political economy *Studies in the Surplus Approach*

volume 3, number 2, 1987

Contributions on East-Asian Capitalism edited by Amiya K. Bagchi

The Paradigm of Late Industrialization*

Alice H. Amsden

THE PARADIGM OF LATE INDUSTRIALIZATION THROUGH LEARNING

The First and Second Industrial Revolutions shared in common the generation of new products and processes. By contrast, economies commencing industrialization in the twentieth century generated neither, products and processes new to this century more likely than not being generated by older industrializers. Instead, economies commencing industrialization in the twentieth century have transformed their productive structures and have raised their incomes per capita on the basis of borrowed technology. They have produced products, with processes, conceived in unallied economic and political units. The means by which they managed to do so is what I refer to as *learning*.

The nature and role played by technical knowledge, therefore, distinguishes the industrial revolutions in England, Germany, and the United States, on the one hand, from the industrialization that occurred in agrarian societies in the twentieth century. If industrialization in England in the eighteenth century occurred on the basis of *invention*, or change in production methods associated with the personal management of owner-entrepreneurs of small-scale firms; and if it occurred in Germany and the United States in the late nineteenth century on the basis of *innovation*, or the massive commercialization of inventions by salaried managers in large-scale productive enterprises; then it occurred among backward countries in the twentieth century on the basis of learning. Twentieth century industrializers experienced their critical phases of industrialization by borrowing technological knowledge accumulated in the First and Second Industrial Revolutions.

The twentieth-century paradigm of late industrialization through learning is quite general to a diverse assortment of countries with different growth

* This article is based on a book by Alice H. Amsden entitled *Late Industrialization in South Korea: The General Properties of Expansion Through Learning*, Boston (Mass.), Harvard Business School.

records: Japan, South Korea, Taiwan, Brazil, India, possibly Mexico, Turkey, and so on. (Although this list might be expanded, one could not add to it the city states of Singapore and Hong Kong, because neither began from an agrarian base.) Growth rates differ among late industrializing countries, but in all cases industrialization has been a process of learning rather than generating new inventions or innovations, and learning has been based on a similar set of institutions. This article is intended to illuminate such institutions as well as to suggest why countries like Korea and Taiwan have performed better than other late industrializers. The conventional explanation is that they have conformed more to free market forces, but in fact, the fundamentals of their industrial policies are the same as those of other late industrializers. In all cases there is defiance of the market mechanism. Instead, it is suggested below that some late industrializing countries have performed better than others because the institutions of late industrialization have been better managed.

Industrialization on the basis of learning rather than invention or innovation is not unique to the twentieth century. The global process of industrialization has always tended to be combined and uneven, with leaders and laggards, forerunners and followers. If England pioneered on the basis of invention in the eighteenth century, Continental Europe and the United States pursued on the basis of learning in the nineteenth. If Germany was itself an innovator in the nineteenth century, it also studied the examples of early England and its emulators. The United States in the nineteenth century has been described as both borrower and initiator.[1] Learning, moreover, cannot be separated neatly from the creation of new knowledge. The interregnum between the First and Second Industrial Revolutions — in the period from the 1840s to the 1870s — witnessed the European and American emulators introducing incremental improvements to technologies devised earlier. Such maturation also occurred behind a technological frontier that was unstable.

Nevertheless, a process of industrialization whose central tendency is learning rather than invention or innovation deserves treatment as a distinct phenomenon or typology. The dynamics of growth and structural change are different, depending on the presence or absence of new technological discoveries. In conventional theories of growth, the advanced countries are taken as models and increases in productivity are made to depend on new innovations, exogenously determined. Yet, by definition, new innovations are absent in late industrializing countries so conventional growth theories are irrelevant. The productivity increases of late industrialization depend on endogenous factors, such as how rapidly foreign technology is absorbed (the rate of investment), whether it is utilized at the proper scale (decreasing costs), and how well it is applied (learning-by-

[1] N. ROSENBERG, *Technology and American Economic Growth*, New York, M. E. Sharpe, 1972.

doing). The rate of investment, economies of scale, and learning-by-doing are all related positively to the growth rate of output, so the growth dynamic in late industrialization is a closed loop, running from productivity to growth to productivity.

The nature of competition is also different in the First, Second, and late industrializing paradigms. Inventors are aided in the conquest of markets by either a new product or a new production technique. Their expertise in a particular area of specialization allows them to retain their competitiveness by generating a stream of innovations. Learners, by contrast, cannot innovate and must compete initially on the basis of low wages. The threat from still lower wage countries in labor-intensive industries, however, means that late industrializers cannot specialize in such products if they wish to grow or catch up. The whole process of catching up and diversifying into new industries is profoundly at odds with the principle of specialization. The accretion of competitiveness in late industrializing countries abides by a different set of rules from those implicit in the law of comparative advantage.

Finally, late industrialization qualifies as a distinct paradigm both because it is based on learning rather than the creation of new technical knowledge and because it is historically specific. Learners in the twentieth century confront an environment that is different geo-politically and socio-economically from those of earlier learners. For one, the gap between backward and advanced countries is wider. For another, the involvement between backward and advanced countries through institutions like those of Bretton Woods is unique.

THE SPEED OF INDUSTRIALIZATION

While the most successful twentieth century industrializers like Japan and Korea have invited inquiry about their rapid growth and structural change, the nineteenth century European emulators have drawn attention to their slowness. In the words of David Landes[2]:

> "In this effort to study and emulate British techniques, the nations of western Europe were favored by a number of advantages. Their supply of capital and standard of living were substantially higher than in the 'backward' lands of today. And with this went a level of technical skill that, if not immediately adequate to the task of sustaining an industrial revolution, was right at the margin. In short, if they were in their day 'underveloped', the word must be understood quite differently from the way it is today. Nevertheless, their Industrial Revolution was substantially slower than the British. Why the delay? Surely, the hardest task would seem to have been the original creative acts that produced coke smelting, the mule, and the steam engine. In view of the enormous economic superiority of these innovations, one would expect the rest to have followed automatically".

[2] Cf. D. S. LANDES, *The Unbound Prometheus*, Cambridge, Cambridge University Press, 1969.

Why indeed the delay? And why was it that industrialization beginning in the late nineteenth century and then following World War II appears to have been far faster than that of the Napoleonic War period?[3] Part of the answer to this set of questions lies in the advance of science, which is worth discussing briefly. The advance of science underlies the distinction between industrializing by invention and industrializing by innovation in the First and Second Industrial Revolution respectively. Scientific advance also had an electrifying effect on the growth rates of twentieth century late comers.

Invention and innovation, as the terms are typically used, are intimately connected insofar as innovation presupposes invention in a logical sense. In textbook treatments of new technological developments, invention is associated with the idea and, like Creation in the Bible, comes first, followed by innovation or the application of the idea to commercial uses. I, however, regard invention and innovation not as abstract stages, one preceding the other in new tecnological discoveries, but rather as descriptions of particular historical periods, invention preceding innovation in an intergenerational sense. As representations of two distinct time periods, one key difference between the two lies in their degree of scientific content.

