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CENTER DISCUSSION PAPER NO. 697

LABOR MARKETS, HUMAN CAPITAL
AND DEVELOPMENT PERFORMANCE IN EAST ASIA

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LABOR MARKETS, HUMAN CAPITAL,
AND DEVELOPMENT PERFORMANCE IN EAST ASIA

Abstract

This paper focuses on the human resources side of development performance in East Asia since the 1950s, with special attention paid to Taiwan and South Korea. Two frames of reference are used to analyze the successful records of these two systems. One is to analyze the relationship between labor markets and human capital formation, the second the changing interplay between domestic and international forces.

The initial conditions in each system in the early '50s of course played an important role. We then consider the nature of the import substitution phases in both systems, unusually mild, as was the unusual emphasis on agriculture and the early attention paid to linkages between agriculture and rural industry even during this inward-oriented subphase of development. Subsequently, as both systems undertook major policy reforms, shifting to labor-intensive industrial export-oriented economies in the '60s and early '70s, we again analyze the importance of labor market conditions along with the rapid mobilization of agriculture on behalf of a booming industrialization effort. Lastly, as labor surplus is exhausted, the human capital emphasis in both systems becomes even more important as they enter the technological era of the '70s and '80s. Human resource and technology policies with respect to vocational education, higher education, R&D, etc., are shown to accommodate, not obstruct, the needs of the systems over time. Institutional and organizational investments, along with flexibility in macro-economic policies, are seen as important contributors to the well-known success story of East Asia.

LABOR MARKETS, HUMAN CAPITAL,
AND DEVELOPMENT PERFORMANCE IN EAST ASIA

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There are, of course, a number of ways to analyze the developmental success of the East Asian economies, with specific focus on the relationship between labor markets and human capital, on the one hand, and both the domestic and international performance of the economy, on the other. We have chosen to concentrate on the critical dimensions of the economic record of these systems over time, with special emphasis on the case of Taiwan, the most successful, though we will be making frequent reference to parallel Korean experience. For each sub-phase of the transition we will endeavor to relate performance to the role of government, especially as it relates to the labor market and human capital dimensions.

Section I will present a brief description of the initial conditions which represent an essential part of the post-independence story in contemporary East Asia. Section II will focus on the decade of the 50s and early 60s, characterized by heavy attention to agriculture, especially in Taiwan, and a mild version of the import substitution syndrome in both countries. Section III will be concerned with the period between the early 60s and 70s, when both societies were engaged in a vigorous,

* The research assistance of Fritz Foley and Ryan Schneider is gratefully acknowledged.

largely labor-intensive export-oriented development drive. Finally, Section IV will analyze the rest of the 70s and 80s, when these economies, moving out of labor surplus and into labor-scarce situations, witnessed a dramatic shift in output mix towards the higher tech, more capital and skill intensive end of the industrial spectrum. Section V will present some brief conclusions.

I. Initial Conditions.

It should be recognized that both Korea and Taiwan already had unusually high literacy rates (about 60%) when the transition curtain rose in the early 50s; second, in Taiwan a colonial 1905 land reform was reinforced by another major land reform in 1949-53; and a similarly substantial redistribution of land took place in Korea under post-war U.S. prodding. Both economies had been part of the Japanese colonial network, producing what was needed at home, especially agricultural products, with 95% of sugar and 52% of Taiwan's rice production exported to the mother country. It should also be noted that the colonial administration had consequently expended substantial resources on both rural physical infrastructure, i.e. roads, drainage, irrigation, power, and on rural institutional infrastructure, i.e. agricultural research, experiment stations and farmers' associations. This permitted a substantial "green revolution" in rice (based on the ponlai variety) to occur, raising yields by 4% per year between 1921 and 1937 on Taiwan. It should be noted that the multiple cropping index already stood at the 137 level in the early 1950s

and that 33% of all households already had electricity.

With respect to non-agricultural activities, large-scale industry had been kept in the hands of the Japanese, and while the local population was not admitted into higher education, the continuing attention to primary education had permitted the local population to expand its participation in small and medium-sized industrial and service activities. It should also be noted that Taiwan's initial human capital fund was substantially enhanced by the early influx of small traders, especially after the separation from the Mainland in 1949. At that point, public sector enterprises, taken over from the Japanese, included some very large industrial activities, e.g. cement, pulp and paper, mining, which were soon divested in connection with the land reform program. The continued gradual process of privatization in industrial production on Taiwan is illustrated in Table 1a. In Korea most of the large-scale industry was located in the North, while the South was preponderantly agricultural. We therefore find less public sector industrial activity there at the outset and no evidence of a further privatization trend prior to 1972 (see Table 1b).

It should be clear that Taiwan, and to a large extent Korea, which had received somewhat less infrastructural attention during the colonial period, were inheritors of relatively favorable initial conditions on the human capital and agricultural side. In both systems substantial rural activity had been occurring in the 30s. Moreover, there were no landed or large-scale industrial vested interest groups to be overcome. This, plus the

perceived external threat from the Mainland and North Korea, respectively, gave these newly independent autocratic governments unusual freedom of action in the economic sphere.

Table 1a

Relative Importance of Private and Public Industrial Production:

Taiwan

Years	% Private	% Public
1952-61	48.66	51.34
1962-71	64.24	35.76
1972-81	80.80	19.20
1982-87	83.82	16.18

Source: Taiwan Statistical Data Book 1987, p. 89.

Table 1b

Korea

Years	% Private	% Public
1963	88.4	11.6
1964	87.4	12.6
1971	86.2	13.8
1972	86.1	13.9

Source: L.P. Jones, Public Enterprise and Economic Development, KDI, Seoul, 1975.

II. Interrelations and Performance During the Import Substitution Phase, Approximately 1953-63.

This period was characterized by the rapid growth of agricultural productivity working in a balanced fashion with

rapid increases in rural non-agricultural activity, facilitated by competitive labor markets and accommodating government policies at both the macro and institutional levels. Let me first examine the performance and then link it to features of the labor market and human capital formation story, as well as other direct dimensions of government activity.

A dynamic agricultural sector is not frequently encountered during the typical initial LDC import substitution period. Yet if there is such a thing as an early "leading sector," it clearly was agriculture, especially in the case of Taiwan. In 1952, that sector generated 33% of the net domestic product, 60% percent of total employment and 90% of Taiwan's still relatively modest exports. By 1988 these figures were 6%, 14%, and 6%, respectively, as we shall see below; but in getting from here to there, the sector had played a major historical role not only as a provider of savings, foreign exchange, and labor, but also in terms of its contribution to the encouragement of dynamic rural non-agricultural activity along the way.

Agricultural output increased by roughly 4.2% a year during the 50s on Taiwan (see Table 2), regaining pre-war levels by 1951. Even more significant is the fact that agricultural employment rose by 12% during the decade, with man-days deployed increasing by 17% and the multiple cropping index rising to 188 by 1964 (and the diversification index from 3.5 in 1952 to 5.8 in 1964). The output of traditional crops rose by about 50%, but that of non-traditional crops, especially cotton, fruit and vegetables, approximately doubled. Non-traditional crops were

much more labor intensive statically, and additionally more subject to technology change of the labor-using variety over time. Working days per hectare thus increased from 170 just after World War II to 260 in the early 60s.

Table 2
Growth Rate of Agricultural Output (%)

Years	Taiwan (annual average)	Korea (annual average)
1952-60	4.2	2.2
1960-70	4.3	4.9
1970-80	2.6	3.4
1980-89	-0.8	0.7

Sources: Taiwan Statistical Data Book: Council for Economic Planning and Development, Republic of China, 1990.
 Das, D., Korean Economic Dynamism, Paris, MacMillan, 1990.

It is interesting to note that 45% of the growth of agriculture during the 50s was attributable to total factor productivity change, largely a function of government-supported research and technology diffusion activities, focused in part on new strains of rice and sugar, but mainly on new crops, cotton, fruit, vegetables, and, during the 60s (see below), asparagus and mushrooms. Agricultural output growth in Korea was much more modest in the early period, but accelerated later (see Table 2) as the government belatedly recognized its neglect of the rural economy and sought to redress it via its "New Community Movement."

In reference to the contribution of agriculture, we should note the gap between agricultural labor productivity change (changes in the average product of labor) and agricultural wages (see Figure 1), which permitted substantial agricultural surpluses to be generated, especially in Taiwan. While labor productivity grew by 3.7% a year between 1955 and 1964 on Taiwan, the growth was more modest in Korea, i.e. 2.4%, during the same period. This is partly due to the less favorable initial conditions there, including climate and soil fertility, partly also to the less intensive infrastructural investments of the Japanese period, but also the relatively lower level of attention initially paid to rural development by the Korean government.

Taiwan's agricultural surpluses went partly into the coffers of the government via land taxes, a fertilizer-rice barter program which represented a hidden tax on agriculture, as well as armed forces procurement at below-market prices. But an increasing proportion of the agricultural surplus also found its way into rural non-agricultural activities via the substantial household savings occasioned by a combination of fast growth, the absence of any need to spend privately on education, and an interest rate reform which took place quite early (in the 50s) and provided positive incentives. It is estimated that 15-20% of total agricultural output was thus transferred in the 50s and 60s, about 10% via the hidden rice tax, 3% in the form of private savings in the 50s, rising to 12-15% in the 1960s.

