
Industrial Policy: Growth Elixir or Poison?

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The debate about industrial policy occasioned by the East Asian financial crisis is the latest chapter in an ongoing discussion about the effectiveness of selective government intervention in fostering rapid industrial growth. The crisis that began in the Republic of Korea in 1997 and the weak growth in Japan over much of the 1990s have prompted a reexamination of the effectiveness of the government actions in the two countries that pursued sectoral selectivity most intensively. If indeed industrial policies were important in accelerating growth, there may be lessons for other countries still in the early stages of industrialization. Conversely, if the magnitude of the contribution was small, more conventional policies should be pursued unless it is assumed that governments can improve on the efforts of Japan and Korea.

The East Asian financial crisis that erupted in July 1997 renewed interest in the East Asian miracle, a term that had only recently entered the development vocabulary. Many causes were identified quickly, ranging from the excessively rapid opening of capital markets to the decline in the extent of prudential regulation of the banking system that had characterized the countries through the early 1990s. Some analysts argued that the financial vulnerabilities revealed during the crisis stemmed in part from earlier efforts to implement an industrial policy that required commercial banks to lend to sectors and firms selected by the government. Banks, in this view, had inherited weak balance sheets as a consequence of the low profitability of these preferred sectors (see Claessens, Djankov, and Lang 1998). Moreover, the banks had lost (or failed to acquire) the ability to select, evaluate, and monitor individual loans (Fry 1995). The huge capital inflows that began in the mid-1990s into countries such as the Republic of Korea thus were channeled through institutions that had suffered a serious erosion of skills and discipline. Industrial policy, in this view, had been a slow-acting poison for the countries pursuing it, one that necessitated emergency measures in 1997 and 1998. Others argued that, on the contrary, industrial policy had been a growth elixir that led to more rapid growth than would have been

obtained from simply following good macroeconomic policies combined with supportive efforts such as encouraging the rapid growth of education (Amsden 1989; Lall 1997).

The debate about industrial policy occasioned by the financial crisis was only the latest installment in an ongoing debate about the efficacy of government intervention in fostering more rapid economic growth. Some of the earliest literature in development economics, based on a preliminary understanding of Soviet growth, argued that sectors such as heavy metals and machinery were particularly important and that these sectors generated externalities whose benefits were so desirable that they warranted government support. Other analysts argued that there were important market failures such as real external economies stemming from research and development and important imperfections in the market for information (Chenery 1959; Scitovsky 1954). Partly in response to such views and partly because of the perception that agriculture was inferior to industry, many governments initiated import substitution policies in the 1950s.

By the 1970s import-substituting industrialization was widely viewed as a failure. Several rounds of empirical research showed that it led to static misallocation of labor and capital across industries and did not improve long-run growth in total factor productivity (Balassa and associates 1982; Bhagwati 1978; Krueger 1978; Little, Scitovsky, and Scott 1970). These interpretations were based on careful empirical research in a large number of countries, from Argentina to India. The rapid growth for three decades or more of a number of East Asian economies, including Japan, Korea, Singapore, and Taiwan (China), all of which pursued government-led industrial policies, gave rise to an optimism that such policies, if executed correctly, could have beneficial effects (Pack and Westphal 1986; Rodrik 1995; Stiglitz 1996). But the crisis that began in Korea in October 1997 and the weak growth in Japan over much of the 1990s have prompted a reexamination of the impact of industrial policy in those two countries. If indeed industrial policies were important in this process, there may be lessons for other countries still at early stages of industrialization. Conversely, if the magnitude of the contribution was small, more conventional policies should be pursued unless other countries assume that their governments can outperform those of Japan and Korea.

Industrial policies comprise a variety of actions designed to target specific sectors to increase their productivity and their relative importance within the manufacturing sector. Proponents of an active industrial policy place considerable emphasis on the potential of such activity for encouraging a shift to newer and more modern sectors—sectors that are characterized by industrywide external economies and by learning-by-doing on the part of individual firms. Industrial policy is viewed as likely to lead to growth in total factor productivity (TFP) in the targeted sectors. Such arguments were used to rationalize import-substituting industrialization policies, but the evidence suggests that policymakers' hopes for success were not realized. The

question is whether the undoubtedly better policies pursued by Japan and Korea constitute a basis for optimism about the potential gains from a well-designed set of industrial policies.

In both countries, government actions that contributed to rapid economic growth extended well beyond industrial intervention: promoting education, building a large and efficient social infrastructure, encouraging international technology transfers, and fostering research and development. Macroeconomic policies that promoted growth included the encouragement of private saving, the maintenance of stable real exchange rates, the prevention of speculation in financial markets for a considerable part of the period (Stiglitz 1994), and a fiscal-monetary stance that limited inflation.

Interpretations of the Sources of Success

A market-oriented interpretation of the success of Japan and Korea had gained ascendancy by about 1980 and contrasted the experience of the two East Asian countries favorably with that of Latin America and Southeast Asia (Little 1982). The core of this view was that after brief interludes of intensive import-substituting industrialization, Japan and Korea switched to increasingly liberal trade policies. Macroeconomic policy controlled inflation relative to the experience of many developing countries, and the real effective exchange rate rarely appreciated. When it did, such episodes were quickly corrected. Manufacturers were thus able to concentrate on improving productivity rather than coping with rapidly changing relative prices of inputs and outputs. In contrast, Latin American countries experienced considerable macroeconomic dislocations, from high rates of inflation to periodic balance of payments crises. These countries protected their industries for several decades and did not attempt to offset the adverse effects of such policies on exporters. Moreover, for much of the period, exchange rates were volatile and overvalued. Thus attempts to foster specific industries occurred in a context that did not favor the learning necessary for manufacturers to become internationally competitive.

After a consensus had formed on the role of markets in fostering growth in Japan and Korea, additional research uncovered significant amounts of discriminatory policies in the two countries in both product and factor markets, although less than in other countries (for Korea, see Amsden 1989; Jones and Sakong 1980; Pack and Westphal 1986; for Japan, see Johnson 1982; Yamamura 1986; Yamamura and Yasuba 1985). For example, the extent of selective trade protection in individual sectors is now documented to have been quite substantial in Korea and Japan, although less than in other developing countries (for a survey on protection in various developing countries, see Erzan and others 1989). This has led to support for the view that selective government intervention, if well executed, could be a major contributor to growth. This article tests that hypothesis.