The scientific content of the inventions of the First Industrial Revolution moved the world far beyond the mysticism of the Middle Ages towards an opaque understanding of how mechanical devices worked. The Second Industrial Revolution, however, represented a discrete giant step forward insofar as technological change began to occur not by observation, trial, and error, but, far more than previously, on the basis of theory and experimentation.[4]

The application of science to production provided the basis for the stream of German and American innovations that lowered the British flag. For three interrelated reasons, the advance of science also made it monumentally easier for technology to be transferred, which a century later made a profound impact on the backward countries. One, higher scientific content increased the codifiedness or explicitness of technology, making it more of a commodity and hence, more technically and commercially accessible and diffusible from country to country (although even in mature industries, technology remains idiosyncratic). Two, the application of science in the fields of transportation, communications, and management improved the *mode* of technology transfer. Technical assistance can now be dispatched over longer distances to larger numbers of people more quickly and anonymously, not being dependent on the know-how of a particular person. Three, the crowding out of art by science in the design of new processes has had its analogy on the shop floor, in their utilization. The rise in the

[3] Maddison provides time series data on trends in output and per capita income which suggest that both variables grew faster in sequentially later industrializers. See A. MADDISON, *Phases of Economic Development*, Oxford, Oxford University Press, 1982.

[4] Cf. J. D. BERNAL, *Science in History*, vol. 2, The Scientific and Industrial Revolutions, Cambridge (Mass.), MIT Press, 1965.

scientific content of technology has dealt a blow to the skilled crafts worker.[5]

Nevertheless, the impact of the advance of science on the backward regions was ambiguous. Despite the benefits, it created a far wider gap in income levels and technological capability than previously and strengthened the hand of the stronger nations over the weaker. This is reflected in the speed of industrialization. After all is said and done, the speed with which late learners in the twentieth century have industrialized may not be any faster than that of the European emulators in the early nineteenth century. What is decisive is how one dates the onset of industrialization and how one decides when a country can legitimately be described as industrialized.

If one dates the start of industrialization in the European emulators from, say, 1776, when the new economic order in Britain was given theoretical recognition by Adam Smith; and if one dates the closing of the gap between Europe and England from, say, 1850 to 1873, after which England began to be overtaken, then Korean industrialization, dating from the time Korea was opened by foreign imperialist, does not appear especially fast. Modern Korean history began in the 1870s, when the thousand-year-old Yi dynasty began to shatter as a consequence of Japanese intrusion, much as the Tokugawa regime in Japan had been shaken by the appearance of Admiral Perry only two decades earlier. This amounts to a delay in the onset of industrialization in Korea of about ninety years, from the 1870s to the 1960s. The revolutionary period of Korean industrialization continues, moreover, in that rapid growth and structural change are still in full swing and Korea has not yet come anywhere close to catching up with the most advanced countries. Even in mature industries, required labor hours per unit of output in the late 1970s were far higher than in Japan, by a scalar that averaged roughly 2.8.[6] In the mid-1980s Korea's share of industrial

[5] As recently as 1903, when the Ford Motor Company was founded, building automobiles was a task reserved for crafts workers who had received training in the bicycle and carriage shops of Michigan and Ohio. According to Eli Chinoy: "Final assembly, for example, had originally been a highly skilled job. Each car was put together in one spot by a number of all-around mechanics" (as cited in H. Braverman, *Labor and Monopoly Capital*, New York, Monthly Review Press, 1974, p. 146). That all-around mechanics have reappeared in the experimental workshops of the Volvo Motor Company after three-quarters of a century suggests that the assembly line may not be the final word in cost-cutting. Nevertheless, it made operations far easier to transfer to late industrializing countries, where all-around mechanical skills were scarce. The skilled crafts person has played only a minor role in late industrialization.

[6] The industries included in this calculation are cotton, textiles, paper, rubber tires, caustic soda, cement, iron castings, and ball bearings. The engineering method was used to calculate productivity, which involves computing required labor hours per unit of output. The study was undertaken by Han'guk Saengsangson Ponbu (Korea Productivity Center), *Worinara Saneup Oe Saengsangsong Hyunwhangkwa Opero Oe Kwajae* (*The Level of Productivity in Korea's Industry and the Future Task*), Seoul, 1985. For a comparison of productivity levels and growth rates in Korea and Japan, calculated as output divided by employment, see Kim, Chok-kyo, Ji-seong Yoo, and Kyu-cheon Whang, *Han'guk, Daeman, Ilbon Oe Jaejoup Saengsonseong Bunsuk* (*The Analysis of Manufacturing Productivity in Korea, Taiwan, and Japan*), Hangyang University, Institute for Economic Research, Seoul, 1984.

activity arising from indigenous R&D was minuscule. Korea's growth rates only surpass all records once industrialization started.

Nevertheless, the reasons why late industrialization was slow in starting can be explained by the same set of factors that explain why such countries grew faster than the European emulators once their industrialization got underway. The institutions of late industrialization that underscore its success, and whose absence was responsible for delay, are the following: an interventionist state, large diversified business groups, an abundant supply of competent salaried managers, and an abundant supply of low-cost, well-educated labor. Each of these institutions is now introduced briefly and Korea's finesse in managing them is indicated. Later, attention is redirected towards the state and the overall process of catching up.

KOREA AS A SPECIAL CASE OF LATE INDUSTRIALIZATION

The state in late industrializing countries intervenes with subsidies deliberately to distort relative prices in order to stimulate economic activity. This has been as true in Korea, Japan, and Taiwan as it has been in Brazil, India, and Turkey. In Korea, Japan, and Taiwan, however, the state has exercised discipline over subsidy recipients. In exchange for subsidies, the state has imposed performance standards on private firms. Subsidies have not been giveaways, but instead have been dispensed on the principle of reciprocity. Adherence to the principle of reciprocity has made a critical difference in economic performance, as discussed shortly.

Below the level of the state, the agent of expansion in all late industrializing countries is the modern industrial enterprise — large in scale, multidivisional in scope, and administered by hierarchies of salaried managers. Even in Taiwan, an economy with a reputation for small-scale enterprise, the large size firm (often a government enterprise) spearheaded industrialization in the early stages of growth. As Table 1 indicates, in 1973 Taiwan had a higher percent of output accounted for by firms employing 500 or more workers than any other nonsocialist country (for which data are available). In Korea the modern industrial enterprise takes the form of diversified business groups or *chaebol*, the top 10 among them accounting in the early 1980s for as much as 30% of shipments and 67% of sales (see Table 2). The *chaebol* are large even by the standards of late industrialization. In 1986, *Fortune's* list of the 500 largest international firms included 10 private, non-oil producing firms from Korea compared to 5 from other developing countries.[7] The large size of the *chaebol* and their wide diversification into nonrelated products have allowed them to survive the hardships of late industrialization, to penetrate the lower end of a large

[7] See "The International 500", *Fortune*, August, 1987.

number of foreign markets, and to supplant the need for multinational firms to undertake major investments in new industries. While Korea has depended heavily on foreign loans, it has entertained almost no direct foreign investment outside the labor-intensive sectors.

