U.S. while Honduras exported none. Honduras is a major exporter of ignition wiring sets (HS 854430) whereas the Dominican Republic barely exports any. Taiwan exported $279 million worth of bicycles to the U.S. against Korea's $623 *thousand.* Korea exports a lot of air conditioning machines; Taiwan very few. The overlap among the top 25 exports of these two pairs is somewhat larger than in the case of Bangladesh/Pakistan, but far from overwhelming—9 out of 25 for Honduras/Dominican Republic and 10 out of 25 for Taiwan/South Korea.[10]

Suppose we take export performance in different product categories as a measure of a country's relative productivity across these categories. Then these statistics reveal that the range of products countries end up becoming good at producing is quite narrow. Exports are typically highly concentrated, even in rich and relatively diversified countries. This is shown in Figure 1, which displays the cumulative share of the top export items for the six countries mentioned above. The figure also includes German exports for comparison purposes. The top 4 export commodities account for around 40 percent of South Korea's and Honduras' total exports to the U.S. market, and 30 percent of the other countries'. The cumulative share of the top 25 export items ranges from a high of 83 percent for Honduras to a low of 43 percent for Germany, with the figure for all others lying above 60 percent (save for Taiwan).

The message we take from these numbers is twofold. First, for all economies except possibly the most sophisticated, industrial success entails concentration in a relatively narrow range of high-productivity activities. Second, the specific product lines that eventually prove to be hits are typically highly uncertain and unpredictable.

[10] Edward N. Wolf reports a related finding in chapter 11 of Gomory and Baumol (2000). Wolf shows that the industrial structures of the *advanced industrial countries* have not converged even though aggregate total factor productivity and relative factor endowments both have. Patterns of specialization are divergent, and once set, remain stable.

Absorbing foreign technology

Neoclassical models of trade and economic growth presume not only that production functions are known, but that they are identical across countries. Absent government-imposed barriers, once an innovator figures out how to produce something, the same technology quickly becomes available for adoption by followers in other countries.[11] In reality, the problem of mastering modern production techniques is greatly complicated by the *tacit* elements in technology. This aspect of technological development is well recognized in discussions of technology transfer by development economists and economic historians. In a survey for the Handbook of Development Economics, for example, Evenson and Westphal express the point clearly:

> … much of the knowledge about how to perform elementary processes and about how to combine them in efficient systems is tacit, not feasibly embodied and neither codifiable nor readily transferable. Thus, though two producers in the same circumstances may use identical material inputs in conjunction with equal information, they may nonetheless employ what are really two distinct techniques owing to differences in understanding of the tacit elements. … Even supposing that [currently existing techniques] represent optimal solutions for the circumstances in which they are respectively used, it does not follow that they must necessarily be optimal with respect to different circumstances where they have not been previously tested…. Once technology is understood in these more complex terms, it is quite obvious that investments in technology are made whenever it is newly applied, regardless of the novelty of the application. Learning about technology and problem solving using the knowledge acquired in mastering technology are not costless, even if the choices made in realizing the technique to be used are identical in generic terms to choices previously made elsewhere…. A stream of investments over time is typically required to overcome tacitness and thus achieve mastery. Not only is much technology tacit, so too is much knowledge about the specifics of local circumstances and about the ways that differences in circumstances affect the productivity of particular techniques. Tacit knowledge can only be acquired through investments in learning.… (Evenson and Westphal 1995, 2212-2214)

[11] There have been some interesting departures from these assumptions in the recent literature. For example Basu and Weil (1998) and Caselli and Coleman (2000) both focus on differences that arise in per-capita GDP due to differences in "appropriate technologies." However, neither paper considers the role played by uncertainty in technology adoption.

This lengthy quote expresses well many of the points we have tried to capture in our stylized model above. Entrepreneurs in developing countries who start to produce standardized goods that have long been on the scene in more advanced countries are forced to make technological investments even though the goods in question may not be new in any sense. These investments require discovering the tacit elements of technology and adapting them to the local environment. That in turn entails a process of experimentation and learning. As Lall puts it, "enterprises may not be able to predict if, when, how, and at what cost they would learn enough to become fully competitive, even when the technology is well known and mature elsewhere" (2000, 17). There is really no such thing as off-the-shelf technology.

One of the best-studied cases of technology transfer in economic history concerns the cotton textile industry. Cotton mills in Britain's Lancashire were the world leader in this industry until well into the 20th century. The diffusion of technology from Lancashire to other regions—India, Japan, the United States—makes for a fascinating story about the role of local capabilities in recipient countries. Lancashire's technological mastery resided in mule spinning. It gave rise not only to British dominance in world markets for cotton textiles, but also to the establishment of a capital-goods export industry which sold textile machinery and expertise to other countries. Lancashire firms such as Platt would supply foreign buyers a full technological package, complete with equipment, know-how, training, and even managers and skilled workers. Thanks to this, countries around the world had in principle access to the "same" technology that was available to Lancashire textile producers. In the case of India, for example, an important textile producer in its own right, Clark and Woolcott (2001, 10-11) note that "up to at least the 1940s there is no sign of any Indian lag in the types of machinery employed compared to the advanced economies." Yet productivity and profitability in Indian mills remained a fraction of the levels in Lancashire, a failure that Clark and Woolcott attribute to India's "inability to employ the technology effectively" (2000, 10-11). Saxonhouse and Wright have studied the history of the cotton textile industry in detail by analyzing the records of the textile machinery exporters from Lancashire. They too note the heterogeneity in performance across countries despite the access to identical technologies, and they observe: "the diversity of experience among the newly emerging industries make it clear that progress was a two-sided affair, a mutual adaptation between machines and local conditions" (2000, 10).