Japan targeted a number of industries in the 15 years after the end of World War II, in an effort to restore them to their previous levels of capacity and efficiency, and relied on tariff protection and subsidized interest rates to encourage the introduction of more advanced technology. At the same time, rationalization cartels facilitated the exit of higher-cost firms (Mutoh 1988; Tanaka 1988; Yamawaki 1988; Yamazawa 1988; Yonezawa 1988). These efforts to rebuild industries that were previously highly productive differed from the attempts that were launched in the 1960s to encourage new product areas. These later policies, which attempted to “pick winners,” were pursued with a variety of policy instruments (Johnson 1982; Yamamura 1986). Evidence of varying levels of protection for Japan is shown in table 1.

In the 1960s Korea encouraged the development of industries such as textiles by protecting the domestic market and by offering export subsidies and access to low-cost credit to firms that reached export targets. These efforts were limited in extent and may have had some effect on growth (Westphal 1978). An entirely different order of magnitude characterized Korea’s interventions in the 1970s, which encouraged the growth of basic metals, machinery, and chemical sectors (typically described as the heavy and chemical industry—HCI—drive). Table 2 shows that in 1978, at the height of the promotion effort, tariffs and quotas provided very high levels of protection to domestic manufacturers of consumer durables, electrical and nonelectrical

Table 1. *Effective Protection in Japan, 1963, 1968, and 1972*

<i>Sector</i>	<i>1963</i>	<i>1968</i>	<i>1972</i>
All manufacturing	32.3	24.2	14.4
Textiles	54.3	28.2	18.6
Clothing	72.8	32.8	22.4
Wood products	14.0	25.6	16.1
Pulp, paper	9.7	18.0	11.0
Publishing	-16.7	1.0	-0.9
Leather and rubber products	30.9	21.8	12.3
Chemicals	33.4	17.7	8.8
Petroleum and coal products	19.5	14.5	7.1
Nonmetallic minerals	22.2	15.7	8.1
Iron and steel	30.1	30.0	17.1
Nonferrous metals	30.4	34.1	22.1
Metal products	13.8	19.9	9.9
Machinery	36.7	20.0	7.7
General	23.0	14.5	8.7
Electrical	30.9	16.5	5.4
Transport equipment	61.5	31.0	9.2
Precision instruments	34.9	22.9	10.4

Note: These are minimum estimates insofar as the calculations of effective rates of protection are based on tariff data, not on implicit price estimates of nominal levels of protection.

Source: Shouda (1982) as cited in Itoh and Kiyono (1988).

Table 2. Effective Rates of Protection and Subsidy, Korea, 1978

<i>Sector</i>	<i>Subsidy rate for exports</i>	<i>Effective rate of protection for domestic sales</i>	<i>Average incentive effect for domestic and foreign sales</i>
Processed food	31.7	-29.4	-23.0
Beverages, tobacco	13.2	28.0	27.8
Construction materials	19.1	-15.0	-10.5
Intermediate products 1	23.6	-37.9	-31.4
Intermediate products 2	26.3	7.9	12.0
Nondurable consumer goods	17.3	31.5	24.0
Consumer durables	38.0	131.2	83.2
Machinery	24.4	47.4	43.2
Transport equipment	26.1	135.4	87.2
All manufacturing	22.8	5.3	9.7

Note: The two categories of intermediate products represent different levels of manufacturing complexity. For precise industry definitions, see Nam (1990).

Source: Nam (1990).

machinery, and transport equipment. Simultaneously, substantial loans were directed to the targeted sectors, with interest rate subsidies for the HCI sectors ranging from 2 to 6 percent (Sakong 1993: table A.19).

Were these attempts at promoting specific sectors essential to the success of the two East Asian countries, or were they a marginal gloss on the governments' nonselective macroeconomic policies? (See Stiglitz 1996 for an account of the nontraditional policy interventions and how they may have stimulated growth in Japan and Korea.) If the rapid growth of these countries was attributable to selective policies, other poor countries might learn from them. Skeptics argue, however, that Japan and Korea would have grown even faster had it not been for selective intervention. In this view, given macroeconomic stability, a realistic and stable real exchange rate, the availability of traded inputs at international prices, relatively competitive labor markets, very high saving and investment rates, high and growing levels of education, and considerable numbers of capable entrepreneurs, the contribution of intervention was negligible or harmful (Saxonhouse 1983; Trezise 1983; Wolf 1988).

Testing the Effects of Intervention

Economic analysts employ a variety of strategies to assess the quantitative impact of import substitution policies on individual economies. To establish the magnitude of static losses in output, researchers estimate effective rates of protection and derive a cost for misallocation of resources of 3–6 percent of gross domestic product (Pack 1988). Another approach calculates the growth rate of TFP during alternating periods of import restrictions and free trade (Krueger and Tuncer 1982). Using an elabora-

tion of the second approach, I calculate the combined impact of industrial policies on the sectoral structure of manufacturing and the TFP growth rate of individual sectors. If the calculated effect is large and positive, there may be a basis for least-developed countries, such as those in Africa, embarking on more-intensive industrialization, to weigh the benefits and costs of some elements of industrial policy. If, however, even Japan and Korea, where general policies were well designed and bureaucracies were very capable, were unable to extract major benefits from selective intervention to foster individual sectors, this would seem an unpromising path to industrialization.

To calculate the effects of industrial policy on the growth rate of total factor productivity for the entire manufacturing sector, I first calculate TFP growth in each sector weighted by the sector's share of value added:

$$(1) \quad \text{TFP}^* = \sum_i (VA_i/VA) \text{TFP}_i^*$$

where i indicates individual branches such as food processing, textiles, and machinery within the manufacturing sector, VA_i is value added originating in sector i , VA is manufacturing-wide value added, and TFP_i^* is the rate of TFP growth in sector i . The ratio of value added in each sector to value added in all of manufacturing, VA_i/VA , represents the industrial structure. Industrial policy may affect manufacturing-wide productivity by increasing the importance of industries whose TFP growth is above average, by altering VA_i/VA , or by stimulating TFP_i^* itself. The major issue is to establish a counterfactual set of figures for the two variables contained in equation 1.