Given the equal distribution of land on Taiwan, plus the shift towards increasingly labor-intensive crop mixes and

Figure 1a
Taiwan Agricultural Indices

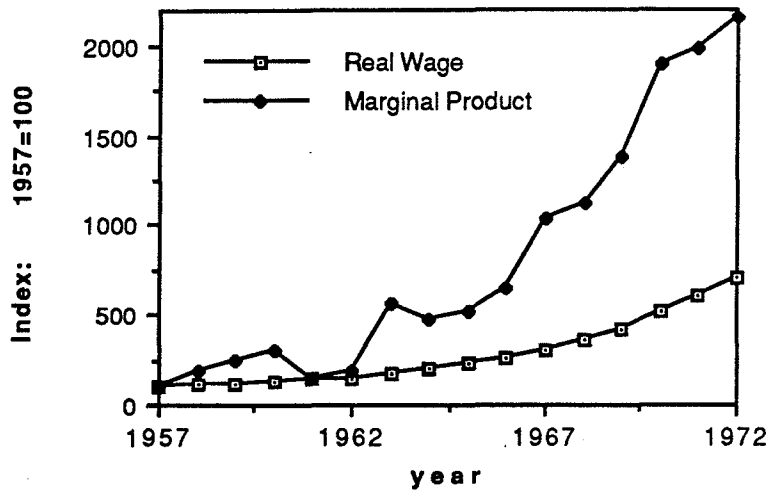
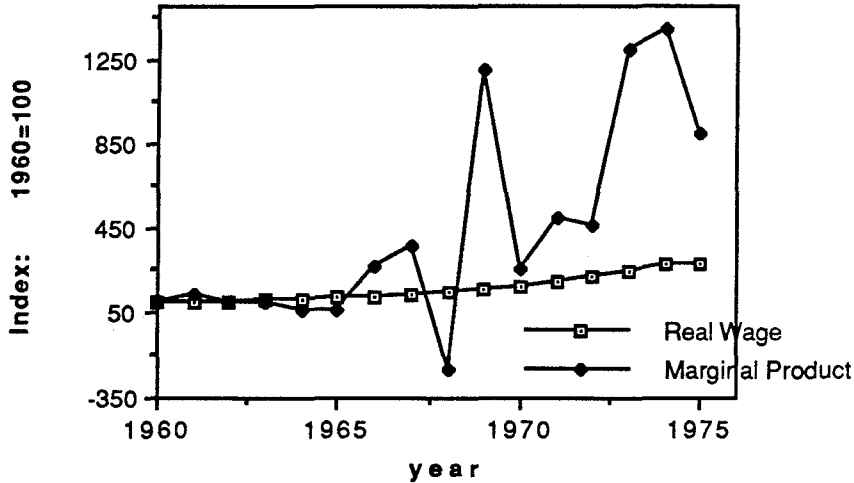


Figure 1b
Korean Agricultural Indices



Source: Das, D. Korean Economic Dynamism: Paris; MacMillan, 1990.
The Economic and Social Modernization of the Republic of Korea:
 Cambridge; Council on Asian Studies, Harvard University Press, 1980.
Major Statistics of the Korean Economy: Economic Planning Board,
 Seoul, 1978.
 U.N. Food and Statistical Office
U.N. Statistical Yearbook: Various issues, United Nations, NY.
 Kuo, S. The Taiwan Economy in Transition: Boulder; Westview Press.
Taiwan Statistical Data Book: Council for Economic Planning and
 Development; Republic of China, 1990.

technologies, the demand for non-agricultural products was increasingly directed towards the small and medium-scale (S&M) enterprises located largely in the rural areas, thus strengthening the mutual linkages between agricultural and non-agricultural productivity change. This is less true for Korea, where agriculture was less dynamic and industrialization substantially more urban-oriented and concentrated. This early and continuing relative preponderance of medium and small-scale firms in Taiwan has been much commented upon. It clearly represents a central feature of the landscape, helping to explain the multi-dimensional success of the system in terms of growth, employment generation and equity.

The facts are unambiguously clear: in employment terms there occurred a remarkable shift in the allocation of rural household labor from agricultural to rural non-agricultural activities over time, i.e. the latter constituting 29% of the total in 1956, 47% in 1966, and 67% in 1980. In income terms, the proportion of income earned outside of agriculture by rural households rose from 25% in 1962 to 43% in 1975, and a whopping 60% in 1980. Taiwan's industrialization pattern thus clearly avoided the customary relative (sometimes absolute) decline in post-colonial rural non-agricultural activities, which indicates that they were not unfairly competed out of existence by protected urban industry and services.

An increasingly egalitarian agricultural income distribution, partly resulting from land reform, partly from the increasingly labor intensive agricultural output mix (see below,

Tables 7 and 8), was helpful. Rural income Ginis, estimated above .5 in 1950, declined to .31 in 1964, permitting substantial forward consumption linkages in the direction of domestic S&M and appropriate goods activities. This simultaneously encouraged reverse or backward linkages of the modern inputs variety as well as via the enhanced willingness of agriculturalists to take risks in response to new non-agricultural investment opportunities. The strength of the forward linkages can be demonstrated by noting that household surveys show that consumers in 1964 spent approximately 70% of their total on food, beverages, tobacco, footwear and clothing. If we match that up with the employment distribution in Taiwan at that time, we note that the percentages of those employed in establishments of less than 10 workers comprised 46% in the food and beverage industry, 64% in clothing, 62% in leather and 90% in furniture, implying strong demand for the products of small establishments, most of which can be assumed to be rural. With respect to the simple version of the backward linkages story, in the farm machinery industry, for example, over 40% of Taiwan's production took place in small firms, very much a function of the fact that agricultural technology was 80% focussed on small power tillers, again very unusual by LDC standards in this phase. It is thus clear that both the forward and backward linkages were directed towards the creation of domestic niche markets, in terms of modern inputs as well as the pattern of consumption.

While Taiwan's agricultural output grew at approximately 4% on average during the 50s, non-agricultural output increased at

the rate of about 12% (see Table 3). Korea's non-agricultural growth was not very different, but more of it was urban and financed by a combination of industrial reinvestment and foreign capital. Moreover, while exports began to play an increasing role in both systems, it should be noted that in Taiwan, for example, 60% of overall growth between the early 50s and mid-60s was still domestically oriented, a fact which is often overlooked when the East Asian experience is cited. During a relatively mild import-substitution phase, the close contact between agriculture and rural industry and services permitted mutually reinforcing productivity changes to take place.

Table 3

Growth Rate of Non-Agricultural Output (%)

Years	Taiwan (average)	Korea (average)
1952-60	11.7	9.7
1960-70	18.5	17.6
1970-80	12.9	19.2
1980-89	9.8	6.4

Sources: Das, D., Korean Economic Dynamism. Paris, MacMillan, 1990.

Taiwan Statistical Data Book, Council for Economic Planning and Development, Republic of China, 1990.

Non-agricultural wage rates, tied to agricultural wages, but at a modest margin, remained relatively stable throughout the 50s and 60s (see Figure 2), especially if we focus our attention on unskilled wages (instead of average wages, which distorts the picture considerably by incorporating marked changes in the skill

Figure 2a

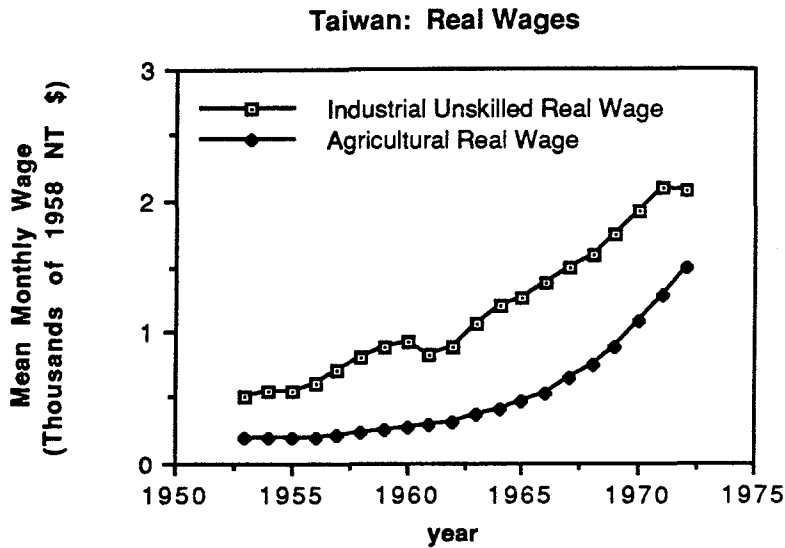


Figure 2b



Source: Kuo, S. The Taiwan Economy in Transition: Boulder; Westview Press. Taiwan Statistical Data Book: Council for Economic Planning and Development; Republic of China, 1990.
Das, D. Korean Economic Dynamism: Paris; MacMillan, 1990.
The Economic and Social Modernization of the Republic of Korea: Cambridge; Council on Asian Studies, Harvard University Press, 1980.
Major Statistics of the Korean Economy: Economic Planning Board; Seoul, Korea, 1978.

mix). Thus, with labor productivity rising in both agriculture and non-agriculture, but unskilled wages rising only modestly in both sectors, substantial margins remained available for both agricultural and non-agricultural savings and reinvestment. Nevertheless, mainly due to the effect of employment increases, the non-agricultural wage bill did not decline, in spite of the fact that the ample supply of labor kept wages from rising very much. Indeed, even during the 50s and early 60s, non-agricultural employment in Taiwan rose by more than 3% per year. The fact that the relative share of labor remained virtually constant permitted the overall size distribution of income to improve, largely because of the improvement in the distribution of agricultural income, following land reforms, plus the marked changes in the composition of agricultural output in the direction of greater labor intensity. Moreover, even in the 50s and early 60s, and yet more clearly in the later period, as we shall see, private savings, generated by households and small businesses, contributed substantially to the high and rising national savings rate (see Table 4). The contrast with Korea's substantially lower domestic savings rate and consequently greater reliance on foreign savings is marked.

It should also be noted (see Figure 3) that the gap between non-agricultural skilled and unskilled real wages was relatively modest by most LDC, especially Latin American and African, standards. There is no evidence of any government intervention, via minimum wage legislation or otherwise, even during this period of ISI. The skilled/unskilled gap seemed to decline in

the early 70s, once unskilled labor surplus began to give way to labor shortage.

Table 4a

Savings Rate and Composition: Taiwan

Year	Gross Domestic Savings Rate (S/GNP)	% Contribution		
		Private Sector	General Gov't	Pub. Enterprise
1952	15.3	50.93	35.58	13.49
1960	17.8	54.72	22.45	22.83
1965	20.7	69.55	12.64	17.80
1970	25.6	68.03	13.94	18.02
1980	32.3	60.35	24.49	15.16
1985	32.6	65.61	16.81	17.58
1988	34.9	64.22	22.76	13.02

Sources: DGBAS; Taiwan Statistical Data Book, Council for Economic Planning and Development, Rep. of China, 1989.