Japan, which started out way behind India, was able to overtake India in the early part of the 20th century and become a strong competitor of Britain. Japanese progress was based not on the British mule-spinning technology, but on American-style ring spinning. The story of Japan's cotton textile industry is an intricate one involving both entrepreneurial ingenuity and state initiative. The beginning of the industry can be dated to 1872 when the Meiji government took over a small private mill with the intent of making into a model factory that would inspire private investment in similar enterprises. While not a huge commercial success, the factory proved to be a major popular attraction: "Such large crowds gathered outside to gawk at the mill that it decided to charge a fee of ten sen for a tour" (Fletcher 1996, 53). The government started more model factories, purchased spindles from England, and sold them to local entrepreneurs on very easy terms (providing 10-year loans at zero interest) (Fletcher 1996, 54). The state-initiated projects were unable to operate the imported technology efficiently, and after the 1880s the government ceased direct assistance to cotton spinning. It was private firms with independent operations and using variants of ring-spinning technology that came to dominate the Japanese industry. Saxonhouse and Wright attribute Japan's success to the Japanese producers' skill in adapting the American techniques to "an entirely different economic and cultural environment" (2000, 10).

Japan's experience with steel had many of the same elements. Early, "off-the-shelf" imports of foreign technology during the Meiji period did not produce results until Japanese engineers were able to adapt production processes to local conditions. Odagiri and Goto (1993, 90-91) describe the Meiji government's efforts. In 1874, the Meiji government overrode a local engineer's more modest plans, and built a large steel furnace in Kamaishi using British equipment and engineers. The plant had to be closed down after 196 days of operation because of problems with local supplies of fuel: charcoal availability was inadequate, and when the fuel source was switched to coke, the coke that could be obtained proved to be of poor quality. The plant was restarted several years later after a smaller furnace based on local technology was introduced. When in 1896 the government decided to build an integrated steel mill in Yawata, "the lesson of Kamaishi appears to have been forgotten" (Odagiri and Goto 1993, 91). A German company was hired to make the plans, equipment was brought in from Germany, and German engineers and managers were put in charge. But the quality of coke in Japan differed from that in Germany, making steel production very difficult. The mill was forced to shut down within a year. Once again, the plant had to be reconfigured by domestic engineers to make the furnaces more appropriate to Japanese coke.

The more recent history of East Asian and Latin American countries in the postwar period is also replete with experiences that highlight the importance of local adaptation of technology. Amsden (1989, 278) relates the story of Korean shipbuilder Hyundai, which established its first shipyard in the early 1970s using imported designs from a Scottish firm Scotlithgow. Because Scotlithgow had small capacity, the Scottish firm's technique relied on building the two halves of the ship separately, and then putting them together. When Hyundai followed the same approach, trying to replicate all specifications in detail, it turned out that the Korean workers could never make the two halves fit just right. There was more to the technology than following the blueprint; the tacit knowledge required in building the ships could not be transferred. Hyundai eventually became the world's largest shipbuilder, but only after it made a large investment in in-house design and research capabilities.

The Hyundai story is broadly indicative of Korea's experience with regard to technology imports: "It is a striking fact that formal purchase of technology in complete packages through such means as turnkey plant contracts and licensing, plus their functional equivalent—direct foreign investment—accounts for only a modest share of the technology that has been mastered in Korea…" (Evenson and Westphal 1995, 2263-64). Similarly, in Taiwan, "activities such as imitating, copying, or limited improvement of the existing foreign product (i.e., various reverse engineering tactics), were the major sources of acquiring foreign technologies" (Hou and Gee in Nelson, 390).

Even in technologically lagging countries, significant amount tinkering normally takes place in order to adapt imported techniques. In Argentina, "many of the newly erected firms found themselves needing to gradually develop 'in house' technological capabilities in areas such as product design, production engineering, industrial planning, and organization where 'from the shelf' technology was not particularly well suited, given the highly idiosyncratic nature of the local production structure" (Katz and Bercovich in Nelson 455; see also Katz and Kosacoff 2000). These instances show how local firms have to engage in a series of improvements to enhance productivity even when the technology is standardized and implemented in the form of turnkey plants (see also Kim in Nelson 365). According to Evenson and Westphal (1995, 2241): "Plants established under turnkey projects … often continue years later to produce well under their design capacity owing to insufficient local effort to develop the requisite production capabilities."