The ratios of value added in each sector to value added in all manufacturing can be thought of as representing industrial structure, where sectors with higher ratios are more prominent than sectors with lower ratios. TFP growth in all manufacturing, then, is the sum of TFP growth in each sector, weighted by a measure of the importance of that sector.

The Counterfactual Sectoral Structure of Production

I consider the periods 1960–79 for Japan and 1966–85 for Korea. The period 1960–79 is one in which Japan initiated efforts to enter new sectors. In Korea the period 1966–85 includes the intensive heavy and chemical industry program of 1973–80. Although the Korean government encouraged some sectors in all periods, the magnitude of the HCI effort dwarfed previous and subsequent efforts to promote individual sectors. I use the values of VA_i/VA at the end of the periods during which industrial policy was important to calculate a base value for equation 1. The use of end-of-period sectoral shares is favorable to finding a positive effect of industrial policy because it assumes that any higher growth rate of favored sectors that resulted from sectoral promotion generated benefits for the entire period rather than only part of it.

Without government intervention, international trade theory predicts that the major determinant of the structure of production (and international trade patterns) is the relative supply of factors of production, assuming that tastes are similar across countries. Macroeconomic and education policies may affect relative factor supplies, but these policies are not targeted to particular sectors and, by definition, are not part of industrial policy. Most of the research using these models has generated relatively poor predictions of production and trade patterns. Statistical estimates that use as many as 10 factors of production do not explain well the distribution of value added among manufacturing sectors (Harrigan 1995) or the pattern of exports (Noland 1997). Given the lack of a rigorous statistical model for generating the counterfactual values of VA_i/VA , I employ these values for a number of countries that had similar income per capita at the end of the periods in question and for which the value added by detailed industrial branches is available.

Japan's benchmark countries in 1979, in ascending order of per capita income, are Italy, Finland, Austria, Australia, France, and the Federal Republic of Germany (table 3). These countries are relatively similar to Japan in terms of their stock of capital and the education of their citizens, so that differences in industrial structure might be attributable to specific sectoral interventions. For Korea, the countries of comparison are Uruguay, Portugal, Malaysia, Mexico, and Panama. None of these had fostered the intensive industrialization of Korea; certainly none had attempted so consciously to shift the structure of production. Using these countries as peers provides a maximum measure of the alteration in the structure of production engendered by industrial policy. Other researchers have used alternative measures of sectoral evolution, including those implied by Syrquin and Chenery (1989). Use of the sectoral distribution implied by their estimates suggests a smaller impact on industrial structure in both Japan and Korea than in the peer countries. Thus the calculation used here contains a bias in favor of finding a greater impact from discrimination among industries.

To compare Japan and Korea with their peer countries, I calculate average sectoral shares of value added for each of 28 sectors in the peer economies and aggregate these to 11 sectors (figures 1 and 2). Japan and Korea show a few substantial sectoral differences in the structure of production relative to their benchmark countries. In particular, in both countries the combined metal products, machinery, and electrical equipment (MPMEE) sector is much larger than in the peer countries, suggesting that government policies may have had their intended impact on sectoral structure.

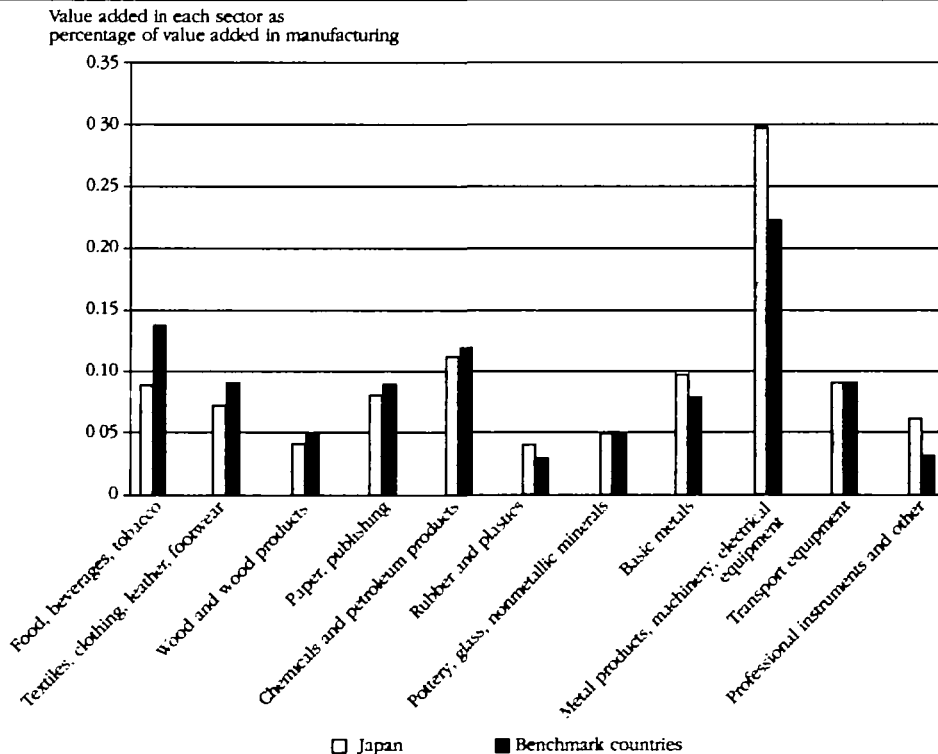
By using the industrial sectoral structure derived from the benchmark countries, I am assuming that all of the observed differences in industrial structure are attributable to industrial policy rather than to (unobserved) differences in supplies of factors of production. Insofar as the favored sectors in Japan and Korea contributed greater shares to total value added *and* exhibited higher rates of TFP growth, this assumption

Table 3. Per Capita Income of Japan, Korea, and the Benchmark Countries, 1979 and 1985
(U.S. dollars in current prices)

Country and year	Per capita income
<i>1979</i>	
Japan	8,810
Italy	5,250
Finland	8,160
Austria	8,630
Australia	9,120
France	9,950
Germany, Fed. Rep.	11,730
<i>1985</i>	
Korea, Rep. of	2,150
Uruguay	1,650
Portugal	1,970
Malaysia	2,000
Mexico	2,080
Panama	2,100

Source: World Bank (various years).