Table 4b

Korea

Year	Gross Domestic Savings Rate (S/GNP)	% Contribution	
		Private Sector	Public Sector
1945	4.63	92.27	7.73
1960	6.79	63.90	36.10
1965	7.40	76.78	23.22
1970	17.30	62.37	37.63
1975	19.10	78.48	21.52
1980	21.90	68.94	31.06
1984	27.40	76.14	23.86
1988	30.0 ^a	n.a.	n.a.

^a as % of GDP

Sources: Economic Statistics Yearbook, Bank of Korea, Seoul, 1990; National Income Accounts Statistics Yearbook, United Nations, N.Y. (various years).

Figure 3a

Taiwan Industrial Wage Gap

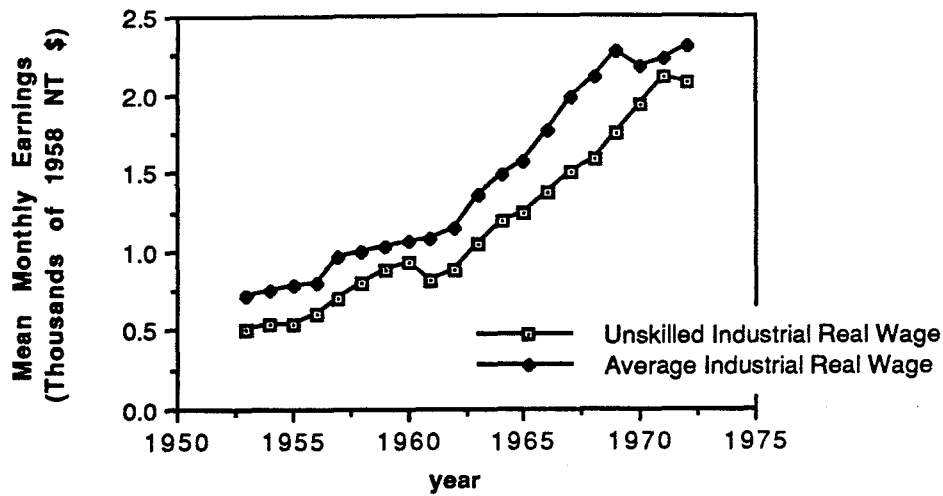
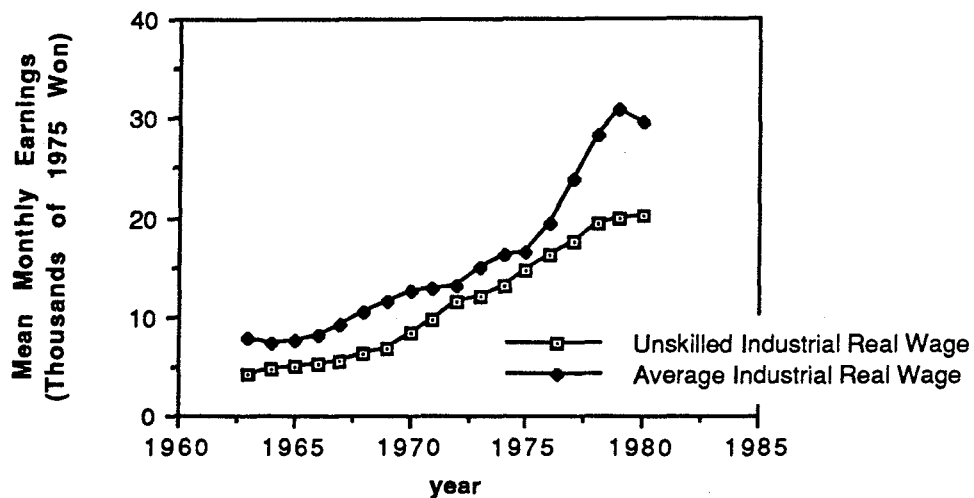


Figure 3b

Korea Industrial Wage Gap



Source: Kuo, S. The Taiwan Economy in Transition: Boulder; Westview Press, 1983.
Taiwan Statistical Data Book: Council for Economic Planning and Development; Republic of China, 1990.
1988 Statistical Yearbook of the Republic of China: Directorate-General of Budget, Accounting, and Statistics; Republic of China.
Major Statistics of the Korean Economy: Economic Planning Board, Seoul, 1978.
Kim, C. 'Labor Market Development' in Kwon (ed.) Korean Economic Development: New York; Greenwood, 1990.

Government policies during East Asia's relatively mild import substitution phase not only moved the systems towards higher real interest rates, breaking the back of inflation with the help of foreign aid inflows -- especially from the United States -- but also began to gradually open these economies to foreign investment and to replace quantitative controls by tariffs. As early as 1956, a customs duty rebate system for exports was instituted on Taiwan, followed by foreign exchange reforms, i.e. a major devaluation followed by unification and maintenance of a relatively realistic exchange rate regime after 1960. The four large government enterprises -- cement, paper, forestry and mining -- were transferred to private ownership by 1954 as part of the compensation to landlords under the land reform program, with the policy of assigning to the private sector the principal role in industrial development affirmed as early as 1962. By the early 60s, the so-called 19 points of macro-economic reform had substantially liberalized Taiwan's economy, facilitating entry into the next, export-oriented phase of development. A similar package of macro-economic reforms was introduced in Korea, if generally a few years later.

Referring once again to direct actions by government, it should be noted that Taiwan and, once again to a lesser extent, Korea continued to build on the favorable rural infrastructure left by the Japanese colonial period. This is demonstrated by the fact that Taiwan's rural road network was further extended (it was 2 1/2 times as dense as that of the Philippines by 1976) and substantially paved (twice as much as that of the

Philippines). We may also note that access to electricity, especially in the rural areas, which is critical for decentralized industrial growth, climbed rapidly, as did communications and the provision of simple amenities. This is well illustrated in Table 5.

Table 5

Infrastructure: Taiwan

	% Households with Electricity	% Households with Telephones	% Households with Piped Water
1952	33	2	14.4
1979	99.7	71.1	63.8

Source: Statistical Abstracts of Transport and Communication.

The differential post-independence treatment of the institutional structure left behind by the Japanese in the rural areas of our two East Asian cases is both important and instructive. In Taiwan, the JCRR (Joint Commission on Rural Reconstruction) was reorganized to provide for a "bottoms up" relationship with the farmers' associations, while the same associations were used for "top down" instruction and taxation in Korea. This is one of the reasons we believe there resulted not only the referenced differential performance of agriculture in the two cases, but also a very differential pattern of non-agricultural growth.

In Taiwan, most farmers' associations were focussed on agricultural production, some specifically concerned with irrigation, others with fishing. In addition to providing all-

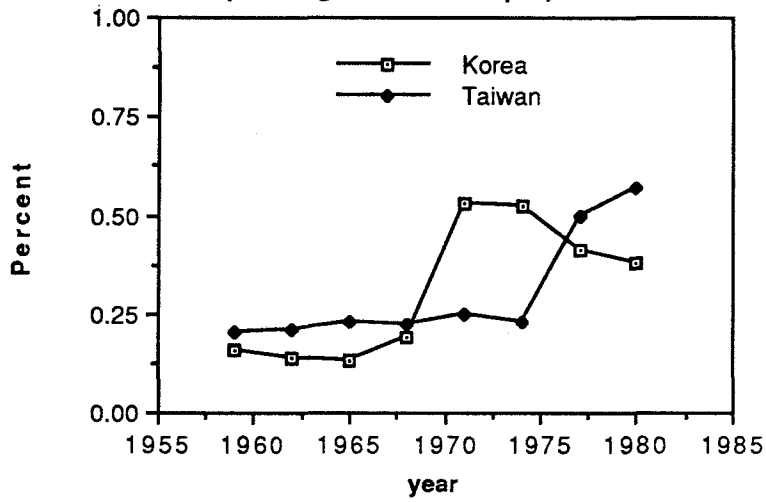
important research and extension, the JCRR featured assistance with purchasing, marketing, warehousing, and processing. By 1964 the multiple cropping index stood at 188 and the diversification index had almost doubled. While the JCRR at the center provided overhead funding and services, priorities were set by the farmers' associations at three levels: provincial, county and township. Farmers' associations organized cooperative banks, with farmers depositing their own savings and receiving loans for production and marketing. The JCRR provided information and technical assistance as well with respect to rural non-agricultural activities, especially food processing. Agricultural processing, including for export, constituted the fastest growing non-agricultural activity by the end of this sub-phase.

Korea, starting with a lower initial base, relatively neglected its agricultural sector during the 50s and early 60s both in the resources and institutional sense. It later, however, began to recognize its mistake and to attempt to repair the damage in the 70s via institutional reforms (New Community Movement) as well as increased research attention (see Figure A for comparative trends in the two countries). As a consequence total factor productivity in agriculture grew at 4.7% annually in the 70-77 period, compared to 1.4% between 1954 and 1965.¹

¹ The differential agricultural output growth figures over time were presented above (in Table 2). The relative contribution of total factor productivity in Taiwan was 49% between 1957 and 1967 and 18% between 1973 and 1977. In Korea, on the other hand, the relative contribution of total factor productivity was 36% in 1954-65 and 86% in 1970-77. (Agricultural Development in Chian, Japan and Korea, Hou Chi-Ming and Tzung-Shin Yu, editors, Academia Sinica, Taipei, Taiwan, R.O.C.)

Figure A

Agricultural Research Expenditure
(% of Agricultural Output)



The absence of official intervention in East Asian labor markets, so frequently encountered elsewhere, either through minimum wage legislation or government-sponsored unionization, may be seen as an important contributor to the development process -- even during this relatively interventionist import substitution period. What is sometimes referred to as "repressed" labor markets really constituted an unwillingness by government to create an elite organized labor force at the expense of foregone employment opportunities as long as substantial underemployment existed. The fact that wage bills held steady or increased, while wage rates continued to reflect the underlying endowment during the 50s as well as the 60s, contributed to -- rather than hurt -- the relative position of East Asia's working families.