Salaried managers are a key figure in late industrialization because they are the gate keepers of foreign technology transfers. Once the government takes the initiative in major investment projects in deciding what, when, and how much to produce, the task of how to produce falls to the salaried manager. Squeezed between the state on the one hand and the salaried manager on the other, the role of the private entrepreneur in large-scale enterprise in late industrialization has been much reduced by the standards of the entrepreneurial histories of advanced countries.

Salaried managers have performed especially well in Korea because of heavy investments in education, from the primary level on up. In terms of sheer quantity, a large number of engineers has meant competition among them for the best jobs and the fastest promotions, thereby driving up

Table 1

Distribution of Manufacturing Value Added by Firm Size[a], *1973*[b]

Country	*1-9*	*10-99*	*100-499*	*500 or more*
Korea	5.8	13.8	27.7	52.7
Taiwan[c]	4.4	16.7	22.5	56.4
Hong Kong	7.4	30.2	32.1	30.2
Brasil	3.4	23.7	36.1	36.6
Turkey[d]	11.7	10.1	27.5	48.4
Peru	4.0	23.9	46.4	25.7
Japan[d]	8.7	28.4	24.9	37.9
Canada[d]	2.0	21.1	37.4	39.3
Czechoslovakia	0.2	5.4	18.2	76.1
Austria	0.8	21.5	36.2	41.5
United Kingdom	15.7[e]		24.4	60.0
United States[d]	2.4	18.3	30.5	48.7

[a] As measured by number of workes employed.
[b] Value added in producers' values.
[c] Value added in factor values, 1971.
[d] Net value added in factor values.
[e] 1-99.

Source: All countries, except Taiwan: United Nations, *The 1973 World Programme of International Statistics. Summary of Data from Selected Countries*, New York, 1979. Taiwan: Executive Yuan, *The Report of Industrial and Commercial Census of Taiwan and Fukien, District of the Republic of China, 1971*, as cited by S. Ho, "Small-Scale Enterprises in Korea and Taiwan", World Bank staff working paper No. 384, Washington, 1980.

Table 2

Business Concentration Ratio (BCR) in Korea (1974-1984)[a]

BCRn[b]	*1974*	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*1983*	*1984*
BCR1	4.9	4.3	4.7	7.9	6.9	8.3	8.3	10.5	10.4	11.8	12.0
2	7.2	7.5	8.1	12.5	12.9	12.8	16.3	19.1	19.0	21.2	24.0
3	9.0	9.8	11.3	16.0	16.9	17.6	23.9	27.6	27.4	30.5	35.8
4	10.3	11.4	12.9	18.2	20.7	22.1	30.1	35.2	35.6	38.7	44.3
5	11.6	12.8	14.5	19.8	22.9	24.6	35.0	41.3	42.2	46.7	52.4
6	12.7	14.1	16.1	21.3	24.7	26.6	38.2	44.9	46.0	51.0	56.2
7	13.5	15.3	17.5	22.8	26.4	28.5	41.0	48.0	49.2	54.2	59.4
8	14.3	16.2	18.4	24.0	27.7	30.3	43.6	50.9	52.2	57.1	62.1
9	14.7	16.7	19.3	25.2	28.9	31.6	46.0	53.3	55.1	59.8	64.8
10	15.1	17.1	19.8	26.0	30.1	32.8	48.1	55.7	57.6	62.4	67.4

[a] Manufacturing sector only.
[b] BCRn is defined as (total sales figure of top n firms among business groups/GNP) × 100 for each year.

Source: SEOK KI KIM, "Business Concentration and Government Policy: A Study of the Phenomenon of Business Groups", Boston (Mass.), Harvard Business School, D.B.A. dissertation, 1987.

productivity. Moreover, enough of them have been trained to ensure that enough of them pursue the career intended by their education.

In terms of quality, or the way salaried managers have been utilized by the modern industrial enterprise, three points stand out in the Korean case. First, firms have showed a preference to hire engineers over administrators. Whereas between 1960 and 1980 the number of Korean managers grew by a factor of 2.2, the number of Korean engineers grew by a factor of over 10 (see Table 4). Second, even as managerial capitalism in Korea has spread, overhead has been kept in check. As Table 3 indicates, in the 20 years between 1960 and 1980 the ratio of white collar workers (excluding clerks) to blue collar workers remained constant, even declining slightly, from 0.13 to 0.10. Korean firms have not created huge overheads but instead have appointed managers to the shop floor, in production positions, which is where the competitive advantage of late industrializing countries lies. Third, the number of layers of management has been kept quite small in Korea. Engineers at the plant level keep in close contact with the ranks.

Turning now to production workers, late industrializers have exceptionally well-educated work forces by comparison with earlier phases of industrialization. Moreover, the wages of these workers have been

prevented from rising rapidly by a conspiracy of forces: political repression, an unlimited labor supply at the onset of growth, an absence of international opportunities to migrate, and the insignificance of a class of skilled crafts persons, who were the organizers of trade unions in earlier periods. Korea, however, has set a number of world records in the area of labor which has made its work force unusually productive.

On the one hand, Korea appears to have the longest work week in the world, a throwback to the work week in effect in the harsh factory system under Japanese colonialism (see Table 4). On the other hand, Korea's growth rate of real wages possibly exceeds that of any previous industrial revolution (including Japan's) and probably that of any contemporary one (see Table 5). High real wage increases have acted as a stimulant to firms to acquire technological capability and have acted as an inducement to workers to work hard. In addition, Korea's work force is highly segmented, which has energized a new labor aristocracy. Korea has the dubious distinction of having one of the highest gender wage gaps, although this honor sometimes falls to Japan (see Table 6). On average, Korean women earn less than half of what men earn. Korea also has one of the largest wage dispersions within the manufacturing sector. According to Table 7, Korea's wage dispersion by industry is among the world's highest. Korea's new labor aristocracy

Table 3

Managerial Resources in the Manufacturing Sector by Category, 1960-1980

Employment *Category*	*1960*	*1970*	*1980*	Increase *1980/1960*
Engineers	4,425	16,252	44,999	10.2
Managers	31,350	47,166	69,585	2.2
Sales	5,025	27,778	68,716	13.7
Service	13,660	22,740	49,522	3.6
Clerical	17,330	143,849	356,362	20.6
Production	404,735	1,188,406	2,206,851	5.4
Total	479,975	1,447,520	2,797,030	5.8
Administrative/ Production (ratio)[b]	0.13	0.96	0.10	—
Administrative and Clerical/Production (ratio)	0.18	0.22	0.27	—

[a] Includes transportation and communication workers in the manufacturing sector.
[b] Administrative includes engineers, managers, sales and service workers.

Source: A. H. AMSDEN, *Late Industrialization*, op. cit.

is male, occupied in one of the basic industries, and employed in a large-scale firm.

A further introduction to the state in late industrialization is now presented because, of all institutions, it is the most controversial.