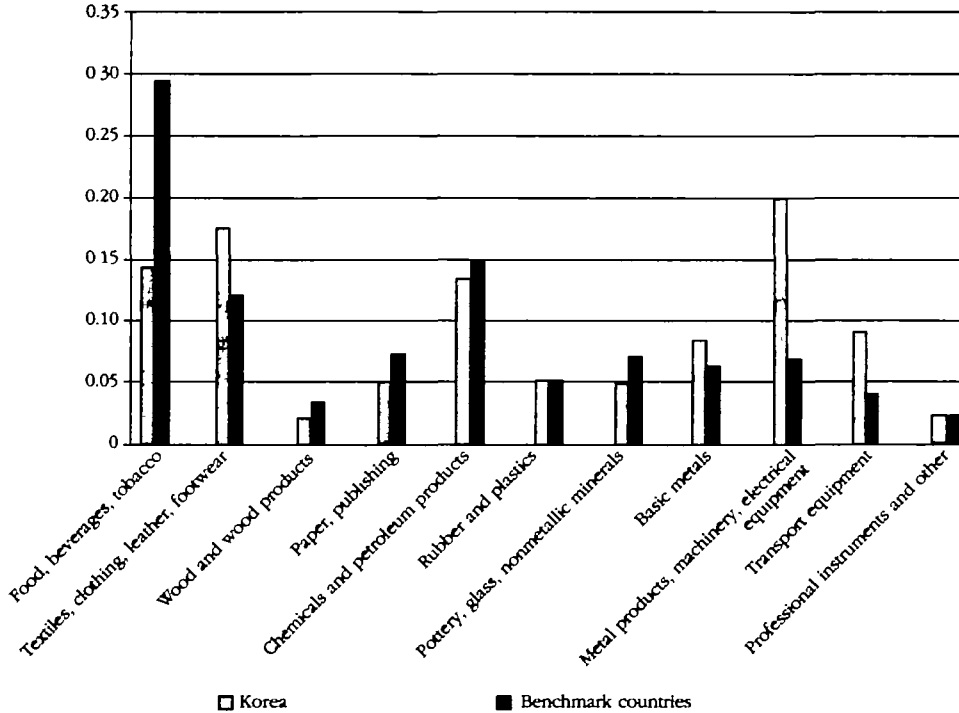
Figure 1. Sector Shares, Japan and Benchmark Countries



Source: United Nations (various issues).

Figure 2. Sector Shares, Korea and Benchmark Countries

Value added in each sector as percentage of value added in manufacturing



Source: United Nations (various issues).

overstates the contribution of industrial policy. But the value calculated helps to establish a plausible upper limit on the effect of industrial policy.

The Counterfactual Impact of Industrial Policy on Manufacturing-Wide Productivity Growth

It is possible to calculate the counterfactual growth of TFP by comparing actual TFP growth rates across sectors in Japan and Korea or by comparing TFP growth in each sector in Japan and Korea with that in comparable countries. Differences in rates of productivity growth across countries, however, reflect country-specific factors, such as the intensity of competition, public investment in infrastructure and education, the legal structure governing intellectual property rights, and firms' investments in learning and worker training. It is inappropriate to attribute the higher rates of TFP growth in favored sectors in Japan and Korea, compared with those in, say, Austria or Mexico, to selective industrial policy alone, since Austria and Mexico lack several

of these productivity-enhancing characteristics. I thus focus on interindustry differences in productivity in Japan and Korea by comparing favored and neglected sectors rather than relying on international comparisons for identical industrial branches.

Jorgenson, Kuroda, and Nishimizu (1987) have estimated sectoral TFP growth for Japan during 1960–79 (table 4).¹ As noted, many of the critical acts of the Japanese government with respect to industrial policy occurred in the 15 years following World War II and were designed to reestablish the previous peak levels of production in sectors such as coal mining, textiles, and steel production. The attempt to foster nontraditional industrial sectors began around 1960. It can be seen that MPMEE and transport equipment exhibited much higher rates of growth of productivity than other sectors, confirming the views of proponents of Japan's industrial policy. Given that the MPMEE sector also had a higher share of VA_i/VA in Japan than in the benchmark countries, this resulted in an increase in sectoral TFP growth. It appears that industrial policy in Japan may have increased both the importance and the productivity of the industry; the issue is the precise size of the increase.

For Korea, I calculate measures of TFP and convert them to annual growth rates (table 5).² During the height of the HCI program, 1970–78, the mean values of TFP growth in the HCI sectors, 4.9, substantially exceeded the group average of the “ne-

Table 4. Total Factor Productivity Growth in Japan, by Industrial Sector, 1960–79

Sector	TFP growth rate (percent)
Food	-1.20
Textiles	0.47
Clothing	1.98
Leather and shoes	1.03
Wood	2.81
Furniture	1.74
Paper	1.44
Printing	-0.18
Chemicals	3.36
Petroleum	-3.55
Rubber	1.02
Plastics	0.55
Pottery and glass	0.92
Iron and steel	2.86
Other metals	0.16
Metal products	3.41
Machinery	2.30
Electrical machinery	5.38
Transport equipment	4.32
Professional instruments	4.45
Other manufacturing	4.98

Source: Jorgenson, Kuroda, and Nishimizu (1987).

glected" sectors, 3.1. In the succeeding period, the neglected sectors had a higher average value of TFP growth. Individual sectors in Korea—both neglected and favored—had high TFP growth rates. The difficulty of establishing the beneficial effects of promotion on productivity can be seen in one example: the much greater growth of TFP in the industrial chemical sector in the period 1966–70, before the HCI drive, than in the succeeding periods in which the sector was encouraged. The fact that its TFP growth rate for the entire 1966–85 period is the highest of any sector is attributable to its performance in the earliest period. The same is true of the transport equipment sector.