Domestic spillovers and imitation

There is a large body of anecdotal evidence on the process of technology diffusion from successful first-comers to later imitators. In their review of literature on technology transfer, Evenson and Westphal (1995) cite several cases. They discuss the case of a successful foreign-owned farm machinery producer in Brazil, which progressively lost market share to indigenous producers as the latter first imitated and then adapted the multinational's models, making them better suited to local conditions. Within twenty years, local firms came to dominate the market for all but the most complex models (Evenson and Westphal 1995, 2257). Another case involves rice-threshing technology:

> … the key activity enabling Philippine rice producers to benefit from rice threshing technology developed in Japan was the adaptive invention of a prototype thresher at IRRI. Using this prototype, local inventors made the specific adaptations required to enable the economic use of threshers in the many different circumstances in which they are now used in the Philippines. (ibid, 2261)

Note that the International Rice Research Institute (IRRI) is a non-profit, public entity. Had a private producer instead played IRRI's role, it would have been unable to appropriate much of the social returns due to the rapid entry of imitators.

The diffusion occurs typically, but not exclusively, through the turnover of skilled workers and managers who have acquired the requisite expertise on the job. Indeed, the poaching of such employees by later entrants is one of the most important competitive threats that pioneering firms face. The early Japanese experience with cotton textiles again provides an interesting illustration. A private enterprise, Osaka Spinning Co., Ltd., became so profitable in the 1890s that its success "produced fifteen firms more or less modeled upon that firm" (Yonekawa 1982, 29). The high priority that these early investors attached to retaining their skilled workers is evident from the statutes of the Japan Spinners Association—the industry association that was established in 1882 by the director of one of the early government-owned mills: "The most specific provisions [in the Association's regulations] … aimed at preventing firms from raiding skilled workers from each other and from hiring troublemakers" (Yonekawa 1982, 56).

The practice of raiding pioneering firms' workers has not lost its attractions over the years. In Korea, for example, it is the main channel through which technology has diffused within the domestic economy. According to Dahlman et al., when they establish new lines of production Korean firms, "simply offer higher salaries to engineers and other technicians from other local firms, technicians already skilled in the installation and operation of the new process being adopted" (1985, 45).[12] Most late entrants poach personnel from incumbents—initially state enterprises and later on other private enterprises—to set up their own facilities (Kim 1993, 365). In Taiwan, labor mobility appears to have played a similar role, particularly in diffusing technology from the local subsidiaries of foreign firms to other domestic firms (Hou and Gee 1993, 389). In the Indian IT industry, poaching of workers by late entrants and employees leaving to start their own companies are among the main headaches faced by established firms (Lateef 1997, Forbes Global 1998).

Consider the garment industry in Bangladesh, which is a well-studied case of industrial take-off (Rhee 1990). At the origin of the Bangladeshi garment "miracle" lies a largely serendipitous investment made by a local entrepreneur in a joint venture with Dawoo of Korea.

[12] As Dahlman et al. note, "such footloose personnel can speed diffusion considerably, but they also discourage investments by firms in their human capital" (1985, 45).

As Rhee makes clear in his account, few local investors had shown interest in garments, and Daewoo did not hold very high hopes for the project either. (Daewoo's interest in investing in Bangladesh derived from other reasons). But once the venture, called Desh, proved successful, imitation was very rapid: "…115 of the initial corps of 130 workers trained by Daewoo in Korea left Desh at different times following the end of the Desh-Daewoo agreement to set up their own, often competing, garment exporting firms" (Rhee 1990, 341). [See the story of the Mohammadi company in the paper.] As a result, the industry grew from a handful of factories in 1979 to more than 700 exporters by 1985 (ibid). The spread of know-how from the workers initially trained by Desh was critical—much more so than the availability of capital and other resources. Once it became common knowledge that Bangladesh had a profitable market niche in garments, the industry took off like a mushroom. But note as well that, as our previous review of export statistics for Bangladesh, has highlighted, the consequence of all this was not a generalized enhancement of industrial capacity in manufactures, or even in all types of labor-intensive manufactures. The spillovers to other types of manufacturing seem to have been very limited, and Bangladeshi exports remain extremely undiversified.

Or consider the Colombian cut flower industry, the story of which is told in Rhee and Belot (1990). How did Colombia get from nowhere to being the largest supplier of cut flowers to the U.S.? Once again, it was a single entrepreneur that was responsible for it all. Thomas Kehler, an American businessman in Colombia, happened to be looking for a business opportunity. He and some partners did a feasibility study, jointly put up an initial investment of $100,000, and set up Floramerica in 1969. By 1986, annual sales had risen to $50 million, and this produced a tremendous demonstration effect:

> Other companies have copied Floramerica's production and marketing methods; this dynamic process has been facilitated by the movement of key staff who embodied the

> know-how accumulated at Floramerica… David Cheever, one of the founders of Floramerica, left the company after two years to become a consultant to the growing Colombian flower industry. By assisting in the start-up of many new flower companies, he has been a driving force in diffusing know-how accumulated in Floramerica throughout the country. Second, two salesmen at Floramerica's Miami sales office left the company …." (Rhee and Belot 1990, 31).