THE STATE

The first step to understand why backward countries in the twentieth century eventually expand is to ask why they became backward in the first place. The development process is enormously complex, but one can say as a first approximation that the onset of economic expansion has tended to be delayed by fatal weaknesses in the state's ability to act. If and when industrialization accelerates, it has done so at the initiative of a strengthened state authority. By contrast, one cannot say that countries in the twentieth century that have fallen behind have been relatively defiant of the market mechanism while those that have advanced have conformed to it, an alternative theory.

Table 4

Hours of Work in Manufacturing (1976-1985)

Country	*Average Workweek*
South Africa	47.0
Argentina	45.6
Mexico	46.0
Puerto Rico	38.0
United States	40.1
Hong Kong	47.1
Israel	38.7
Japan	46.0
Korea	53.3
Malaysia	48.4
Belgium	34.3
France	40.1
Germany	41.2
Norway	38.1
Sweden	37.8
United Kingdom	41.5

Source: ILO (International Labour Organization), *1986 Yearbook of Labor Statistics*, Geneva, 1987.

Table 5

Real Nonagricultural Wage Increases, Korea, Brazil, Argentina, Mexico and India, 1970-1984

Year	*Korea*[a]	*Brazil*[a]	*Argentina*	*Mexico*	*India*[a]	*Taiwan*
1970	100	100	100	100	100	—
1971	102	110	105	103	100	—
1972	104	114	99	104	—	100
1973	119	119	107	104	106	107
1974	130	119	126	107	97	98
1975	131	127	124	114	110	110
1976	154	129	80	123	120	126
1977	187	134	76	125	116	138
1978	219	142	77	122	124	151
1979	238	134	87	121	130	163
1980	227	130	100	116		166
1981	225	118	91	119		171
1982	241	115	79	117		180
1983	261	97	97	86		188
1984	276	84	112	83		191

Note: Base = 100. Deflated by consumer price index.

[a] Real earnings manufacturing sector.
[b] Average wages for skilled workers in construction. Data are from the Central Bank.
[c] Rupees per hour for industrial workers.

Source: A. H. AMSDEN, *Late Industrialization*, op. cit.

Table 6

International Comparisons of Manufacturing Wage Differentials by Sex, 1980

Country	%	*Country*	%
Sweden	89.3	Belgium	69.4
Burma	88.8	U.K.	68.8
Denmark	86.1	Syria	68.8
Norway	81.9	Ireland	68.7
Netherlands	80.1	Greece	67.8
El Salvador	78.9	Switzerland	67.7
Australia	78.6	Egypt	63.1
France	77.0	Luxembourg	61.2
Finland	75.4	Cyprus	50.2
West Germany	72.7	Japan	48.2
New Zeland	72.4	South Korea	44.5

Note: (Female/male average wages)*100. In most cases, 1980 wages. Hourly wages except for Cyprus, Egypt (weekly), and Burma (monthly). Adults only for United Kingdom.

Source: ILO (International Labour Organization), *1981 Yearbook of Labor Statistics*, Geneva, 1982 as cited by J. W. Lee, "Economic World Development and Wage Inequality in South Korea", Ph. D. Dissertation, Harvard University, Boston, 1983.

Table 7

Wage Dispersion Among Manufacturing Industries in Select Countries

	Year	
	(1)	(2)
	1973	*1982*
Country	*Standard Deviation of Log Wages*	
Bolivia	.204	.168
Canada	.225	.239
France	.143	.126
Germany	.137	.141
Japan	.216	.263
Korea	.349	.314
Mexico	.147	.155
Norway	.075	.107
Poland	.126	.097
Sweden	.067	.081
USSR	.117	.101
United Kingdom	.087	.140
United States	.206	.241
Yugoslavia	.126	.120

Source: A. B. KRUEGER and L. H. SUMMERS, "Reflections on the Inter-Industry Wage Structure", Harvard Institute of Economic Research, discussion paper No. 1252, July 1986.

There are many reasons why some countries in the twentieth century found themselves behind others in income and wealth. The probable reasons can be grouped into four categories: natural resource endowment, demography, commercial factors, and social forces. The natural resource explanation for backwardness can be dismissed out of hand. The association between resource endowment and per capita income is visibly weak. The attribution of underdevelopment to excess population is now also pretty well discredited. Population explosions are currently believed not to have led to failures to industrialize but rather to have emerged as a consequence of them.[8]

There remains, therefore, two major contending views, the market and the institutional. The market explanation for economic development poses as the grand mover and shaker of the past 200 years of economic progress.

[8] The argument that rapid rates of population increase are the consequences of failures to develop is most cogently put by H. MYINT, *The Economic of the Developing Countries*, New York, Praeger, 1964.

No one could possibly deny the overarching role that the market has played in speeding growth. Yet one must distinguish between the market and the market *mechanism*. The former refers to the means to satisfy supply and demand. The latter refers to rules to allocate resources. All industrializations have made use of the market. Nevertheless, adherence to the market mechanism cannot explain very satisfactorily why late industrializers delayed so long in starting to expand, or why they eventually succeeded in growing.

The economic histories of backward countries are quite varied, yet the archetypal late industrializer in the twentieth century was at one time or another a colony of one of the Great Powers (Japan included among the potentates). Colonial histories differ, but the typical economic regime of a colony was quite exemplary from the viewpoint of competitive theory. Basically, colonies followed policies of free trade and exploited their static comparative advantage in agricultural commodities. Their growth, therefore, could not be said to have been stunted by a failure to be guided by the market mechanism.[9] Indeed, it could be said to have been stunted by a failure to follow interventionist policies, namely of throwing up trade barriers and offering financial incentives to cradle infant industries.

This leads to the final explanation, one related to social relations. Quite simply, industrialization was late in coming to backward countries because their states were too weak to mobilize forces to inaugurate economic development and fend off a wave of foreign aggression begun in the second half of the nineteenth century. Their states' weakness, moreover, arose from internal social conflict—ethnic, racial, regional or class. Such conflict precluded arrogating enough power to a central authority to prevent foreign intervention, invasion, or the catastrophic loss of statehood altogether. Korean history in the period 1871-1962 is dominated by the struggle to create a state with the ability to plan and coordinate economic expansion.

States in modern history have always intervened to spur economic development, but state intervention has intensified over time as industrialization has increasingly taken the form of catching up.

Intervention by means of the subsidy serves as a symbol of late industrialization, not just in Korea and Taiwan but also in Japan, the Latin American countries, and so on. The First Industrial Revolution was built on laissez-faire; the Second, on infant industry protection. In late

[9] L. REYNOLDS argues that under colonial regimes of free trade, the backward regions grew at a fairly rapid clip, although to be sure, there were exceptions to the rule. According to Reynolds: "... against the view that 'life began in 1950', ... the third world has a rich record of prior growth, beginning for most countries in the 1850-1914 era". (See L. REYNOLDS, *Economic Growth in the Third World, 1850-1980*, New Haven, Yale University Press, 1985, p. 4) In anticipation of the obvious objection, that developing countries are still desperately poor, Reynolds writes: "Certainly people in Western Europe and the United States are much better off than people in Sri Lanka [the example he uses], though not as much better off as the World Bank Table suggests ... conversion from the local currenciees to U.S. dollars at official exchange rates exaggerates the actual difference in consumption levels" (*op. cit.*, p. 40).

industrialization the foundation is the subsidy, which includes protection as well as financial incentives. The pivotal role of the subsidy has rendered the government not merely a banker but an entrepreneur, using the subsidy to decide what, when, and how much to produce. The subsidy has also changed the process whereby relative prices are determined.