The results in table 5 are more favorable to the HCI strategy than are other estimates of growth. For example, Dollar and Sokoloff (1990), examining 1963–79, find that TFP growth rates were higher in labor-intensive industries than in capital-

Table 5. Total Factor Productivity Growth in Korea, by Manufacturing Sector, 1966–85

<i>Industry</i>	<i>1966–70</i>	<i>1970–78</i>	<i>1978–85</i>	<i>1966–85</i>
<i>Light industries</i>				
Food	6.5	–0.8	3.7	2.3
Beverages	10.3	4.3	2.1	4.0
Tobacco	13.8	2.0	5.2	4.5
Textiles	7.2	3.4	2.8	3.3
Clothing	9.9	3.8	4.5	4.2
Footwear, leather	6.2	4.4	–3.5	2.4
Wood	1.1	6.6	–1.1	2.5
Furniture	25.4	–2.4	0.7	4.7
Pulp, paper	7.4	4.0	0.3	2.7
Printing	–3.2	4.1	0.0	1.4
Other chemicals	4.2	6.8	–1.8	2.9
Petroleum, coal products	3.5	–0.1	2.1	1.3
Rubber products	3.1	6.8	1.0	3.5
Nonmetallic minerals	4.0	4.0	0.2	2.5
Other manufactures	13.2	–0.1	–2.1	2.5
Average	7.5	3.1	0.9	3.0
<i>Heavy and chemical industries</i>				
Industrial chemicals	22.7	9.0	1.3	6.6
Oil refining	13.3	–1.8	–7.5	0.1
Iron and steel	–0.4	3.8	4.0	2.5
Nonferrous metals	0.4	3.7	6.4	3.6
Fabricated metals	1.1	8.0	–3.6	2.8
Nonelectrical machinery	1.2	7.7	–1.7	3.0
Electrical machinery	5.3	5.7	0.4	3.3
Transport equipment	8.5	3.3	4.0	3.9
Average	6.5	4.9	0.4	3.2

Source: Author's calculation of Tornqvist indexes based on data contained in Yoo (1990).

intensive ones, which include the HCI sectors.³ They note that “whereas capital deepening does indeed seem to have been the dominant factor in the (growth of) highly capital-intensive industries, total factor productivity growth was the major contributor to gains in labor productivity in the rest of manufacturing” (Dollar and Sokoloff 1990: 310). Their results would lower the increase in sectorwide TFP growth due to selective policy.

What is most striking about manufacturing productivity in Korea is the high absolute values of TFP growth in most sectors. Although there are sectoral differences, the individual values and their average are extremely high by international standards (Nishimizu and Page 1987). They exceed the productivity growth achieved by the Organisation for Economic Co-operation and Development (OECD) countries in the same period. Although industrial policy achieved its goal of shifting factors among sectors, the cost of doing so was forgone high productivity growth in the neglected sectors. Unless the “neglected” sectors also somehow realized high productivity growth as a result of policies that implicitly discriminated against them, industrial policy cannot have been a major factor in Korean industrial growth. (The potential impact of spillovers from promoted to neglected sectors is considered below.)

It seems likely that government pressure to export was a major impetus for the relatively high rates of growth of TFP. In return for subsidized loans and various other incentives, the government set ever-increasing export quotas for each firm (Jones and Sakong 1980); the targeted quotas depended on previous export growth and assessments of future potential. Given Korean firms’ high ratios of debt to equity, the credible threat of withdrawal of subsidized credit was a potent inducement to meet export targets. Assuming that in each period firms were equating marginal cost to world price, a 20 percent increase in the export target forced them to reduce their costs rapidly if they were to avoid a loss on the increment in exports. Another source of productivity growth was technical advice that exporters received from customers in the OECD countries (Rhee, Ross-Larson, and Pursell 1984).

The Counterfactual Calculations

I use four calculations to measure the potential effect of industrial policies in Japan and Korea.

BASE CALCULATION. The basis of comparison is the calculated rate of TFP growth employing equation 1, using the observed value added shares in 1979 (Japan) or 1985 (Korea) and the sectoral TFP growth rates shown in tables 4 and 5. This calculation assumes that the sectoral structure of production and any differences between TFP growth in favored and neglected sectors were attributable entirely to industrial policy. The values for TFP growth, 3.12 for Korea and 2.36 for Japan, are shown in row 1 of table 6.

I now consider three variations of the basic calculation of what the path of TFP growth would have been in the absence of industrial policy.

ALTERNATIVE 1. In the first calculation, I assume that the only effect of industrial policy was to shift the sectoral patterns of production; TFP growth in individual subsectors was not affected by the policy. I assume that the sectoral pattern in the absence of industrial policy would have been similar to that in the benchmark countries. Under these assumptions, Korea's TFP growth was 3.04 percent and Japan's was 2.04 percent. In other words, Korea obtained a 0.08 percentage point increment (3.12 – 3.04) and Japan obtained a 0.32 percentage point increase in annual TFP growth rates from the policy-induced difference in sectoral structure.

ALTERNATIVE 2. The second scenario assumes the reverse: that, instead of shifting the sectoral pattern of production, industrial policy only had an effect on the TFP growth rates of the sectors. I assume that half of the observed TFP growth rates in the favored sectors was attributable to industrial policy. Under these assumptions, the contribution of industrial policy to TFP growth was 0.72 percentage point in Korea and 0.89 percentage point in Japan.

ALTERNATIVE 3. The third calculation combines the assumptions of the first two. I assume that industrial policy affected both the sectoral structure and productivity growth in the individual sectors. These assumptions imply that industrial policy accelerated TFP growth by 0.60 percentage point in Korea and by 0.99 point in Japan.

These calculations overestimate the benefits from industrial policy because they assume that the entire sectoral deviation in value added from benchmark countries and any improvements in TFP growth are due entirely to intervention.

Were these (maximum) figures of decisive importance to aggregate economic growth in the two countries? Given that Korea's manufacturing sector accounted for about a third of gross domestic product (GDP) at the end of the period, industrial policies that contributed 0.60 point to the manufacturing growth rate would have accounted for no more than 0.20 point of aggregate growth (roughly 9 percent a year). For Japan, a similar calculation implies that the extra 0.99 percentage point in

Table 6. Simulation of the Effect of Industrial Policy on Total Factor Productivity Growth

<i>Scenario</i>	<i>Korea</i>	<i>Japan</i>
Base	3.12	2.36
Alternative 1	3.04	2.04
Alternative 2	2.40	1.47
Alternative 3	2.52	1.37

manufacturing would have contributed about 0.3 point to aggregate growth of 9 percent. Even if these figures were doubled, it would still be the case that industrial policy was a minor hormone rather than the magic elixir of aggregate growth.

There are many anecdotes relating to the accelerated development of individual companies. If, however, the growth of these companies has not been sufficient to affect the results at the level of disaggregation used here, they cannot have been, *in the aggregate*, quantitatively important sources of growth.