As far as human capital formation is concerned, the emphasis in both countries during this period continued to be mainly on improving literacy via the pursuit of compulsory universal primary education, as Table 6 indicates. Total enrollment rates rose especially fast between 1953 and 1965, faster for women than for men. It is worthy of note, however, that Taiwan clearly had a substantial advantage early and held it over time.

In summary, given East Asia's relatively mild import substitution phase, agriculture behaved unusually well, especially in Taiwan. More remarkable was the very active balanced rural growth process already in evidence, given the still somewhat distorted overall macroeconomic setting prior to the major liberalization package adopted in the early 60s.

In making these policy changes, Taiwan was undoubtedly assisted, in the political economy sense, by the 1961 announcement that the U.S. intended to terminate its foreign aid program by 1965. Thus, a combination of an intrinsic natural resource poverty and the announcement of the end of economic aid by its major foreign donor undoubtedly helped focus the minds of Taiwan's policy-makers and induced the economy to shift relatively smoothly towards the export-oriented phase beginning in the early 60s.

In Korea, this macro policy shift took place a little later. The aftermath of the Korean War and the continued confrontation between the South and North, plus the fact that the U.S. economic presence, including U.S. troops, remained a feature of the landscape, probably reduced the pressure on the Koreans to undertake similarly thorough-going reforms. Certainly it led to a greater relative willingness early on to neglect agriculture and the rural sector generally and to instead concentrate more on bestowing favors on partly foreign-financed large-scale urban industry. However, certainly by comparative LDC standards, both these East Asian systems were eminently successful in making this politically difficult transition; both had clearly moved into a vigorous labor-intensive industrial export phase by the mid-60s, a subject to which we now turn.

Table 6a

Population by Levels of Education
(At and Over the Age of Six)

Taiwan

End of Year	% of Population				
	Higher Education	Secondary Education	Primary Education	Others	Illiterate
1952	1.4	8.8	43.5	4.2	42.1
1960	1.9	12.4	54.1	4.5	27.1
1966	2.5	15.8	54.8	3.8	23.1
1970	3.7	26.5	51.8	3.3	14.7
1974	4.8	29.1	49.9	2.9	13.3
1980	7.1	36.9	43.3	2.4	10.3
1988	10.1	44.2	37.0	1.3	7.4

Source: MOI.

Table 6b

Population by Levels of Education
(At and Over the Age of Six)

Korea

End of Year	% of Population			
	Higher Education	Secondary Education	Primary Education	Illiterate
1944	0.3	1.7	11.3	86.7
1960	2.6	17.5	36.2	43.7
1966	4.5	24.7	40.0	30.8
1970	5.6	31.8	39.2	23.4
1974	5.7	38.0	36.0	20.3

Source: McGinn et al., Education and Development in Korea, Cambridge: Harvard University Press, 1980.

III. Interrelations and Performance During the Labor-Intensive Export Substitution Phase, Approximately 1963-72.

The decade of the 60s was a period of the most rapid overall growth in East Asia, particularly Taiwan. Agricultural output increased at an average rate of 4.3% (see Table 2), and labor productivity rose even faster, with the total agricultural labor force beginning to decline absolutely after 1965. Most of the agricultural output increase came through increased yields at the intensive margin, as a consequence of a new burst in agricultural research and the shift to such new crops as mushrooms and asparagus, already referred to. The resulting dramatic changes in the composition of agricultural output as well as in its accompanying labor intensity are illustrated in Tables 7 and 8.

Table 7

Agricultural Output Composition (%): Taiwan

	Rice	Other Traditional Crops	Non-Traditional Crops
1960	57.0	15.8	27.3
1970	45.0	12.9	37.1
1980	41.8	7.4	51.0
1988	27.1	7.9	65.0

Source: Y.K. Mao and C. Schive, "Agricultural and Industrial Development of the Republic of China," processed (Table 2.6).

Table 8

Agricultural Labor Utilization (Days/Ha): Taiwan

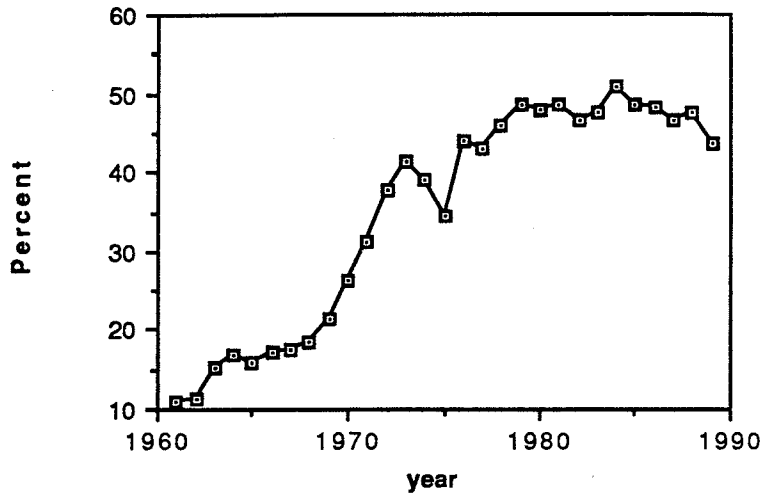
	Rice	Other Traditional Crops	Mushrooms	Asparagus
1970	206	131	270	730

Source: Taiwan Agricultural Council.

Meanwhile non-agricultural output boomed in both countries (see Table 3) and the rate of increase of non-agricultural employment doubled. The role of agricultural savings in helping to finance this rapid expansion of non-agricultural output remained important, especially in the early years of the decade. It is estimated that on the average 15-20% of Taiwan's agricultural output was transferred as agricultural surplus to non-agriculture during this period. Agriculture thus continued to be a major asset to the growth of the economy. But by 1972 its contribution to GNP had fallen from 36% in 1952 to 14%, and its contribution to employment from 56% in 1952 to 33%. Manufacturing had increased from 11% in 1952 to 32% in terms of output, and from 12% to 25% in terms of employment.

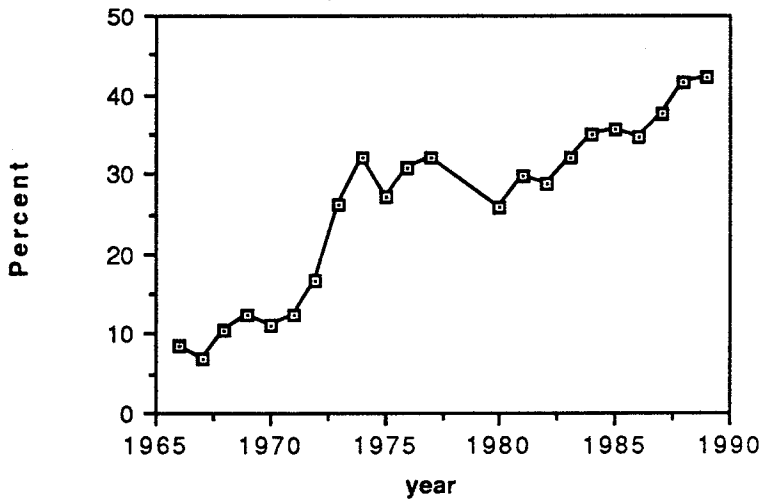
This was clearly the decade when industrialization, now increasingly export-oriented, concentrating first in agriculturally processed goods and later in labor-intensive commodities based on imported raw materials, began to soar. The 1960s indeed embody the best example of a mutually reinforcing relationship between the two blades of Taiwan's development: domestic balanced growth, on the one hand, and labor intensive industrial exports, on the other. Figure 4 shows the rapid growth in the overall export orientation of both systems at a time when GDP itself was rising at 8% per year. Table 9 provides evidence of the dramatic change in the composition of these rapidly growing exports, from about 90% agricultural to 85% non-agricultural in the course of a mere decade.

Figure 4a
Taiwan Export Orientation
 (% of GNP)



Source: Taiwan Statistical Data Book: Council for Economic Planning and Development; Republic of China, 1990.

Figure 4b
Korea Export Orientation
 (% of GNP)



Source: Major Statistics of the Korean Economy: Economic Planning Board; Seoul, Korea, 1978.
Monthly Statistics of Korea: National Bureau of Statistics; Economic Planning Board, 1979.
U.N. Statistical Yearbook, various issues., United Nations.
Statistical Yearbook of Foreign Trade: Office of Customs Administration, Republic of Korea, 1980.

Table 9a

Composition of Exports in Taiwan

Year	Agricultural and Processed Agricultural Products	Industrial Products
1952	91.9	8.1
1960	67.7	32.3
1965	54.0	46.0
1970	21.4	78.6
1975	16.4	83.6
1980	9.2	90.8
1985	6.2	93.8
1988	5.5	94.5

Sources: MOF;
Taiwan Statistical Data Book.

Table 9b

Composition of Exports in Korea

Year	Agricultural and Processed Agricultural Products	Industrial Products
1959	87.5	12.5
1960	85.8	14.2
1965	38.9	61.1
1970	22.6	77.4
1975	18.3	81.7
1980	9.5	95.5
1985	8.2	91.8
1988	6.2	93.8

Sources: MOF;
Office of Customs Administration;
The Bank of Korea -- Economic Statistics Yearbook,
Various Years

Taiwan's industrial sector labor absorption, which had been at a 3% annual level in the 50s, approximately doubled to more than 6% in the 60s. It should be noted, however, that much of this so-called "migration" consisted of people not actually leaving the rural household, but continuing to work in surrounding areas or even by commuting to export-processing zones. Only 17% of the so-called "migrants" actually left the rural areas in 1963 and, even as late as 1968, only 26% of newly absorbed industrial workers had actually physically migrated.

This feature once again underlines the continued remarkable expansion, not only absolutely but even relatively, of rural industry and services. As Table 10 shows, the percentage distribution of employed persons by locality actually shifted in favor of the rural areas in both manufacturing and services between 1956 and 1966, a quite remarkable phenomenon.

This booming non-agricultural activity, still heavily rural but increasingly export-oriented, was facilitated by such policy inducements as the streamlining of previously established tariff rebates for exports (in lieu of fuller import liberalization) as well as the construction of several export processing zones in the mid-60s, supplemented by bonded factories, away from the port cities, increasingly dotting the landscape. If one accepts the recent Lucas theoretical comment on Taiwan's success², this rapid change in East Asian exports and export composition would seem to be one way in which an accelerated learning-by-doing process on the human capital side took place.