Industrial expansion depends on savings and investment, but in backward countries especially, savings and investment are in conflict over the ideal interest rate, high in one case, low in the other. In Korea and other late industrializing countries, this conflict has been mediated by the subsidy. Throughout most of the 25 years of Korean industrial expansion, long-term credit has been allocated by the government to selected firms at negative real interest rates in order to stimulate specific industries (see Table 8). The high real interest-rate policy that started in 1965 — in the spirit of liberalization — ended in 1972 with a return to low real interest rates. However, even during those seven years domestic savings were never sufficient to meet investment demand. The government, therefore, arranged long-term international credit for favored firms at rates far below those obtainable domestically. Thus, the government established multiple prices for loans, some more favorable than others, and only one of which could possibly have been «right» according to the law of supply and demand. Moreover, the most critical price, that for long-term credit, was wildly wrong.

As for the foreign exchange rate, another key relative price in economic expansion, it has also been deliberately distorted by late industrializers, which need a high rate to export and a low rate to repay foreign debt and import raw materials and producer goods that cannot yet be produced domestically. Exchange rates have a negative impact on growth if they are grossly distorted. In Korea, however, they were distorted within reasonable bounds, but only had a positive impact on growth when they operated in conjunction with other policies to stimulate exports. As Figure 1 indicates, there is no close relationship between exports and the real effective exchange rate. Exports have been heavily subsidized. They have also been heavily coerced, so inside the range of reasonableness, market prices have been altogether irrelevant. According to a survey of exporters in the mid-1970s conducted under the aegis of the World Bank, over half of the respondents claimed that export quotas had a negative effect on their firms.[10] Exporters, however, were compensated for having to export by being allowed to sell in the domestic market at inflated prices. Such prices were distorted due to protection. Tariff barriers and nontariff barriers comprise a key ingredient in Korea's industrial policy. Even imports supposedly liberalized in the mid-1980s are subject to an average tariff rate wich may amount to as

[10] YUNG WHEE RHEE, B. ROSS-LARSON and G. PURSELL, *Korea's Competitive Edge*, Baltimore, Johns Hopkins for the World Bank, 1984.

Table 8

Cost of Foreign Capital (annual averages)
Unit: %

		1966-70	*1971-75*	*1976-80*	*1981-83*
I.	Domestic Bank Lending Rate[a]	24.4	17.0	18.0	12.5
	(Curb Market Interest Rate)	(54.2)	(40.1)	(41.3)	(30.6)
II.	Foreign Interest Rate[b]	6.4	7.9	11.5	11.1
III.	Foreign Inflation Rate (GNP Deflator)[c]	4.9	8.4	5.9	4.1
IV.	Exchange Rate Depreciation[d]	5.1	7.8	5.5	10.1
V.	GDP Deflator (Rate of Change): Korea[e]	14.6	18.7	19.7	9.9
VI.	Real Foreign Interest Rate (II-III)	1.5	-0.5	5.6	7.0
VII.	Interest Rate Differential Between Home and Foreign Markets (I-II-IV)	12.9	1.3	1.0	-8.7
VIII.	Real Private Cost of Borrowing Abroad (II + IV-V)	-3.1	-3.0	-2.7	11.3

[a] Discounts on bills of Deposit Money Banks (three year moving averages).
[b] LIBOR (90 days).
[c] Average of Japan and United States.
[d] BOK (Bank of Korea) standard concentration rate (three year moving averages).
[e] Three year moving averages.

Source: Bank of Korea, *Monthly Bulletin*, various issues as cited by YUNG CHUL PARK, "Korea's Experience with External Debt Mangement", in G. SMITH and J. CUDDINGTON (eds.), *International Debt and the Developing Countries*, World Bank, 1985.

much as 30% and there persist nontariff barriers equal in subtlety to those in Japan.

From this perspective, the price determination of savings and investment and of exports and imports is the outcome of a far more complex process than the market model would suggest. Economic expansion in late-industrializing countries has come only at the cost of such complexity. As a general property of late industrialization, interest rates are more favorable for some investors than for others. Exporters and importers face different exchange rates. Some imports are duty free; others are subject to high trade barriers. In the case of Korea, exports are subsidized but exporters are coerced to exceed export targets.

Whatever one wishes to call such a mixture of policies, one cannot call it «getting relative prices right» or «conforming to market forces». I call such a mixture of policies market augmenting, in recognition of its immediate objective, which is to increase either home or overseas demand for domestically supplied output (in Korea's case, output supplied by Korean-owned firms).

Economic paradigms are largely defined by the internal mechanism that is built into them to exert discipline over firm behavior. In the case of the market paradigm, discipline is dispensed by the invisible hand. With the subsequent erosion of competitive market structures, which was inconsistent with the market paradigm, Schumpeter recognized a new disciplinarian in technological change. It was the creative gales of new technological discoveries that uprooted old monopolies and increased productivity, not steadily but in great spurts.

There is no mechanism in the market-augmenting paradigm that is equivalent to the invisible hand or to technological change. To the extent that oligopolists the world over compete along dimensions other than innovation, oligopolists in late industrializing countries also compete, although the dimensions that they compete along relate to their status as learners and they tend to compete far more vigorously because growth is faster. However, there is no neat mechanism in the market-augmenting paradigm that can be relied upon to drive firms automatically to compete with one another, because growth itself does not happen automatically. Growth in late-industrializing countries depends on government intervention to augment supply and demand.

Few aspiring emulators of the Korean model appreciate just how extensive subsidies have been, just how pervasive protection is, and just how encouraging government support continues to be in Korea. Government support has included expansionary rather than contractionary policies in times of external shock and almost unfailing bailouts of financially troubled, large-scale firms (at what sometimes appear to be great social savings and at other times, great social costs). With such discretionary power under the control of mere mortals, two questions arise: What mechanism will discipline subsidy recipients? And no less pertinent, what mechanism will discipline the donor of subsidies, the state itself?

All paradigms have their hidden premises, a large number of firms confronting one another in the same industry in the case of the market conforming paradigm, an undulating stream of new technological discoveries in the case of Schumpeter's. Although the market augmenting paradigm does not have an automatic disciplinary device, it nonetheless has a premise on which industrial expansion depends. The premise of late industrialization is a reciprocal relationship between the state and the firm. This does not simply mean close cooperation, which is sometimes the way business government relations in Korea and Japan are simplistically depicted. It means that in exchange for subsidies, the state exacts certain performance standards from firms. The more reciprocity characterizes state-firm relations, the higher economic growth.