Externalities and Investment Coordination

So far, it has been assumed that selective industrial policies directly affected the targeted sectors and that high rates of productivity growth in the neglected sectors did not reflect spillovers from the promoted sectors. But industrial policies could have generated benefits in other sectors as a consequence of three developments: domestic production of intermediate goods with special characteristics that were not available internationally but improved productivity in the local purchasing firm; job transfers by a trained labor force from firms in targeted sectors to other firms, bringing with them uncodified knowledge; and direct interactions on equipment design by producers and local buyers that led to adaptations that were particularly suitable for local firms.

All three externalities could potentially increase TFP growth in the neglected sectors. The potential quantitative importance of specialized nontraded intermediate inputs and uncodified knowledge transmitted by workers depends on how much the neglected sector interacts with the promoted sector. One way to gauge these benefits is to measure the purchases of an input from a favored sector per dollar of gross output in the neglected sector. The larger the purchase, the more likely it is that the neglected sector will benefit from the existence of local producers. The neglected sector may also derive greater benefits if there are few imports, which constitute an alternative source of specialized inputs.

Several measures showing the magnitude of the interaction between promoted and neglected sectors in Korea are presented in table 7; those for Japan are presented in table 8. First, in both countries the average input-output interaction is quite small. The favored sectors account for a very small portion of the domestically purchased inputs of most neglected sectors. Second, the heavy industries purchase extensively from one another. Third, in Korea imports by the neglected sectors are, on average, twice as large as total purchases from the favored domestic sectors (0.134 versus 0.068). In Japan, imports constitute a smaller percentage of total purchases. Whether this is due to the nontraded characteristics of Japanese production or to the restrictive trade regime is not clear (Lawrence 1993; Saxonhouse 1993). These patterns suggest the following probable effects of industrial policy on neglected sectors:

Table 7. Intersectoral Purchases, Korea, 1985

Purchasing sector	Purchases from			
	All domestic sectors	Heavy industries	Chemical industry	Foreign suppliers
Neglected sectors	0.293	0.021	0.047	0.134
Favored sectors				
Chemical industry	0.357	0.010	0.249	0.209
Heavy industries	0.411	0.342	0.021	0.176

Source: Author's calculations from input-output tables contained in Bank of Korea (various issues).

- It is unlikely that the promoted sectors were quantitatively critical in increasing the range of available inputs. Although industrial policies may have encouraged the domestic production of some unique, nontraded inputs, the overall impact was slight relative to all domestic and foreign purchases. Unless there was very low substitutability between domestic and foreign inputs, the quantitative effect of domestic inputs was small. Rosenberg (1976) cites the importance of local interactions in situations where both user and producer were themselves at the world frontier and there were no suppliers in other countries. In contrast, Korean and Japanese firms in the periods considered were not at the world frontier in the neglected sectors and had many opportunities for obtaining specialized inputs from abroad.
- Insofar as workers and managers transmitted important knowledge, the small purchases from the promoted sectors imply that the effect of such learning was limited. Although one can posit, as in the case of specialized inputs, that there was a critical piece of knowledge whose possession had exceptionally high marginal productivity for the recipient sector, the quantitative case does not seem plausible. Moreover, such information could have been obtained from technology licensing agreements and foreign consultants.
- Promoted sectors are substantial purchasers of one another's inputs, at least in the metal-based sectors. Any externalities from such interaction are already accounted for in the calculations shown in table 6 insofar as they employ the

Table 8. Intersectoral Purchases, Japan, 1980

Purchasing sector	Purchases from			
	All domestic sectors	Heavy industries	Chemical industry	Foreign suppliers
Neglected sectors	0.354	0.016	0.048	0.113
Favored sectors				
Chemical industry	0.532	0.011	0.356	0.051
Heavy industries	0.521	0.329	0.008	0.035

Source: Author's calculations from input-output tables contained in Bank of Japan (various issues).

Table 9. Ratio of Imported to Domestically Produced Machinery, Korea and Japan

Sector	Korea (1985)	Japan (1980)
General machinery	3.04	0.06
Electrical machinery	0.27	0.04

Source: Author's calculations based on input-output tables contained in Bank of Korea (various issues); Bank of Japan (various issues).

observed values of total factor productivity growth, which includes any benefits from the posited spillovers among sectors.

Some interactions are not captured by the input-output transactions shown in tables 7 and 8. In particular, the interactions between the producers and *final* purchasers of machines are not given because investment is a final demand. In Korea, the value of imports of nonelectrical machinery was three times that of domestic production (table 9). It is difficult to argue that there were no imported substitutes or that special adaptations to local conditions were quantitatively significant. Even if locally produced equipment was less expensive and conferred some cost reductions for its users, it would have affected only one-quarter of annual general machinery investment as late as 1985.

For Japan, the evidence is more ambiguous; Japan imports very little industrial equipment relative to domestic production (table 9). It thus is possible that domestic manufacturers may have designed equipment that was not available from imports and that did increase productivity.

Investment Coordination

The establishment of a domestic steel industry may provide low-cost steel for auto producers, but it does not pay to build a steel mill unless there is an auto industry to use the steel, guaranteeing it a large market and enabling it to realize economies of scale. Conversely, the auto factory may not be built if it is unable to obtain low-priced steel. Investment coordination, which was part of government policy in Japan and Korea, could have benefited both sectors (Pack and Westphal 1986). However, the prices that allow viability could have been obtained in the first place if inputs (steel used in autos) had been available at world prices. Conversely, although the steel sector may benefit from scale economies as its level of production increases, this increase in productivity could have been obtained by exporting steel, as indeed occurred in Japan and Korea. Both countries relied on exports to reduce the need to coordinate investment in sectors where economies of scale were important. Even if one abstracts from the fact that investment coordination only generates benefits where one of the goods is not traded and asks whether Japan and Korea could have ob-

tained significant benefits from such coordination, the data in tables 7, 8, and 9 suggest that the gains from coordination would have occurred largely within the heavy industries, as very few neglected sectors made large purchases from them. Thus any productivity gains from coordination are already reflected in the higher productivity growth of the heavy industries.