By 1990, there were about 250 flower export firms in Colombia, the vast majority of which were fully Colombian-owned (ibid).[13]

Concluding remarks

We have focused here on a neglected aspect of economic development. Learning what one if good at producing is an important determinant of structural change, but it is also one that is unlikely to be adequately provided under laissez-faire. The social returns to such learning are likely to be much larger than the private returns, as successful "discoveries" of what can be produced at low cost can be easily imitated in general.

There is a role here for government policy, but it is not a simple one. Optimal strategies have to complement the promotion of "new" activities with the pruning of investments that turn out to be high cost ex post. That in turn requires the government to exercise a certain amount of discipline over the private sector. This is a task at which many governments have proved inadequate. But in the absence of a policy framework that is cognizant of this obstacle, adoption of good institutions and openness to foreign technology may well prove insufficient to spark a sustained process of economic transformation and growth.

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[13] For more examples of how competitive industries are often started as a result of efforts by individual entrepreneurs who combine vision and expertise, see Rhee and Belot (1990). Rhee and Belot call these "catalysts."

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Table 1: Comparison of top 25 export items to the U.S in 2000: Bangladesh and Pakistan (US$ million)

A. Bangladesh

	HS Code and Product	Bangladesh exports	Pakistan exports
1	**620520 - MENS/BOYS SHIRTS - WOVEN - COTTON**	236.2	34.5
2	**620342 - MENS/BOYS TROUSERS, OVERALLS AND SHORTS - WOVEN - COTTON**	183.9	70.9
3	650590 - HATS AND OTHER HEADGEAR - KNITTED OR FROM TEXTILE MATERIAL NOT IN STRIPS	175.1	0.7
4	620462 - WOMENS/GIRLS TROUSERS, OVERALLS AND SHORTS - WOVEN - COTTON	148.5	17.2
5	030613 - SHRIMPS AND PRAWNS - FROZEN	145.2	7.5
6	620630 - WOMENS/GIRLS BLOUSES, SHIRTS AND SHIRT-BLOUSES - WOVEN - COTTON	141.4	11.4
7	611030 - SWEATERS, SWEATSHIRTS AND WAIST-COATS - KNITTED - MAN-MADE FIBRES	123.3	5.6
8	**611020 - SWEATERS, SWEATSHIRTS AND WAIST-COATS - KNITTED - COTTON**	99.4	284.1
9	620193 - MENS/BOYS ANORAKS, SKI AND WIND JACKETS AND SIMILAR ARTICLES - WOVEN - MAN-MADE FIBRES	82.0	2.6
10	**620343 - MENS/BOYS TROUSERS, OVERALLS AND SHORTS - WOVEN - SYNTHETIC FIBRES**	61.4	20.0
11	610821 - WOMENS/GIRLS BRIEFS AND PANTIES - KNITTED - COTTON	51.5	0.7
12	620293 - WOMENS/GIRLS ANORAKS, SKI AND WIND JACKETS AND SIMILAR ARTICLES - WOVEN - MAN-MADE FIBRES	48.7	2.4
13	620920 - BABIES GARMENTS (INCL COATS AND SNOWSUITS) AND CLOTHING ACCESSORIES - WOVEN - COTTON	36.9	5.5
14	621111 - MENS/BOYS SWIMWEAR - WOVEN	35.7	0.7
15	**621142 - WOMENS/GIRLS COVERALLS, SMOCKS AND GARMENTS NES - WOVEN - COTTON**	35.7	24.9
16	620640 - WOMENS/GIRLS BLOUSES, SHIRTS AND SHIRT-BLOUSES - WOVEN - MAN-MADE FIBRES	34.1	0.7
17	620821 - WOMENS/GIRLS PYJAMAS AND NIGHTDRESSES - WOVEN - COTTON	31.6	3.6
18	620530 - MENS/BOYS SHIRTS - WOVEN - MAN-MADE FIBRES	31.3	2.4
19	620463 - WOMENS/GIRLS TROUSERS, OVERALLS AND SHORTS - WOVEN - SYNTHETIC FIBRES	31.3	6.8
20	630622 - TENTS - SYNTHETIC FIBRES	31.2	0.6
21	620452 - WOMENS/GIRLS SKIRTS AND DIVIDED SKIRTS - WOVEN - COTTON	25.5	4.5
22	611120 - BABIES GARMENTS (INCL HOSIERY) AND CLOTHING ACCESSORIES - KNITTED - COTTON	23.7	11.7
23	620469 - WOMENS/GIRLS TROUSERS, OVERALLS AND SHORTS - WOVEN - TEXTILE NES	23.2	0.9
24	621040 - MENS/BOYS SNOWSUITS AND SIMILAR GARMENTS NES - WOVEN - COATED FABRICS	20.6	0.9
25	**610510 - MEN'S/BOYS SHIRTS - KNITTED - COTTON**	20.6	172.4
	SUB-TOTAL	1878.1	693.4
	OTHERS	540.3	1474.0
	TOTAL (ALL PRODUCTS)	2418.4	2167.4