² Making a Miracle, August, 1992, processed.

Table 10

Distribution of Employed Persons by Locality (%) :
Taiwan

	1956			1966		
	Cities	Towns	Rural	Cities	Towns	Rural
Manufacturing	42.68	10.06	47.26	37.02	10.80	52.18
Food	24.11	8.51	67.38	23.50	9.83	66.67
Textile and Apparel	34.10	14.40	51.50	27.87	13.65	58.48
Production of wood, stalk, bamboo	31.29	8.16	60.55	40.06	6.63	53.31
Furniture and fixtures	32.00	9.71	58.29	32.07	9.28	58.65
Chemicals	57.53	9.86	32.79	42.48	10.92	46.60
Nonmetallic products	31.84	6.70	61.46	25.85	6.12	68.03
Metal products	52.32	12.58	35.10	49.90	12.37	37.73
Machinery & equipment	62.60	8.66	28.74	54.94	6.10	38.96
Transport equipment	60.32	5.82	33.86	48.58	7.55	43.87
Others	57.10	9.27	33.63	42.90	12.50	44.60
Construction	44.84	11.45	43.71	43.92	12.27	43.81
Utilities	51.30	9.74	38.96	47.25	9.89	42.86
Commerce	44.36	9.98	45.66	42.34	10.56	47.10
Trade	42.77	9.92	47.30	38.78	10.83	50.39
Bank, insurance, etc.	65.47	10.79	23.74	65.12	8.83	26.05
Transport & communication	54.27	8.92	36.81	50.74	9.50	39.76
Services	41.16	9.73	49.11	34.44	9.38	56.17
Public service*	50.27	10.45	39.28	32.63	9.97	57.41
Education	36.81	8.79	54.40	36.53	9.50	53.98
Personal service	34.06	9.76	56.18	33.14	7.88	58.98
Others	39.85	8.89	51.26	43.48	8.86	47.67

* In 1956, excludes military personnel living on military bases.

Source: Table 4 in Samuel P.S. Ho, "The Rural Non-Farm Sector in Taiwan," World Bank Studies in Employment and Rural Development, no. 32 (Washington, D.C., September 1976). Underlying data from the 1956 and 1966 population censuses. Cities includes the seven largest Cities; Towns, the nine largest towns; Rural, the rest.

What rendered rapid growth consistent with the continued equitable distribution of income during the 60s were two major factors already at play in the 50s and continuing to assume an important role. One was that the poorest, i.e. the smallest,

farmers continued to participate more than proportionally in the economy's booming rural industrial and service activities. Second was that these rural industries and services were extremely labor-intensive and increasingly so, especially in the mid-60s when food processing played a prominent role. As a consequence, the Kuznets-Arthur Lewis prediction that during a period of labor surplus the profit share would have to rise and the labor share fall, and that the size distribution of income would therefore worsen, was not borne out. Employment increases made up for the continued low level of unskilled industrial wages and permitted the Gini Coefficient to remain in the .29 range throughout this period of very rapid growth. Counter to the usual assumptions, the shift that took place was not from an egalitarian agricultural sector to a non-egalitarian non-agricultural sector, but from an increasingly egalitarian agricultural sector to an even more egalitarian non-agricultural sector.

The situation in Korea was not quite as favorable, because, as has already been pointed out, its non-agricultural sector was more urban-oriented, large-scale, capital-intensive, and increasingly so at the margin; the fact that its agricultural sector was not able to contribute as much and foreign capital consequently had to be more heavily relied on was not irrelevant to the outcome. Thus, while Korea still figures prominently as one of the relative success cases in terms of development performance, including income distribution, its Gini levels were substantially higher, in the .35 range, during the 60s and early

70s, and did not improve over the period.

Savings rates in both East Asian countries rose substantially during the 60s (see above, Table 4), with the contribution of the private sector predominant, especially via household savings and the reinvestment by the medium and small-scale entrepreneurs of Taiwan. One of the reasons for the somewhat lower domestic savings rate and the greater reliance on foreign savings in Korea is that, having been less successful in mobilizing agriculture, she early on had to resort to food imports. However, the fact that the government, including its public enterprises, contributed substantially to overall national savings in both countries is itself quite remarkable in the light of general LDC experience.

Let me now turn from the above description of the actual performance of the East Asian case during this phase of the transition to the role of government policy in various dimensions. The important contribution of the JCRR at the center, working with various types of decentralized farmers' associations and providing major institutional support for agricultural productivity increase, as well as related rural non-agricultural activities, has already been referred to. As a semi-public, semi-autonomous agency of government, the JCRR was isolated from daily political pressures, able to respond to local needs in research, extension, credit and marketing, at provincial, county and township levels. Experiment stations funded by the JCRR continued to work on new seeds and non-traditional crops, encouraging changes in the agricultural output

mix. The JCRR-farmers' association network simultaneously served the needs of agricultural extension, provided purchasing, marketing, warehousing and processing information and facilities, as well as, importantly, cooperative banking. This last feature is especially interesting because through it substantial rural private savings were channeled from agricultural into non-agricultural activities, with farmers depositing their own surpluses locally, rather than waiting for subsidized credit lines from above, the typical procedure in most developing countries. Both production and longer-term loans were made without reference to collateral but on a cooperatively guaranteed, Grameen Bank-like basis. Other banks were also able to channel their loans through the cooperative bank wings of farmers' associations.

The Taiwan Government continued to build on the initial conditions already referred to via power, transport, communications, rail- and highway construction throughout the island. Such infrastructure was not directed to the support of particular regions or industries, but there seems to have been a conscious effort to continue to be even-handed, by permitting a decentralized government structure, working largely through the farmers' associations, to pinpoint priorities for the allocation of resources. Rural and urban electricity rates continued to be maintained at parity, so that the power system, while not subsidized overall, engaged in inter-sectoral cross-subsidization. It should, moreover, be noted that, in 1960, the government initiated the setting up of industrial districts,

providing infrastructure and overhead facilities to encourage decentralized industrial activities. By 1986, there were 88 such industrial districts in operation.

We have already referred to the import duty rebate for exports, started in the 50s, and the export processing zones, begun in the mid-60s, as helpful transition devices for economies moving from a domestic to an external orientation. Such devices proved especially helpful in the electronics and other light assembly industries which were part of the rapid output and employment generation spurt of the 1960s. The zones provided no more than 1% of total employment and 3% of investment, but 6% of exports over the years. More importantly, they permitted entrepreneurs to put their feet into competitive waters while the domestic economy continued substantially protected. Gradually, as competence grew, additional forward or finishing stages could be and were added, intermediate inputs procured and sales made into the domestic economy, with the necessary adjustments made in terms of the customary tariff waivers etc. Finally, once labor surplus had come to an end in the late 60s and early 70s, the zones' historical mission had been completed and they began to atrophy, with firms gradually moving out. Thus, in a number of ways beyond the accommodating shift in macro-policies, the government provided specific direct institutional support permitting Taiwan to explore rural niche markets at home and growing competitive markets abroad.

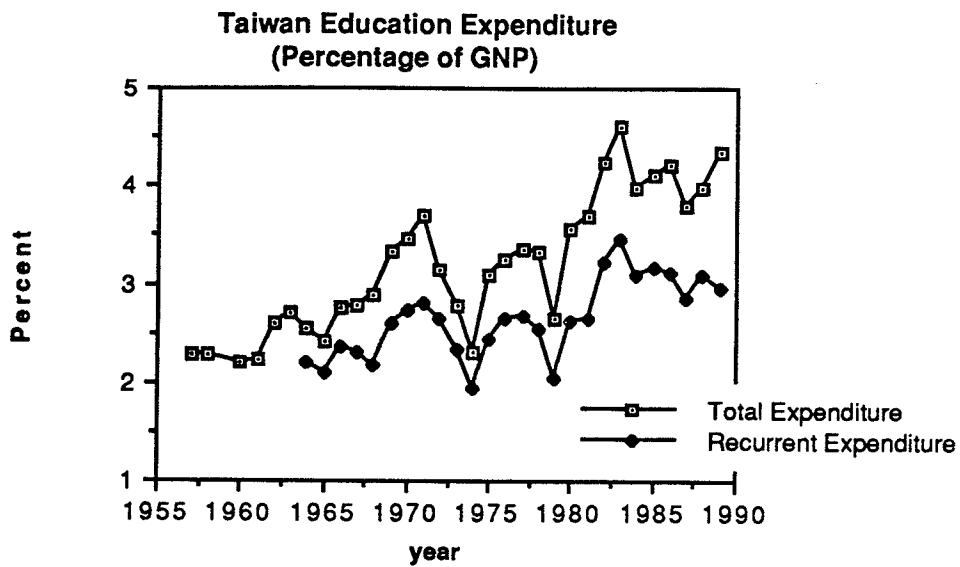
Let me turn now to the human capital, technology, as well as the labor market dimensions of the story, areas in which both

additional government feasance and non-feasance made signal contributions. As was already pointed out, Taiwan's unusually decentralized industrialization effort was initially assisted by the presence of a substantial number of small traders and supported by the continued emphasis on compulsory primary education. As the economy moved through the 60s and the industrial output mix change accelerated, the state's educational emphasis also shifted.

Overall, expenditures on education in Taiwan rose from 2.1% of GNP (11% of the budget) in 1955 to 4.6% (20% of the budget) in 1970. In Korea they rose from 1.7% of GNP in 1965 to 3.5% in 1970. Moreover, it is interesting to note that the East Asian countries not only spent an increasing percentage of their GNP but also allocated a much higher proportion to recurring rather than non-recurring expenditures than is customary in the typical developing country context (see Figure 8). This is illuminating, indicating how much of the effort was directed at the quality of what is going on within the schools, rather than on the size of the educational plant and the expansion of physical facilities. From the very beginning, these governments seem to have understood the importance of human capital in support of the economy. But what is even more interesting is their flexibility in shifting the emphasis of the educational structure over time as the demands of the economy changed.