Some discussions have noted that Korea's export growth in the 1980s and 1990s has consisted increasingly of products that were manufactured in the promoted sectors, and this has been taken as a sign of success. However, just as the sectoral structure of production would have changed as the use of human and physical capital became more intense, so the structure of exports would have changed. Thus it is necessary to consider the evolving export structure relative to that of other countries. Noland (1997) shows that the export structure of the East Asian countries (including Korea) is not much different than would be expected on the basis of factor endowments. Yoo (1990) compares Korea's exports in the 1980s with those of Taiwan, which did not intensively promote the machinery and chemical industries. In almost all product categories that fall within the HCI complex, Taiwan's export growth was similar to or greater than that of Korea's, suggesting that the growth in exports from these sectors resulted from changing comparative advantage rather than from sectorally targeted intervention.

There are, of course, many individual examples of spectacular success that have led some observers to infer a much more important role for industrial policy, but the aggregate impact of such efforts was limited. Some analysts point to the technological complexity of Korean and Japanese industry, contrasting it favorably with that of Hong Kong. But such complexity is not an end in itself—it must yield higher growth per capita than would have been achieved otherwise. The results reported here fail to measure such an effect. Moreover, the complexity usually considered is that of the manufacturing sector. As the events of late 1997 and 1998 underline, a broader view of the economy, including the capabilities of the financial sector, suggests that Hong Kong was hardly inferior to either of the two industrial giants.

Conclusions

In contrast to other cases of interventionist development strategies, Korea and Japan had vastly better experiences, having generated higher growth rates than many economies that pursued import-substituting industrialization. What accounts for the difference? The simplest explanation is that policies in both countries induced significant competition, whether by holding "contests," as in Japan (Stiglitz 1996), or by linking preferential interest rates and tariffs on imported goods to success in export markets, as in Korea. Firms thus had strong incentives to improve productivity. Other countries that attempted to encourage specific sectors relied on protecting the do-

mestic market and never credibly sought to reduce such protection. Profits and wages were never threatened, and incentives to learn were weak. Countries attempting to extract the benefits from industrial policy that Japan and Korea obtained have to possess not only an exceptionally capable bureaucracy but also the political ability to withdraw benefits from nonperforming firms. Experience in dozens of other countries suggests that these conditions rarely obtain.

Using a variety of assumptions, perhaps as much as 1 percentage point of growth in the manufacturing sector might have been attributable to industrial policy, implying one-third of 1 percent of GDP growth. The implied increase in the national marginal product of capital and labor also may have led to some increase in investment rates in physical and human capital; the magnitude would depend on the unknown elasticity of such investment with respect to the rate of return. Allowing for such secondary effects, the increase in aggregate growth rates induced by industrial policy may have been perhaps half of 1 percent a year, hardly trivial, but not the secret of success. To answer the question posed by the title of this article, industrial policy may have been a minor growth hormone. It seems unlikely that, absent a host of other factors that impinged on both Japan and Korea, the delayed adverse side effects of industrial policy on the banking system were the poison that necessitated very strong antidotes in the late 1990s. But in view of the minor benefits and the potentially adverse effects on the financial sector and the neglected industrial sectors, countries should be exceptionally cautious before embarking on such policies.

Notes

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1. The estimates for Japan and Korea overstate the correct value for TFP growth, since data on the impact of education on the labor force are omitted. Thus the calculations of TFP growth overestimate the contribution of industrial policy by some unknown amount.

2. The estimates are based on Tornqvist indexes. I have used the data given by Yoo (1990) for Korean value added, capital stock, and labor force. Yoo's data on capital stock are derived from a study of Pyo (1988). The data are based on consistent input-output definitions of sectors and include a number of adjustments of the labor force to allow for unpaid workers.

3. Their results, however, are not directly comparable because Dollar and Sokoloff use fixed-weight estimates of factor shares rather than a Tornqvist index and their data on capital, labor, and value added rely on different sources (see footnotes to table 1 in Dollar and Sokoloff 1990).

References

The word “processed” describes informally reproduced works that may not be commonly available through library systems.

- Amsden, Alice H. 1989. *Asia's Next Giant: South Korea and Late Industrialization*. New York: Oxford University Press.
- Balassa, Bela, and associates. 1982. *Development Strategies in Semi-Industrial Economies*. Baltimore, Md.: Johns Hopkins University Press.
- Bank of Japan. Various issues. *Japanese Economic Statistics*. Tokyo.
- Bank of Korea. Various issues. *Monthly Statistical Bulletin*. Seoul.
- Bhagwati, Jagdish. 1978. *Foreign Trade Regimes and Economic Development: Anatomy and Consequences of Exchange Control Regimes*. Cambridge, Mass.: Ballinger.
- Chenery, Hollis B. 1959. “The Interdependence of Investment Decisions.” In Moses Abramovitz, ed., *The Allocation of Economic Resources*. Stanford, Calif.: Stanford University Press.
- Claessens, Stijn, Simeon Djankov, and Larry Lang. 1998. “East Asian Corporates: Growth, Financing, and Risks over the Last Decade.” Policy Research Working Paper no. 2017. Finance, Private Sector, and Infrastructure Network, Economic Policy Unit, World Bank, Washington, D.C.
- Dollar, David, and Kenneth Sokoloff. 1990. “Patterns of Productivity Growth in South Korean Manufacturing Industries, 1963–79.” *Journal of Development Economics* 33(October):309–27.
- Erzan, Refik, Kiroaki Kuwahara, Serafine Marchese, and Rene Vossenar. 1989. “The Profile of Protection in Developing Countries.” *UNCTAD Review* 1:29–73.
- Fry, Maxwell J. 1995. “Financial Development in Asia: Some Analytical Issues.” *Asian-Pacific Economic Literature* 9(May):40–57.
- Harrigan, James. 1995. “Factor Endowments and the International Location of Production: Econometric Evidence for the OECD, 1970–85.” *Journal of International Economics* 39(August):123–41.
- Itoh, Motoshige, and Kazuharu Kiyono. 1988. “Foreign Trade and Direct Investment.” In Ryutaro Komiya, Masahiro Okuno, and Kotaro Suzumura, eds., *Industrial Policy of Japan*. Tokyo: Academic Press.
- Johnson, Chalmers. 1982. *MITI and the Japanese Miracle: The Growth of Industrial Policy, 1925–75*. Stanford, Calif.: Stanford University Press.
- Jones, Leroy, and Il Sakong. 1980. *Government, Business, and Entrepreneurship in Economic Development: The Korean Case*. Cambridge, Mass.: Harvard University Press.
- Jorgenson, Dale W., Masahiro Kuroda, and Mieko Nishimizu. 1987. “Japan-U.S. Industry-Level Productivity Comparisons, 1960–79.” *Journal of the Japanese and International Economies* 1(March):1–30.
- Krueger, Anne. 1978. *Foreign Trade Regimes and Economic Development: Liberalization Attempts and Consequences*. Cambridge, Mass.: Ballinger.
- Krueger, Anne, and Baran Tuncer. 1982. “An Empirical Test of the Infant Industry Argument.” *American Economic Review* 72(December):1142–52.
- Lall, Sanjaya. 1997. *Learning from the Asian Tigers: Studies in Technology and Industrial Policy*. New York: St. Martin's Press.
- Lawrence, Robert. 1993. “Japan's Different Trade Regime: An Analysis with Particular Reference to Keiretsu.” *Journal of Economic Perspectives* 7(March):3–20.
- Little, Ian M. D. 1982. *Economic Development*. New York: Basic Books.