Korea has industrialized unusually rapidly partly because the state has imposed relatively stern discipline on private firms. In exchange for subsidized long-term credit, even the most politically favored firms have had to produce rather than speculate, to train their workers rather than exploit them, to invest in R&D as well as rely on foreign technical expertise, and to export as well as savor demand in the protected home market. Exports represent perhaps the most important disciplinarian and an objective, opaque criterion by which firm performance is easily judged. Additionally, firms have been subject to five general controls in exchange for government support.

First, the government has owned and controlled all commercial banks. One of the first acts of the government of Park Chung Hee was to nationalize the banking system (the government of Syngman Rhee had denationalized it a decade earlier to appease American pressures). Although pressures to liberalize in the 1980s led the government to privatize the commercial banks, thereby strengthening aggregate economic concentration and income inequality, the government maintained its control over commercial banking. Government control of the purse has helped orient the *chaebol* towards accumulating capital rather than seeking rents.

Second, in luring firms to enter new industries with the plums of protection and subsidies, the government has imposed discipline by limiting the number it has allowed to enter (although usually not to fewer than two firms per industry (see Table 9)). This has ensured the realization of scale economies and the rise of the mammoth business groups that the government foresaw as necessary to compete internationally.

Third, discipline has been imposed on «market-dominating enterprises» through yearly negotiated price controls, in the name of curbing monopoly power. At the end of 1986 as many as 110 commodities were controlled, including flour, sugar, coffee, red pepper, electricity, gas, steel, chemicals, synthetic fibres, paper, drugs, nylon stockings, automobiles, and television.[11]

Fourth, investors have been subject to controls on capital flight, or the remittance of liquid capital overseas. Legislation (Tuk-Pyul Pon-Jen Ka-Ching-Cho-Pul-Pup) has stipulated that any illegal overseas transfer of $1 million or more was punishable with a *minimum* sentence of 10 years imprisonment and a maximum sentence of death. In the 1980s, the degree of compliance with the law has fallen into doubt.[12] In the 1960s and 1970s, its harsh terms are believed to have been a credible deterrent to

[11] KYUNG-JAE-KI-HEOK-WAM, Ko-Shi Je 86-7 Ho, "1987 Hyun-do Shi-Jang-Ji-Bae-Chok Sa-Up-Ja Ji-Jong" (Economic Planning Board, Notification No. 86-7, "Designation of Market-Dominating Enterprise for the Year of 1987").

[12] Still, a bankrupt shipping magnate was believed to have committed suicide in 1987 for fear of being prosecuted under the law's terms. See "Chairman's Death Makes Waves", *Business Korea*, May 1987, p. 14.

Table 9

Structure of Manufacturing Industry
(Unit: Number of Commodities, 1 billion Won)[a]

		Monopoly	Duopoly	Oligopoly	Competitive	Total
	No. of	442	279	495	276	1,492
	Commodities	(29.6)	(18.2)	(33.2)	(18.5)	(100)
1970						
	Shipment	110	204	439	498	1,252
		(8.8)	(16.3)	(35.1)	(39.8)	(100)
	No. of	667	425	674	343	2,219
	Commodities	(31.6)	(20.1)	(32.0)	(16.3)	(100)
1977						
	Shipment	2264.0	1,536	4,716	5,404	13,920
		(16.3)	(11.0)	(33.9)	(38.8)	(100)
	No. of	533	251	1,071	405	2,260
	Commodities	(23.6)	(11.1)	(47.4)	(17.9)	(100)
1982						
	Shipment	5,649	3,275	24,967	15,481	49,372
		(11.4)	(06.6)	(50.6)	(31.4)	(100)

[a] Figures in parentheses are shares in percentage.

Monopoly: $CR_1 > 80$ percent, $S_1/S_2 < 10$.
Duopoly: $CR_2 > 80$ percent, $S_1/S_2 < 5.0$ $S_3 < 5$ (monopoly is excluded).
Oligopoly: $CR_3 > 60$ percent, (Monopoly and duopoly are excluded).
Competitive: $CR_3 < 60$ percent.

Source: Compiled from the Census of Manufacturing data base, Economic Planning Board, by KYU-UCK LEE, S. URATA and I. CHOI, "Recent Developments in Industrial Organization Issues in Korea", Korean Development Institute and the World Bank, 1986.

private investors who might otherwise have used public subsidies to build personal fortunes abroad.

Fifth, the middle classes have been taxed and the lower classes have received almost nothing in the way of social services. This has enabled a persistent deficit in the government account to reflect long-term investments (see Table 10).

As for the question, «Who will discipline the state?» the answer in Korea is the student movement. Beginning in the period of Japanese colonial rule, the student movement emerged as an unusually belligerent and obstreperous force. Subsequent history suggests that if the state goes beyond the limits of tolerable abuse and corruption, it encounters destabilizing student

Table 10

Sources of Current Account Imbalances in Current Market Prices (Unit: Billion Won)

	Public Sector					
	Private Sector (A)	Goverment (B)	Government Invested Corporations (C)	Subtotal (D = B + C)	A/GNP (percent)	D/GNP
1963	−11.67	14.34	−16.06	−2.02	−2.4	−0.4
1964	−3.39	23.26	−13.79	9.47	−0.5	1.3
1965	−27.88	36.49	−16.15	20.34	−3.5	2.5
1966	−65.20	38.82	−15.14	23.68	−6.3	2.3
1967	−70.89	51.26	−54.39	−3.13	−5.5	−0.2
1968	−136.63	57.03	−36.19	20.84	−8.3	1.3
1969	−110.80	29.98	−63.73	−33.75	−5.1	−1.6
1970	−195.55	60.91	−63.12	−2.21	−7.3	−0.1
1971	−179.19	42.81	−130.31	−87.50	−5.4	−2.7
1972	35.80	−9.16	−200.51	−209.67	0.9	−5.2
1973	51.31	24.86	−107.94	−83.08	1.0	−1.6
1974	−422.54	−36.09	−223.50	−259.59	−5.8	−3.5
1975	−337.19	−129.29	−482.24	−611.53	−3.4	−6.2
1976	−20.73	329.49	−455.95	−126.46	−0.2	−1.0
1977	472.45	18.08	−749.27	−731.19	2.8	−4.3
1978	−281.57	448.27	−1,031.84	−583.57	−1.2	−2.5
1979	−1,675.45	493.31	−1,170.45	−677.14	−5.8	−2.3
1980	−2,381.04	20.81	−1,344.91	−1,324.10	−6.9	−3.9
1981	−1,513.67	5.89	−1,869.06	−1,863.17	−3.6	−4.4
1982	489.47	−124.05	−2,260.19	−2,384.24	1.0	−5.0

Notes:

a) A, B, and C refer to the difference between savings minus investment in each sector.

b) Figures for savings and investment of government invested corporations, which include nonfinancial operations of Federations of Agricoltural and Fisheries Cooperatives, are obtained from BOK's flow of funds tables.

Source: Yung Chul Park, *op. cit.* as cited by A. H. AMSDEN, "Growth and Stabilization in Korea, 1962-84" in L. TAYLOR (ed.), *Stabilization and Development: A Structuralist Approach*, Oxford, Clarendon, forthcoming.

protests. As this is being written, the student protests against the military dictatorship that came to power in 1980 are being joined by the middle classes and workers.