B. Pakistan

	HS Code and Product	Pakistan exports	Bangladesh exports
1	**611020 - SWEATERS, SWEATSHIRTS AND WAIST-COATS - KNITTED - COTTON**	284.1	99.4
2	**610510 - MEN'S/BOYS SHIRTS - KNITTED - COTTON**	172.4	20.6
3	630260 - COTTON TERRY TOWELS AND HOUSEHOLD LINEN OF COTTON TERRY FABRICS	138.0	19.6
4	570110 - CARPETS - WOOL/ FINE HAIR - KNOTTED	100.8	0.0
5	630710 - INDUSTRIAL SHOP TOWELS (FLOOR/DISH CLOTHS, DUSTERS AND CLEANING CLOTHS)	85.9	11.1
6	**620342 - MENS/BOYS TROUSERS, OVERALLS AND SHORTS - WOVEN - COTTON**	70.9	183.9
7	420310 - ARTICLES OF APPAREL OR CLOTHING (EXCEPT GLOVES) - LEATHER	70.3	0.0
8	630210 - BEDSHEETS, PILLOWCASES AND BED LINEN (INCL SETS) - KNITTED OR CROCHETED	50.9	0.0
9	520819 - COTTON (>85%) FABRICS - WOVEN NES - UNBLEACHED - <200 G/M2	39.1	0.0
10	610910 - T-SHIRTS, SINGLETS AND OTHER VESTS - KNITTED - COTTON	34.7	14.9
11	**620520 - MENS/BOYS SHIRTS - WOVEN - COTTON**	34.5	236.2
12	520812 - COTTON (>85%) FABRICS - PLAIN WEAVE - UNBLEACHED - 100-200 G/M2	32.6	2.7
13	630221 - BEDSHEETS, PILLOWCASES AND BED LINEN (INCL SETS) - WOVEN, PRINTED - COTTON	31.3	4.2
14	630222 - BEDSHEETS, PILLOWCASES AND BED LINEN (INCL SETS) - WOVEN, PRINTED - MAN-MADE FIBRES	30.5	0.0
15	711319 - ARTICLES OF JEWELLERY - PRECIOUS METALS (OTHER THAN SILVER)	25.7	0.0
16	**621142 - WOMENS/GIRLS COVERALLS, SMOCKS AND GARMENTS NES - WOVEN - COTTON**	24.9	35.7
17	520512 - COTTON (>85%) YARN - SINGLE, UNCOMBED 714.29-232.56 DECITEX - NON-RETAIL	24.2	0.0
18	901890 - INSTRUMENTS AND APPLIANCES USED IN MEDICAL, SURGICAL OR VETERINARY SCIENCES NES (INCL PARTS)	24.1	0.0
19	520839 - COTTON (>85%) FABRICS - WOVEN NES - DYED 1 COLOR - <200 G/M2	23.4	0.2
20	950662 - OTHER INFLATABLE BALLS FOR SPORTS	23.2	0.0
21	630392 - CURTAINS (INCL DRAPES), INTERIOR BLINDS AND BED VALANCES - WOVEN - SYNTHETIC FIBRES	22.6	0.1
22	630231 - BEDSHEETS, PILLOWCASES AND BED LINEN (INCL SETS) - WOVEN, NOT PRINTED - COTTON	21.8	0.0
23	521021 - COTTON (<85%) /MAN-MADE FABRICS - PLAIN WEAVE - BLEACHED - <200 G/M2	21.4	0.0
24	630790 - MADE UP ARTICLES OF TEXTILE MATERIALS NES (INCLUDING DRESS PATTERNS AND SHOE LACES)	20.3	0.7
25	**620343 - MENS/BOYS TROUSERS, OVERALLS AND SHORTS - WOVEN - SYNTHETIC FIBRES**	20.0	61.4
	SUB-TOTAL	1427.7	690.7
	OTHERS	739.8	1727.7
	TOTAL (ALL PRODUCTS)	2167.4	2418.4

Source: Trade Data Online from Industry Canada (http://strategis.ic.gc.ca/sc_mrkti/tdst/engdoc/tr_homep.html)

Table 2: Comparison of top 25 export items to the U.S in 2000: Honduras and Dominican Republic (US$ million)