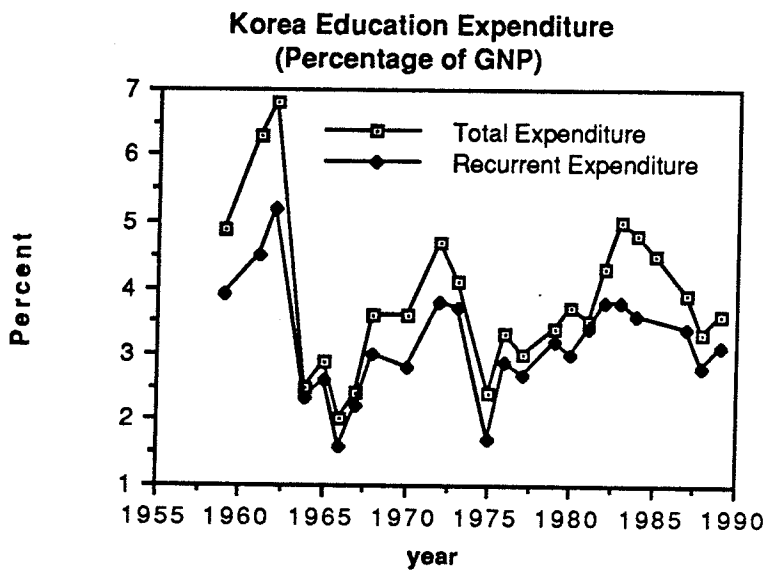
At the outset, literacy and general numeracy objectives seem to have been uppermost. In Taiwan, the six years of compulsory primary education were extended to 9 years in 1968, just when the

Figure 8a



Source: 1990 Statistical Yearbook of the Republic of China: Director-General of Budget, Accounting, and Statistics, Republic of China.

Figure 8b



Source: UNESCO Statistical Yearbook, various issues, 1964-90. United Nations, NY.

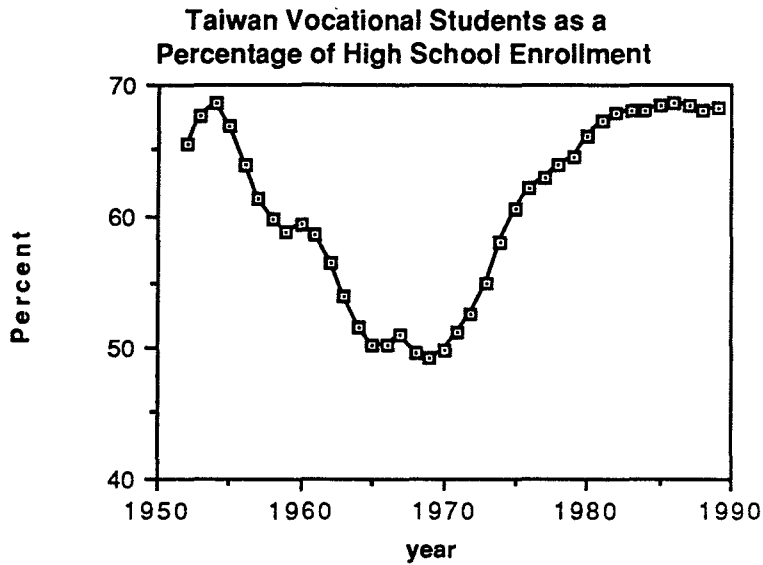
first signs of unskilled labor scarcity, indexed by the rise in unskilled real wages, began to appear. We may also note a sharp increase in female participation rates after 1967. This turning point coincided as well with a much increased emphasis given to vocational relative to academic training at the secondary level. Such training increased six-fold between 1966 and 1974, during a time when the non-agricultural labor force increased by 80%. While 40% of Taiwan's high-school students were in the vocational track in 1963, by 1972 the percentage was 52% and by 1980 almost two-thirds (see Figure 5). It is interesting to note that this pattern is much less pronounced in Korea, both in terms of level and trend over time.

Vocational education in Taiwan was administered approximately half by private enterprises and half by government agencies.³ The government influenced the number and growth of academic relative to vocational and technical high schools by using differential tuition as a carrot. In the vocational schools, agriculture, commerce and the industrial arts were combined. It should be emphasized that the vocational education structure was highly diversified, kept flexible and responsive to changing demands.

At the outset, Taiwan and Korea clearly could call on an efficient but cheap unskilled labor force, an extremely important ingredient in any competitive, export-oriented development

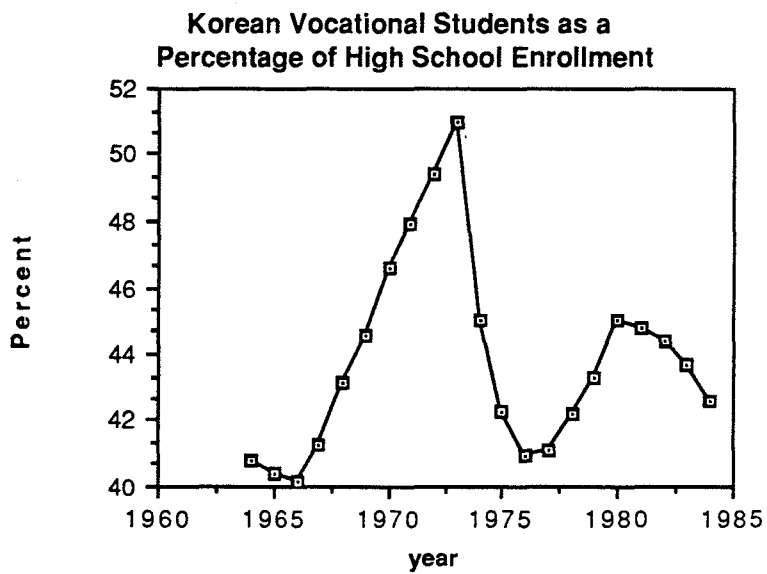
³ Forty-two government agencies and eighty public enterprises providing vocational education, 133 private enterprises providing in-house training, 78 universities as well as 229 private organizations offering relatively short (4-12 weeks) courses.

Figure 5a



Source: Taiwan Statistical Data Book; Council for Economic Planning and Development; Republic of China, 1990.

Figure 5b



Source: Major Statistics of the Korean Economy; Economic Planning Board, Seoul. (various editions)

process. Taiwan's primary enrollment rates for the ages 16-24 rose from 40% in '53/'54 to 60% by the early 70s, even faster for women than for men, the average number of years of schooling for those over 15 rising from 2.8 to 6.9. Very similar figures could be cited for Korea.

Education as a public sector responsibility represents a very strong cultural tradition in East Asia. Even as private sector schooling above the primary level, i.e. high school and above, increased in relative quantitative importance (from 10% in 1950 to 60% in 1980), the best students continued to be trained in the public institutions where the quality was clearly higher. Expenditures per student are 2.5 times those of private schools and the teacher-student ratio at the national university level is 12:1 compared to 29:1 in private universities. Students pay only 50% of the costs even in private schools, the government picking up the rest, while they pay only 7% of total costs in public high schools and universities. Throughout the public system, competitive examinations, rather than the ability to pay or family connection, determine entry, part of the cultural heritage derived from the Imperial Examinations System of traditional China.

As far as the labor market is concerned, as indicated above, agricultural wages continued to lag considerably behind agricultural productivity increase, thus setting the base line for unskilled labor remuneration in the system, as long as the labor surplus persisted. Unskilled non-agricultural wages continued at a reasonably small margin above agricultural wages

(see Figure 3), while the relative price of unskilled workers rose with the end of labor surplus and squeezed the skilled/unskilled wage gap, which had never been high (see Figure 4). The latter differential on Taiwan was about 20% in 1953, perhaps 30% in the mid-60s, and once again 20% in 1970, extremely low by international LDC standards.

The usual interventions in non-agricultural labor markets, i.e. minimum wage legislation and labor unions, accounted for very little in both Taiwan and Korea until very recently. There were as many as 2000 labor unions in Taiwan, covering about 20% of the non-agricultural labor force. But unions have concentrated heavily on working conditions, not collective bargaining, with strikes either illegal or frowned upon and work stoppages still rather rare. The small impact of unionization on labor market conditions -- at least until very recently -- is demonstrated by the fact that the percentage of the non-agricultural labor force unionized in Taiwan was consistently larger than that in Korea (see Figure 6), even though unions have to date played a substantially larger political role in Korea. Minimum wage legislation in Taiwan has been on the books since 1956, but these wages have been consistently below actual wages, usually at 40-60% of the average manufacturing wage, and have not been relevant, even for unskilled labor, at any time in East Asia's development history. In both Korea and Taiwan, wages across different skill levels seem to converge more as a result of supply-side changes brought about by education and increased access, thus reducing educational inequality, rather than as a