It is unclear whether the strong economic measures of the Korean state could have been taken under political democracy, although Japan and the étatiste European countries suggest that such measures and political democracy are compatible. What is clear beyond a doubt is that little industrialization may be expected in backward countries (and maybe in advanced ones) in the absence of a strong central authority. Even getting relative prices "right" according to textbook theory would require a state strong enough to battle the class of subsidy losers.

THE PROCESS OF CATCHING UP

Landes mentions labor supply only briefly in his analysis of catching up, and he certainly does not view abundant labor as Europe's competitive asset. To the contrary, he sees the attainment of competitiveness by learners in the nineteenth century as burdened by lower labor costs. He argues that after industrialization gained momentum in Britain, the same abundant supply of impoverished rural laborers that had made possible Europe's pre-factory industry began to act as "... a deterrent to mechanization and concentration".[13] For Gerschenkron as well, labor did not lend a competitive advantage to late developers, because a suitable labor force did not exist: "... industrial labor, in the sense of a stable, reliable, and disciplined group that has cut the umbilical cord connecting it with the land and has become suitable for utilization in factories, is not abundant but extremely scarce in a backward country".[14]

The creation of competitiveness on the basis of an abundant labor supply is the *differentia specifica* of latter day twentieth-century learning. The United States and Germany caught up with Britain on the basis of innovation, not cheaper labor. Even when Japan penetrated deeper into world markets in the 1910s and 1920s, its cheap labor was but one of several assets it used to gain market share. Therefore, the conquest of world markets beginning in the mid-1960s by late industrializing countries on the almost exclusive basis of low wage rates represents a new phenomenon, a truly new international division of labor.

Nevertheless, low wages were not a sufficient basis to enter world markets in the mid-1960s, even in the industries in which backward countries could be expected to have a comparative advantage, the industries

[13] Cf. D. S. LANDES, *op. cit.*, p. 139.

[14] See A. GERSCHENKRON, *Economic Backwardness in Historical Perspective*, Cambridge (Mass.), Belknap, 1962, p. 9.

that are labor intensive. Through the lens of Korea's leading sector in the 1960s, cotton spinning and weaving, one comes to appreciate that, in the short run, the lowest wage supplier is not necessarily either the lowest labor cost or total cost supplier, no matter how labor-intensive the industry.[15] Korea's system of subsidies and incentives originated in attemps by the government to support the powerful cotton spinners' and weavers' cartel, whose members found it problematic to compete against Japan. The inadequacy of low wages as a basis for late industrializing countries to compete applied *a fortiori* in the basic or heavy industries (which comprise manufactures of chemicals, basic metals, nonmetallic mineral products, machinery, and transport equipment).

After a country invests in labor-intensive manufactures, the next logical step from both a technical and demand-side point of view is to invest in heavy industry. Certain sub-branches of heavy industry have prospered even in small countries, as evidenced by industrial activity in small countries like Austria, Belgium, and Switzerland (the only advanced country that does not appear to have some heavy industry is Denmark). Yet the heavy industries have drawn criticism from economic historians and advisors alike for being an irrational symbol of liberation from backwardness and a violation of comparative advantage.

Symbolism apart, the real significance of the heavy industries for late industrialization lies in the turning point they represent for the unit of production and the basis on which it realizes value. For one, with the heavy industry sector comes the modern industrial enterprise and, hence, salaried management. The salaried management of the cotton spinning and weaving industry in Korea was far less professional than that of the heavy industries. For another, with the heavy industry sector comes a new mode of competition, oligopoly. Of equal importance, transition from light to heavy industry involves a transition from competing on the basis of cheap labor to one of competing on the basis of modern facilities and skills, given whatever labor costs made entry possible. It usually follows that competition against low wage firms is redirected against firms that are also competing on the basis of modern facilities and skill, whatever their initial entry costs. Firms that compete on the basis of modern facilities and skills tend to be from advanced countries. For late industrializers, therefore, the transition from light to heavy industry involves a transition from competing against firms from other low wage countries to competing against firms from high ones, with vastly more experience and technical expertise.

Complicating the process of catching up for late industrializing countries, the progression from light to heavy industry has not been undertaken by the same set of firms. Leading firms in the light industries did not become

[15] Cf. K. D. Woo, "Wages and Labor Productivity in the Cotton Spinning Industries of Japan, Korea and Taiwan", *The Developing Economies*, XVI, 2, June 1978.

leading firms in thechnically more complex industries, with the exception of electronics. The experience gained in producing black and white television sets provided the know-how for big *chaebol* like Samsung and Lucky-Goldstar to advance from assembly to higher value-added activities in consumer electronics, and then from there to computer electronics. Nevertheless, electronic products accounted for a small share of total exports, only 10% in 1976 — before the rise of heavy manufactured exports — and only 11% in 1984, afterwards.[16] Korea's major exports from 1965 to 1975 were apparel, cotton textiles, and miscellaneous manufactures. In the case of cotton spinning and weaving, unambiguosly Korea's leading sector at the time, there were almost no techno-managerial externalities. The cotton textile firms that benefited internally from international competition in the form of exposure to better management techniques and improved production processes did not serve as the organizational building blocks for the economy's more skill — and capital-intensive pursuits. None of the leading *chaebol* evolved from a base in cotton textiles. With profit maximizing horizon that were short term, entrepreneurs who were conservative, and managers who were oriented more towards the art than science of production, textiles firms did not become the agents of further industrialization.

Catching up, therefore, involved the state's creating competitive advantage through a highly politicized process of resource allocation and big business' creating the organizations to compete. Not least critical became their acquisition of technological capability.

OVERCOMING TECHNICAL IGNORANCE

Whatever the time period, learners rely heavily on foreign know-how to narrow the gap. If they are at all successful at learning, they visit international expositions, attend conferences and lectures, read technical journals, hire experienced workers, visit overseas plants, engage foreign technical assistants, consult machinery suppliers, and buy, borrow, beg, and steal foreign design. The form of technology acquisitions has tended to change, however, as technology itself has become more science-based, and as the firm has come to be viewed less as a means to earn a livelihood and more as a means to earn a profit. The central tendency has shifted from the absorption of foreign technology through copying and self-teaching to the adoption of foreign technology through investing in foreign licenses and technical assistence. The former mode of technology acquisition may be called *imitation*, and the latter, *apprenticeship*.

[16] Bank of Korea, *Quarterly Economic Review*, Seoul, various issues.

In Korea, massive imports of foreign technical assistance were viewed as a means to attain technological independence, and were part of a larger effort in both the public and private spheres to avoid foreign control, particularly by Japan. Massive doses of foreign technical assistance were purchased in preference to depending on foreigners to run Korean plants. Whether in Korea's shipyards, steel mills, machinery works, automobile plants, or electronics factories, the credo became to invest now in in-house technological capability — even if outside expertise was cheaper — to reap the rewards of self-reliance later.