A. Honduras

	HS Code and Product	Honduras exports	Dominican Republic exports
1	**610910 - T-SHIRTS, SINGLETS AND OTHER VESTS - KNITTED - COTTON**	499.1	173.7
2	**611020 - SWEATERS, SWEATSHIRTS AND WAIST-COATS - KNITTED - COTTON**	458.7	118.1
3	**620342 - MENS/BOYS TROUSERS, OVERALLS AND SHORTS - WOVEN - COTTON**	142.6	493.0
4	610711 - MEN'S/BOYS UNDERWEAR - KNITTED - COTTON	133.1	123.7
5	**621210 - BRASSIERES**	128.0	144.6
6	610990 - T-SHIRTS, SINGLETS AND OTHER VESTS - KNITTED - TEXTILE NES	122.6	20.8
7	610510 - MEN'S/BOYS SHIRTS - KNITTED - COTTON	121.0	14.0
8	620520 - MENS/BOYS SHIRTS - WOVEN - COTTON	112.1	21.6
9	090111 - COFFEE - NOT ROASTED, NOT DECAFFEINATED	97.2	3.2
10	030613 - SHRIMPS AND PRAWNS - FROZEN	83.6	0.4
11	080300 - BANANAS, INCLUDING PLANTAINS - FRESH OR DRIED	76.1	2.8
12	**620462 - WOMENS/GIRLS TROUSERS, OVERALLS AND SHORTS - WOVEN - COTTON**	74.7	247.8
13	854430 - IGNITION WIRING SETS AND OTHER WIRING SETS USED FOR VEHICLES, AIRCRAFT OR SHIPS	57.9	0.0
14	621010 - RAINCOATS AND GARMENTS NES MADE UP OF TEXTILE FELTS AND NONWOVEN TEXTILE FABRICS	54.8	7.6
15	**240210 - CIGARS, CHEROOTS AND CIGARILLOS (CONTAINING TOBACCO)**	49.8	191.5
16	**610822 - WOMENS/GIRLS BRIEFS AND PANTIES - KNITTED - MAN-MADE FIBRES**	49.6	37.5
17	**620343 - MENS/BOYS TROUSERS, OVERALLS AND SHORTS - WOVEN - SYNTHETIC FIBRES**	47.9	194.5
18	611030 - SWEATERS, SWEATSHIRTS AND WAIST-COATS - KNITTED - MAN-MADE FIBRES	45.8	23.8
19	**610821 - WOMENS/GIRLS BRIEFS AND PANTIES - KNITTED - COTTON**	45.4	36.3
20	620530 - MENS/BOYS SHIRTS - WOVEN - MAN-MADE FIBRES	39.0	13.6
21	610462 - WOMENS/GIRLS TROUSERS, OVERALLS AND SHORTS - KNITTED - COTTON	34.7	19.6
22	030611 - ROCK LOBSTER AND OTHER SEA CRAWFISH - FROZEN	26.4	0.0
23	080719 - MELONS OTHER THAN WATERMELONS - FRESH	22.7	5.9
24	610342 - MEN'S/BOYS TROUSERS, OVERALLS AND SHORTS - KNITTED - COTTON	20.7	18.2
25	620711 - MENS/BOYS UNDERWEAR - WOVEN - COTTON	20.1	2.9
	SUB-TOTAL	2563.7	1915.2
	OTHERS	526.3	2468.8
	TOTAL (ALL PRODUCTS)	3090.0	4384.0

B. Dominican Republic

	HS Code and Product	Dominican Republic exports	Honduras exports
1	**620342 - MENS/BOYS TROUSERS, OVERALLS AND SHORTS - WOVEN - COTTON**	493.0	142.6
2	901890 - INSTRUMENTS AND APPLIANCES USED IN MEDICAL, SURGICAL OR VETERINARY SCIENCES NES (INCL PARTS)	339.9	0.0
3	**620462 - WOMENS/GIRLS TROUSERS, OVERALLS AND SHORTS - WOVEN - COTTON**	247.8	74.7
4	**620343 - MENS/BOYS TROUSERS, OVERALLS AND SHORTS - WOVEN - SYNTHETIC FIBRES**	194.5	47.9
5	**240210 - CIGARS, CHEROOTS AND CIGARILLOS (CONTAINING TOBACCO)**	191.5	49.8
6	**610910 - T-SHIRTS, SINGLETS AND OTHER VESTS - KNITTED - COTTON**	173.7	499.1
7	**621210 - BRASSIERES**	144.6	128.0
8	711319 - ARTICLES OF JEWELLERY - PRECIOUS METALS (OTHER THAN SILVER)	142.3	0.0
9	610711 - MEN'S/BOYS UNDERWEAR - KNITTED - COTTON	123.7	133.1
10	640610 - PARTS OF FOOTWEAR - UPPERS (EXCLUDING STIFFENERS)	119.2	0.0
11	**611020 - SWEATERS, SWEATSHIRTS AND WAIST-COATS - KNITTED - COTTON**	118.1	458.7
12	853620 - AUTOMATIC CIRCUIT BREAKERS - VOLTAGE NOT EXCEEDING 1,000 VOLTS	82.4	0.0
13	170111 - CANE SUGAR - RAW	78.0	4.4
14	720260 - FERRO-NICKEL	70.5	0.0
15	650590 - HATS AND OTHER HEADGEAR - KNITTED OR FROM TEXTILE MATERIAL NOT IN STRIPS	57.0	1.1
16	620333 - MENS/BOYS JACKETS AND BLAZERS - WOVEN - SYNTHETIC FIBRES	51.5	2.8
17	853690 - OTHER APPARATUS - FOR SWITCHING, PROTECTING OR CONNECTING ELECTRIC CIRCUITS - NOT EXCEEDING 1,000 V	51.1	0.0
18	850440 - ELECTRIC STATIC CONVERTERS (INCL POWER SUPPLIES, RECTIFIERS AND INVERTERS)	48.3	0.0
19	611592 - SOCKS AND STOCKINGS - KNITTED - COTTON	46.4	11.2
20	620463 - WOMENS/GIRLS TROUSERS, OVERALLS AND SHORTS - WOVEN - SYNTHETIC FIBRES	42.3	13.2
21	611120 - BABIES GARMENTS (INCL HOSIERY) AND CLOTHING ACCESSORIES - KNITTED - COTTON	38.8	18.0
22	**610822 - WOMENS/GIRLS BRIEFS AND PANTIES - KNITTED - MAN-MADE FIBRES**	37.5	49.6
23	**610821 - WOMENS/GIRLS BRIEFS AND PANTIES - KNITTED - COTTON**	36.3	45.4
24	611241 - WOMEN/GIRL SWIMWEAR - KNITTED - SYNTHETIC FIBRES	34.6	4.2
25	610832 - WOMENS/GIRLS PYJAMAS AND NIGHTDRESSES - KNITTED - MAN-MADE FIBRES	33.5	3.2
	SUB-TOTAL	2996.4	1687.1
	OTHERS	1387.6	1402.9
	TOTAL (ALL PRODUCTS)	4384.0	3090.0