Figure 6a

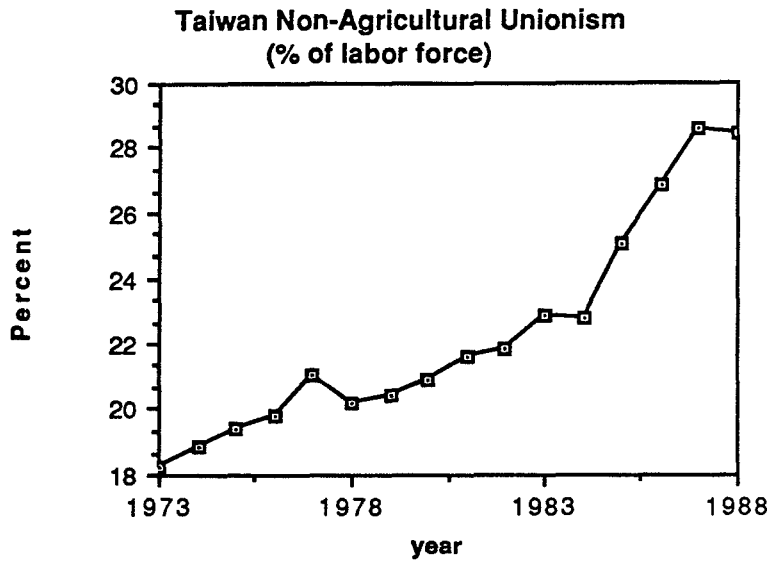
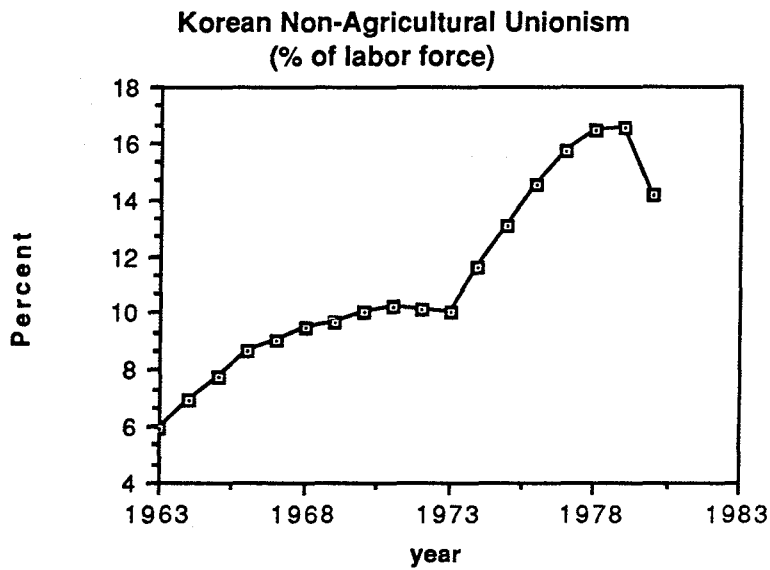


Figure 6b



Source: Michell, T. From a Developing to a Newly Industrialised Country: The Republic of Korea, 1961-1982: Geneva; International Labour Office, 1985.
Taiwan Statistical Data Book: Council for Economic Planning and Development; Republic of China, 1990.

consequence of changes in the industrial structure on the demand side.

The overall economic record is thus quite clear: it was during this decade that rapid growth, heavily supported initially by agriculture, then gradually shifting towards labor-intensive industrial exports, resulted in rapid employment generation and continued favorable income distribution results. Savings and growth rates soared in both countries and total factor productivity increased in importance as both economies, but especially Taiwan, became ever more competitive.

This second phase can be characterized by a huge explosion in the importance of exports, a dramatic shift in export composition, as well as the very rapid absorption of the labor force in non-agricultural activities, with a surprisingly large proportion located in the rural sector. Output mix and technologies continued to favor the absorption of a relatively unskilled, if highly literate and therefore high-quality, labor force. Ultimately, by the early 70s, Taiwan had exhausted her unskilled labor surplus, as is demonstrated by the fact that unskilled real wages, which had been rising gently up to that point, began to rise sharply. Given the continued flexibly competitive labor markets, maximum labor absorption took place. Increased participation rates plus offshore (South-East Asian) sourcing and some (largely illegal) immigration of South-East Asian workers could not postpone the advent of labor shortage.

IV. The Technology Era -- The Mid-70s, 80s, and Beyond.

At least three outstanding phenomena should be emphasized regarding this latest phase of East Asian development -- one through which these systems are currently still trying to find their way to full mature economy status. First is the fact that agriculture, having performed its historical mission, if less well and more belatedly in Korea, has gradually petered out as a catalyst and source of saving and has become a subsidized appendage to the economy. Second, given the newly arrived and increasingly felt shortage of labor, the shift in industrial output and export mixes has accelerated dramatically. Electronics, information, science and technology-intensive exports soared from \$3.1 billion in 1981 to \$12.5 billion in 1989, and now substantially exceed those of textiles, garments and other light industry. The continuing drastic change in the overall structure of exports was already indicated in Table 9. Third, vastly increased attention is now being paid to science and technology-related infrastructure and institutional changes encouraging additional R&D activity in both the public and private sectors.

With respect to the role of agriculture, as we saw clearly from Table 2, East Asia's underlying long-run natural resources poverty has gradually asserted itself. The New Community Movement in Korea gave something of a belated spurt to that sector, but in both cases agricultural goods are increasingly being imported rather than exported, and farmers subsidized rather than taxed -- the latter a less than rational response.

Thus, while 15-20% of Taiwan's agricultural output had been transferred into non-agricultural investment in the form of agricultural surpluses during the 50s and 60s, the direction of resource flow was reversed after 1973. A push for a second land reform, involving land consolidation, the acceleration of mechanization and the advent of specialized cultivating firms permitting the subcontracting of certain processes, all represented predictable, rational policy responses to the changing role of that sector. Unfortunately the enhanced protection and subsidization of farmers represents an equally predictable but less rational response for society en route to economic maturity.

The reader should be reminded that East Asia, especially Taiwan, is still trying to prolong the life of its labor-intensive activities by investing in such low wage overseas areas as Mainland China, Thailand, Indonesia, and the Philippines, also by closing its official eye to a limited volume of unskilled, largely illegal, immigrants from these areas. Her still absolutely substantial labor-intensive exports will continue to flow predominantly to the advanced countries; the rapidly expanding higher-tech and more capital intensive exports, on the other hand, as international trade theory tells us, will see a larger proportion destined for "neighboring" developing countries. Government attention has shifted increasingly in this high-tech, high level manpower direction, both of the home-grown and imported variety, especially at the post-graduate level. It should, moreover, be noted that, with the change in output mix,

there is now some tendency to shift towards the larger scale and greater industrial concentration. Especially in light of the still relatively underdeveloped domestic financial markets, there is even greater reference, e.g. in the current Six Year Plan, to the need for government enterprises to play a role in directly productive activities where economies of scale are pronounced.

With respect to human capital, as non-agricultural output mixes and technologies moved persistently in a more skill-intensive direction, the educational strategy continued to be flexible, reflecting the changing needs of the system. By 1988, total expenditures on education had risen to a new high of 5.2% of GNP on Taiwan; moreover, while, in the 50s, 50% of the total had been spent on primary education, 35% on secondary, and 15% on higher, we now see 30% spent on primary, 40% on secondary, and 30% on higher education. As significant is the fact that by 1989, fully 70% of high schools were vocationally oriented on Taiwan, representing the acceleration of an already referred to earlier trend. With the agricultural population now declining absolutely and at a rapid pace, it is interesting to note that of those who stayed behind, 84% had only primary school education or less, while of those who left 52% were in that category.⁴

In both countries higher education, moreover, has continued to shift towards engineering and the natural sciences, and away from the traditional humanities and agricultural concentrations. Government intervention at the university level was effected by way of quotas, but partly also in the form of financial carrots,

⁴ Computed from 1975 Agricultural Census.

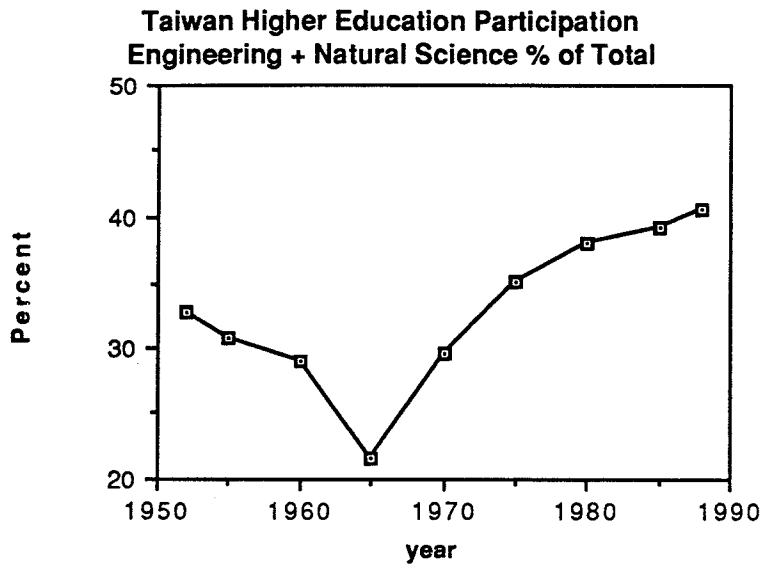
in the case of Taiwan, with new departments in industrial engineering, industrial design, automatic controls, petro-chemistry etc., established. As Figure 7 indicates, the trend seems to have been more pronounced in the case of Taiwan. But everywhere in East Asia it was increasingly being recognized that more engineering and sciences oriented programs were required for developing follower countries which are no longer in a position to depend for their productivity increases either on the shift from agriculture to non-agriculture or on the adaptation of the relatively simple technologies and designs associated with labor-intensive industrial expansion.⁵ It now became necessary to make more careful technology and output mix choices and to devise the appropriate adaptive, and at the end possibly even Schumpeterian type innovative responses. This meant a concerted shift in attitudes toward high-tech manpower as well as R&D and intellectual property matters generally.

An early harbinger of this awareness of changing needs was a scramble to set up R&D-oriented cabinet committees (1965), establish a National Science Council (1967), and create such R&D oriented institutes as the Chung Shan Institute of Science and Technology (1965) and ITRI, the Institute of Industrial Training and Research (1973).

It is also noteworthy that while, between 1960 and 1967, approximately one-sixth of all of Taiwan's college graduates had gone to the United States for further post-graduate study,

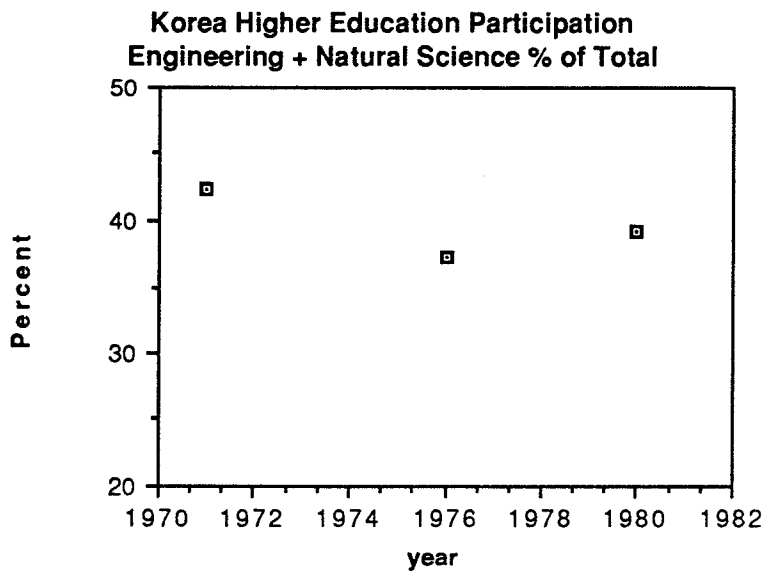
⁵ Technology changes frequently suggested by foreign importers (see the work of Larry Westphal et al. on Korea etc.)