- Little, Ian M. D., Tibor Scitovsky, and Maurice Scott. 1970. *Industry and Trade in Some Developing Countries*. New York: Oxford University Press.
- Mutoh, Hiromichi. 1988. "The Automotive Industry." In Ryutaro Komiya, Masahiro Okuno, and Kotaro Suzumura, eds., *Industrial Policy of Japan*. Tokyo: Academic Press.
- Nam, Chong-Hyun. 1990. "Export Promotion Strategy and Economic Development in Korea." In Chris Milner, ed., *Export Promotion Strategies*. New York: New York University Press.
- Nishimizu, Mieko, and John M. Page. 1987. "Economic Policies and Productivity Change in Industry: An International Comparison." Development Research Department, World Bank, Washington, D.C. Processed.
- Noland, Marcus. 1997. "Has Asian Export Performance Been Unique?" *Journal of International Economics* 43(August):79–101.
- Pack, Howard. 1988. "Industrialization and Trade." In Hollis B. Chenery and T. N. Srinivasan, eds., *Handbook of Development Economics*. Amsterdam: North-Holland.
- Pack, Howard, and Larry Westphal. 1986. "Industrial Strategy and Technological Change." *Journal of Development Economics* 22(June):87–128.
- Pyo, Hak-Kil. 1988. "Estimates of Capital Stock and Capital-Output Coefficients by Industries for the Republic of Korea." Working Paper 8812. Korea Development Institute, Seoul. Processed.
- Rhee, Yung Whee, Bruce Ross-Larson, and Gary Pursell. 1984. *Korea's Competitive Edge: Managing the Entry into World Markets*. Baltimore, Md.: Johns Hopkins University Press.
- Rodrik, Dani. 1995. "Getting Interventions Right: How South Korea and Taiwan Grew Rich." *Economic Policy* 20(April):55–107.
- Rosenberg, Nathan. 1976. *Perspectives on Technology*. London: Cambridge University Press.
- Sakong, Il. 1993. *Korea in the World Economy*. Washington, D.C.: Institute for International Economics.
- Saxonhouse, Gary. 1983. "What Is All This about Industrial Targeting in Japan?" *World Economy* 6(September):253–73.
- . 1993. "What Does Japanese Trade Structure Tell Us about Japanese Trade Policy?" *Journal of Economic Perspectives* 7(Summer):21–43.
- Scitovsky, Tibor. 1954. "Two Concepts of External Economies." *Journal of Political Economy* 62(April):43–51.
- Shouda, Yasutoyo. 1982. "Effective Rates of Protection in Japan." *Nihon Keizai Kenkyu* 11(March).
- Stiglitz, Joseph. 1994. "The Role of the State in Financial Markets." *Proceedings of the World Bank Annual Conference on Development Economics 1993*. Washington D.C.: World Bank.
- . 1996. "Some Lessons from the East Asian Miracle." *The World Bank Research Observer* 11(2):151–78.
- Syrquin, Moshe, and Hollis B. Chenery. 1989. *Patterns of Development, 1950 to 1983*. World Bank Discussion Paper 41. Washington, D.C.
- Tanaka, Naoki. 1988. "Aluminum Refining Industry." In Ryutaro Komiya, Masahiro Okuno, and Kotaro Suzumura, eds., *Industrial Policy of Japan*. Tokyo: Academic Press.
- Treize, P. H. 1983. "Industrial Policy Is Not the Major Reason for Japan's Success." *Brookings Review* 3(2):13–18.
- United Nations. Various issues. *Yearbook of Industrial Statistics*. New York.
- Westphal, Larry E. 1978. "The Republic of Korea's Experience with Export-Led Development." *World Development* 6(March):347–82.

- Wolf, Charles. 1988. *Markets or Governments: Choosing between Imperfect Alternatives*. Cambridge, Mass.: MIT Press.
- World Bank. Various years. *World Development Report*. New York: Oxford University Press.
- Yamamura, Kozo. 1986. "Caveat Emptor: The Industrial Policy of Japan." In Paul Krugman, ed., *Strategic Trade Policy and the New International Economics*. Cambridge, Mass.: MIT Press.
- Yamamura, Kozo, and Yasukichi Yasuba. 1985. *The Political Economy of Japan*. Stanford, Calif.: Stanford University Press.
- Yamawaki, Hideki. 1988. "The Steel Industry." In Ryutaro Komiya, Masahiro Okuno, and Kotaro Suzumura, eds., *Industrial Policy of Japan*. Tokyo: Academic Press.
- Yamazawa, Ippie. 1988. "The Textile Industry." In Ryutaro Komiya, Masahiro Okuno, and Kotaro Suzumura, eds., *Industrial Policy of Japan*. Tokyo: Academic Press.
- Yonezawa, Yoshie. 1988. "The Shipbuilding Industry." In Ryutaro Komiya, Masahiro Okuno, and Kotaro Suzumura, eds., *Industrial Policy of Japan*. Tokyo: Academic Press.
- Yoo, Jung-ho. 1990. "The Industrial Policy of the 1970s and the Evolution of the Manufacturing Sector in Korea." Working Paper 9017. Korea Development Institute, Seoul. Processed.