Source: Trade Data Online from Industry Canada (http://strategis.ic.gc.ca/sc_mrkti/tdst/engdoc/tr_homep.html)

Table 3: Comparison of top 25 export items to the U.S in 2000: Taiwan and South Korea (US$ million)

A. Taiwan

	HS Code and Product	Taiwan exports	South Korea exports
1	**847130 - PORTABLE COMPUTERS (WEIGHT 10-KG OR LESS) WITH AT LEAST A CPU, A KEYBOARD AND A DISPLAY**	3796.1	320.7
2	**847330 - PARTS AND ACCESSORIES OF AUTOMATIC DATA PROCESSING MACHINES (INCL COMPUTERS) AND UNITS THEREOF**	3769.2	2824.3
3	**854213 - MONOLITHIC DIGITAL INTEGRATED CIRCUITS - METAL OXIDE SEMICONDUCTORS (MOS TECHNOLOGY)**	3343.0	6525.7
4	**847160 - INPUT OR OUTPUT UNITS FOR COMPUTERS AND OTHER DATA PROCESSING MACHINES**	1220.7	2236.1
5	**854230 - MONOLITHIC INTEGRATED CIRCUITS NES (OTHER THAN DIGITAL)**	1151.4	586.9
6	852510 - TRANSMISSION APPARATUS - FOR FAX, TELEVISION AND RADIO TRANSMITTERS	908.7	37.4
7	**853400 - PRINTED CIRCUITS**	895.9	226.9
8	847180 - OTHER UNITS (EXCL STORAGE AND INPUT/OUTPUT UNITS) OF AUTOMATIC DATA PROCESSING MACHINES	892.7	112.3
9	851750 - MODEMS AND OTHER APPARATUS FOR CARRIER-CURRENT LINE SYSTEMS OR FOR DIGITAL LINE SYSTEMS NES	614.4	43.0
10	850440 - ELECTRIC STATIC CONVERTERS (INCL POWER SUPPLIES, RECTIFIERS AND INVERTERS)	486.8	62.4
11	852390 - PREPARED UNRECORDED MEDIA FOR SOUND RECORDING OR OTHER PHENOMENA (EXCL CINEMATOGRAPHY) NES	447.7	6.7
12	**611030 - SWEATERS, SWEATSHIRTS AND WAIST-COATS - KNITTED - MAN-MADE FIBRES**	385.7	366.5
13	731815 - OTHER BOLTS OR SCREWS NES (WITH OR WITHOUT THEIR NUTS OR WASHERS) - IRON OR STEEL	318.4	20.6
14	846591 - SAWING MACHINES FOR WORKING WOOD, CORK, BONE. HARD RUBBER, HARD PLASTICS OR SIMILAR HARD MATERIALS	286.6	0.0
15	871200 - BICYCLES AND OTHER CYCLES	278.8	0.6
16	848180 - TAPS, COCKS, VALVES AND OTHER SIMILAR APPLIANCES, NES	277.7	74.4
17	950691 - ARTICLES AND EQUIPMENT FOR EXERCISE, GYMNASTICS AND ATHLETICS	271.0	4.1
18	731814 - THREADED SELF-TAPPING SCREWS - IRON OR STEEL	260.9	3.9
19	**847170 - STORAGE UNITS FOR COMPUTERS AND OTHER DATA PROCESSING MACHINES**	229.9	826.8
20	853669 - ELECTRICAL PLUGS AND SOCKETS - FOR VOLTAGE NOT EXCEEDING 1, 000 VOLTS	215.4	18.0
21	940320 - METAL FURNITURE NOT FOR OFFICE USE	206.2	14.5
22	731816 - NUTS - IRON OR STEEL	203.0	13.7
23	**847150 - DIGITAL PROCESSING UNITS WITH OR WITHOUT REST OF SYSTEM**	202.2	1245.3
24	940360 - WOODEN FURNITURE FOR OTHER USE	193.1	8.5
25	**852540 - STILL IMAGE VIDEO CAMERAS AND OTHER VIDEO CAMERA RECORDERS**	189.4	271.2
	SUB-TOTAL	21045.0	15850.5
	OTHERS	19469.2	24449.8
	TOTAL (ALL PRODUCTS)	40514.2	40300.3