To understand how Korea attained competitiveness, it is necessary to understand the nature of the technological backlog that Korea, and other late learners like it, borrowed. This is most easily accomplished by drawing a comparison between Korea and a still earlier industrializer, Germany, during the stage of its catching up. Thorstein Veblen has written on Imperial Germany, the forerunner not just of Korea but also of Japan, and draws a comparison between German assimilation of foreign technology and England's borrowing from Continental Europe in the period of Tudor rule. According to Veblen, the necessary technological proficiency of Germany

> "was of a kind to be readily acquired; much more so than the corresponding technological proficiency acquired by the English in Tudor times by borrowing from the Continent. In this earlier English case what had to be borrowed and assimilated was not only a theoretical knowledge and practical insight into the industrial arts to be so taken over, but a personal habituation and the acquisition of manual skill on the part of the workmen employed; a matter that requires not insight but long continued training of large numbers of individuals — apprenticeship...".[17]

By contrast, Veblen argues, the technology which Germany borrowed in the nineteenth century:

> "is a different affair in respect of the demands which it makes on the capacities and attention of the community into which it is introduced. It is primarily an affair of theoretical knowledge, backed by such pratical insight into its working conditions as may be necessary to the installation of the mechanical equipment. In all this there is little of an obscure, abstruse or difficult kind, except for such detailed working out of technological applications of theory as call for the attention of expert specialists".[18]

Like the Germans before them, Korean firms were generally not taxed by the need of their operatives to acquire manual skills. Few apprenticeships existed in Korea, and formal vocational training did not commence immediately even in some of the largest firms. Although the *chaebol* sent

[17] Cf. T. VEBLEN, *Imperial Germany and Industrial Civilization*, New York, Viking Press, 1965 (1° edition 1915), p. 187.
[18] *Ibidem.*, p.188.

vast numbers of employees abroad for training, the incidence was greatest at the upper end of the job hierarchy — although inclusive of foremen. And while large numbers of technical assistants consulted in Korea, including operatives with specialized skills, little effort was made to drive these operatives into exile in Korea. A far graver problem for Korea than for Germany, however, was the acquisition of theoretical knowledge, The problem for Germany, according to Veblen, was minor, as was soon manifested by Germany's success at innovating. Korea, on the other hand, lacked theoretical knowledge at the world frontier, not only in the machinery building sector, which Veblen dwells upon, but also in the continuous process industries and, to an acute degree, in electronics. Therefore, the benefits of backwardness notwithstanding, the shift of the world technological frontier in the century after Germany industrialized left Korea relatively further behind, and made it far more difficult for Korea to solve what even for Germany was the most intransigent problem of technology transfer: the detailed working out of technological applications of theory.

The problem of technology transfer, however, cannot be seen merely in technical terms. Socially, it touched upon the tribulation common to all early capitalist development, of getting adventurers in the field of business to take technology seriously. In Germany, what contributed to the triumph of manufacturing over finance as the dominant mode of profit making was that: "These German adventurers in the field of business, being captains of industry rather than of finance, were also free to choose their associates and staff with a view to their industrial insight and capacity rather than their astuteness in ambushing the community's loose change".[19] The German production engineers advanced the notion that industrialization depended on technical competence:

> "The responsible staff and corps in these industries, being men who had come through the schools instead of through the country store and the pettifogger's law office, were not incapable of appreciating that range of theoretical and technical knowledge that is indispensable to the efficient conduct of modern industry; and so the German industrial community was as surely and unresistingly drawn in under the rule of the technological expert as the American, at about the same period [the late nineteenth century], was drawn in under the rule of the financial strategist".[20]

It would be an exaggeration to say that the industrial community in Korea became "surely and unresistingly" drawn in under the rule of the technological expert, because, by world standards, there were no experts in Korea. Nevertheless, like their German counterparts, the production engineers who were the gatekeepers of technology transfer came through

[19] *Ibidem.*, p. 194.
[20] *Ibidem.*, pp. 195-96.

Table 11

Indicators of Human Capital in Seven Late Industrializing Countries

Item	*Year or Period*	*Argentina*	*Brazil*	*India*	*Korea*	*Mexico*	*Singapore*	*Turkey*
Postsecondary students abroad as a	1970	1.0	1.0	1.0	2.0	1.0	—	—
percentage of all postsecondary students	1975-77	0.3	0.7	0.3	1.7	1.0	12.5	3.2
Secondary students as a percentage of	1965	46.0	—	29.0	29.0	17.0	45.0	16
secondary age population	1978	46.0	17.0	30.0	68.0	37.0	57.0	34
Postsecondary students as a percentage	1965	—	—	4.0	5.0	3.0	9.9	4.4
of eligible postsecondary age population	1978	18.0	10.0	9.0	9.0	9.0	8.8	7.7
Engineering students as a percentage of total postsecondary age population	1978	14.0	12.0	—	26.0	14.0	40.8	17.6
Scientists and engineers in thousands	Late 1960s	12.8	5.6	1.9	6.9	6.6	—	—
per million of population	Late 1970s	16.5	5.9	3.0	22.0	6.9	5.2	15.9
	1974	323	75	58	—	101	—	—
Scientists and engineers in R&D	1976	311	—	46	325	—	263	222[a]
per million of popolation	1978	313	208	—	398	—	317	—

(—) = Not available.

[a] 1975.

Source: Adapted from Westphal, L. et al., "Reflections on the Republic of Korea's Acquisition of Technological Capability", in N. ROSENBERG and C. FRISCHTAK (eds.), *International Technology Transfer: Concepts, Measures and Comparisons*, New York, Praeger, 1985, for Argentina, Brazil, India, Korea and Mexico. UNESCO, *Statistical Yearbook* various years, for Singapore and Turkey.

the schools. And in a society hungry to catch up, with a steadfast faith in the value of education, the practical knowledge these professionals wielded went a long way toward winning them influence and esteem. The industrial community in Korea, therefore, became surely and unresistingly drawn in under the rule, if not of the expert, then of the technological trainee.

Once the entrepreneurs recognized that government subsidies could make manufacturing activity profitable, and that Korean engineers could build ships that floated and steel that bore weight, they increasingly turned their attention away from speculating towards accumulating capital.

Symptomatic of the passionate desire to organize and hasten the process of catching up, the Koreans, like the Germans, pushed ahead with forming a native cadre of engineers and technicians. The number of schools in both Germany and Korea was large, unusually so by contemporary standards. The plain fact of the matter is that Korea was a successful learner partly because it invested heavily in education, both formal schooling and foreign technical assistance. As Table 11 indicates, even by comparison with Singapore, Korea has the highest percent of engineers and scientists per capita. Other indices in Table 4 also indicate that the magnitude of Korea's investments in education is exceptional.

As for foreign technical assistance, the preponderance of it came from Japan, a fact that gave Korea an edge over other late industrializing countries

that were culturally and geographically further afield than Korea from Japan. Japan may not have been as close to the world technological frontier as the United States, but it emerged as the world's premier producer, and communicated to Korea both the most efficient production techniques and a seriousness about the manufacturing function.

Harvard Business School, Boston