B. South Korea

	HS Code and Product	South Korea exports	Taiwan exports
1	**854213 - MONOLITHIC DIGITAL INTEGRATED CIRCUITS - METAL OXIDE SEMICONDUCTORS (MOS TECHNOLOGY)**	6525.7	3343.0
2	870323 - MOTOR VEHICLES - SPARK IGNITION - CYLINDER CAPACITY 1500-3000 CC	4281.3	0.4
3	852520 - TRANSMISSION/RECEPTION APPARATUS - FOR CB/AMATEUR RADIOS, FAX, CELLULAR PHONES AND THE LIKE	2916.3	58.2
4	**847330 - PARTS AND ACCESSORIES OF AUTOMATIC DATA PROCESSING MACHINES (INCL COMPUTERS) AND UNITS THEREOF**	2824.3	3769.2
5	**847160 - INPUT OR OUTPUT UNITS FOR COMPUTERS AND OTHER DATA PROCESSING MACHINES**	2236.1	1220.7
6	**847150 - DIGITAL PROCESSING UNITS WITH OR WITHOUT REST OF SYSTEM**	1245.3	202.2
7	**847170 - STORAGE UNITS FOR COMPUTERS AND OTHER DATA PROCESSING MACHINES**	826.8	229.9
8	271000 - PREPARATIONS OF/NON-CRUDE PETROLEUM OILS AND OILS OBTAINED FROM BITUMINOUS MINERALS	599.9	1.1
9	**854230 - MONOLITHIC INTEGRATED CIRCUITS NES (OTHER THAN DIGITAL)**	586.9	1151.4
10	870322 - MOTOR VEHICLES - SPARK IGNITION - CYLINDER CAPACITY 1000-1500 CC	542.8	0.0
11	851650 - MICROWAVE OVENS - DOMESTIC	486.8	0.6
12	**611030 - SWEATERS, SWEATSHIRTS AND WAIST-COATS - KNITTED - MAN-MADE FIBRES**	366.5	385.7
13	**847130 - PORTABLE COMPUTERS (WEIGHT 10-KG OR LESS) WITH AT LEAST A CPU, A KEYBOARD AND A DISPLAY**	320.7	3796.1
14	**852540 - STILL IMAGE VIDEO CAMERAS AND OTHER VIDEO CAMERA RECORDERS**	271.2	189.4
15	841510 - AIR CONDITIONING MACHINES (AIR CONDITIONERS) - WINDOW OR WALL TYPES, SELF-CONTAINED	262.6	1.2
16	620530 - MENS/BOYS SHIRTS - WOVEN - MAN-MADE FIBRES	257.9	18.0
17	852190 - VIDEO RECORDING OR REPRODUCING APPARATUS - EXCLUDING MAGNETIC TAPE-TYPE	235.9	16.5
18	**853400 - PRINTED CIRCUITS**	226.9	895.9
19	852990 - PARTS (EXCLUDING AERIALS) FOR RADIO, TELEVISION, RADAR AND OTHER SIMILAR APPARATUS	187.4	123.0
20	401110 - NEW PNEUMATIC TIRES OF RUBBER - FOR USE ON MOTOR CARS (INCL STATION WAGONS AND RACING CARS)	181.1	43.6
21	852110 - VIDEO RECORDING OR REPRODUCING APPARATUS - MAGNETIC TAPE TYPE	172.5	6.3
22	870899 - OTHER MOTOR VEHICLE PARTS NES	148.2	150.7
23	481011 - PAPER (WOODFREE) - COATED - FOR WRITING/PRINTING - <150 G/M2	143.8	2.8
24	841430 - COMPRESSORS OF A KIND USED IN REFRIGERATING EQUIPMENT	139.0	17.2
25	847149 - OTHER COMPUTERS OR DIGITAL AUTOMATIC DATA PROCESSING UNITS PRESENTED IN THE FORM OF SYSTEMS	131.1	87.5
	SUB-TOTAL	26117.3	15710.6
	OTHERS	14183.1	24803.6
	TOTAL (ALL PRODUCTS)	40300.3	40514.2

Source: Trade Data Online from Industry Canada (http://strategis.ic.gc.ca/sc_mrkti/tdst/engdoc/tr_homep.html)

Figure 1: Export concentration in selected countries