Figure 7a



Source: Educational Statistics of the Republic of China: Ministry of Education, Republic of China, 1989.

Figure 7b



Source: The Economic and Social Modernization of the Republic of Korea: Cambridge; Council on East Asian Studies, Harvard University Press, 1980.
Korea Statistical Yearbook: Bureau of Statistics, Economic Planning Board, Republic of Korea, 1977.

two-thirds in science and engineering, only 4.5% annually had returned. After 1973 a major government effort was started to encourage a reverse flow of this high-talent manpower by active recruitment in such locations as the Silicon Valley and the offer of substantial financial incentives. The effort to tap this overseas reservoir of human flight capital was coordinated by the National Youth Commission and the National Science Council. As a consequence of these efforts, while only a handful of highly trained graduates returned before 1970, by 1986 more than 90% did so. It is estimated that in recent years almost 10,000 Taiwanese graduates of U.S. universities have returned home to take up positions, mainly in Taiwan's science and technology related industrial activities. Many have become venture capitalists in their own right.

The establishment of additional government machinery and infrastructure, focused on the science and technology end of the spectrum, was initially heavily focussed on this effort to reverse the earlier brain drain. The creation in 1982 of the Employment and Vocational Training Administration signalled the government's concern with the maintenance of continued flexibility and the needed enhanced responsiveness of domestic educational efforts to the quickly changing needs of the economy. The China Productivity Center was set up, also in the early 80s, to focus on the management skills needed at the middle and top levels, though less exclusively directed at the science and technology end of the spectrum. A National Science Council committee to worry about R&D needs at the applied end, and the

Chung Shan Institute of Science and Technology at the other had been established as early as the late 60s. The Industrial Training and Research Institute (ITRI) was set up in 1973, and the Institute for Information Industry, along with the Shin Chu Science-Based Industrial Park, in 1979. Most prominent of these has been the last mentioned, encouraging new ventures in high tech areas via the provision of public facilities to private firms on favorable terms⁶ and the guarantee of close physical and intellectual contacts with academic and private commercial interests. Fully 70% of the companies in this park have been under the direction of returned overseas Chinese in recent years.

ITRI, located nearby, carries on basic industrial research in areas which might be under-represented due to the continued predominance of small and medium scale firms in Taiwan. The Institute has a \$400 million annual budget and performs a substantial amount of in-house product and process innovation, much of it by attempting to adapt foreign technology through reverse engineering, devising its own patents and/or issuing licenses as appropriate. It also "sells" technical assistance and market information to medium and small-scale firms, and thus does not depend exclusively on government subsidy, although it is still heavily focused on government research projects, with private contracts growing only gradually.

Overall, in Taiwan, 60% of R&D is carried out within private

⁶ 5-year tax exemptions, a ceiling on taxes at 22% thereafter, subsidized rent and credit facilities, as well as other amenities.

industry and 40% within various public sector institutes, with the government funding 60% and the private sector 40% of the total. In other words, private sector R&D is generally carried out in-house by large firms, while the government has supported and/or carried out R&D and training-related activities of benefit to the large population of medium and small scale firms.

Parenthetically, a recent visit to ITRI convinced this observer that a major explicit contribution of the Institute, in addition to providing information and venture capital to medium and small scale entrepreneurs, has been via the actual creation of a new body of technologically oriented venture capitalists, staff members who, given ITRI's remarkably high turnover rate, found their way continuously into the private sector.

During the decade of the 80s, both Korea and Taiwan increased their R&D from approximately 1% to 2.5% of GNP, a substantial expansion symptomatic of the new phase of growth they had entered, if still substantially less than what the industrial economies allocate. But these figures, it should be understood, do not capture the more informal "blue collar" type of R&D which takes place in the machine-shops and on the factory floors of many S&M establishments. The national "white collar" figures, adding up officially reported R&D activities in the large firms and public sector, thus tend to substantially underestimate the total tinkering and adaptation which is going on, especially in the Taiwan case with its unusually large and relatively growing population of S&M firms. It should also be no surprise that, given the relatively minor role of public sector enterprises in

Korea and their pronounced decline in Taiwan over time, private sector R&D has assumed increasing importance. Moreover, foreign private R&D, never a dominant feature of the landscape in Taiwan, has virtually disappeared there, but retains a substantial role in Korea.

By 1982, admittedly under pressure from the U.S. and Europe, amendments to the trademark and patent laws were introduced to strengthen East Asia's intellectual property rights, and simultaneously additional fiscal incentives were provided for the current costing R&D. In 1983, an integrated program simultaneously strengthening science and technology-oriented training at home while recruiting abroad the high-level manpower needed immediately was formulated; and in 1986 a full-fledged 10-year science and technology development plan incorporating all aspects of the strategy was approved. Unlike in other LDC contexts, in East Asia such general formulations tend to move beyond general exhortation and incorporate specific policy and institutional initiatives. Clearly, along with the move in recent years to more public sector and economies of scale-related projects, as in the recently inaugurated Six Year Plan, there has been active government intervention in accelerating both research and the acquisition of human capital in the science, engineering and high-tech areas.

It should also be noted that the character of R&D itself has undergone considerable change. Basic research is still carried on largely by the government and applied research by the private sector; but product development, which comprised only 40% of R&D

in 1970, constituted 66% by 1979, with government still focussing more on capital goods and process change, leaving product development more and more to the private sector.

Patents as an (admittedly imperfect) indicator of innovative activity of course also increased, from 2,770 in 1980 to 7,500 in 1989, a 300% rise. Similarly, we have witnessed an almost tenfold increase in paper citations during the decade, a measure of the increased productivity of basic research in the public sector sponsored research institutes and universities.

It is, of course, always difficult to assess the impact of this combination of human capital accumulation and R&D activity on bottom line performance. In the mixed economy much clearly depends on the competitiveness of the private sector, which is being fortified and fertilized by the addition of these public goods. Where -- given too much rent-seeking and monopoly power -- there exists little active demand for putting these goods to work in the form of product and/or process innovations, the results are bound to be discouraging. Where a measure of workably competitive conditions exists -- certainly true for Taiwan but perhaps less so for the chaebol-dominated industries of Korea -- the externalities provided by government should have a substantial pay-off. One of the ways of assessing this issue -- though admittedly beset by several problems of both theory and measurement -- is to obtain comparable estimates of the contribution of total factor productivity to growth.

As Table 11 demonstrates, and as our priors might have led us to expect, the aforementioned favorable combination yielded

substantially higher levels of total factor productivity in Taiwan than in Korea, though we only have one data set for Korea showing an extremely wide range. It is necessary, however, to recall that both systems performed substantially better in this respect than, say, Latin America, where most countries have experienced negligible or even negative rates of total factor productivity growth.

As a consequence there is little doubt in my mind that East Asia has the necessary entrepreneurial and policy flexibility to weather inevitable future exogenous shocks and "stay the course." It is likely to be able to continue to avoid the retreat to stop-go restrictionist regimes and/or to policy mixes which fail to recognize the ever more critical importance of relying on the human capital dimension if the systems are to meet the accelerating challenges of globalization and convergence.

Table 11

Percentage Contribution to Growth of Total
Factor Productivity in Manufacturing

Taiwan:

1952-1961	56%
1961-1976	36%
1976-1987	47%
1961-1987	40%

Source: H. Pack, "New Perspectives on Industrial Growth in Taiwan" in G. Ranis, editor, Taiwan: From Developing to Mature Economy, Westview Press, 1992.

Korea:

1960-1973	4% - 44% (range)
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Source: Kwang Suk Kim and Michael Roemer, "Growth and Structural Transformation" in Studies in the Modernization of the Republic of Korea: 1945-1975 (Council on East Asian Studies, Harvard Univ.), 1979.

V. Some Conclusions.

The fact that the East Asian economies are relatively small, natural resource poor and human resources rich, and that they were endowed at the outset with relatively good physical and institutional infrastructure, is as important as the fact that their newly independent governments continued to build on that base. Like other developing countries, they moved into an early import substitution sub-phase, one which was, however, relatively short and relatively mild.

If there was one key to the East Asian success, especially Taiwan's, it was, in my view, the early attention paid to the agricultural sector, working in tandem with decentralized non-agricultural growth. On the human capital front, the East Asians initially emphasized literacy and numeracy by concentrating on primary education, then moved flexibly to emphasizing vocational and, still later, graduate science and technology-oriented education -- all as required by the system's continuously changing economic structure. Labor markets were permitted to behave competitively, i.e. there was very little intervention either through government support of unions, or through minimum

wage legislation which had any "bite." Public policy was instead clearly focused on easing the transition from inward to outward oriented development. This meant providing the necessary infrastructure and externalities to ensure vigorous balanced growth domestically and complementary export oriented activities, concentrating first on labor-intensive and later on continuously changing high-tech, capital and skill-intensive output mixes.

In summary, policy changes seem to have consistently accommodated the changing needs of the economy, rather than directing its path. During the most rapid growth period, the 60s, high growth, equitable distribution and full employment were all achieved by way of the open economy export-oriented strategy. Moreover, such success did not lead to growth activism on the part of the government. Fiscal and monetary policy remained restrained and flexible, relying largely on overt rather than covert means of transferring resources among interest groups. Trade liberalization proceeded slowly but steadily, exchange rates were maintained at more or less realistic levels throughout, and international capital market liberalization kept to the last.

Such prudence and flexibility on the part of policy makers became even more evident when put to the stronger test during times of international adversity. Unlike many other developing countries, Taiwan accepted somewhat lower growth rates in the face of negative external shocks, but maintained the direction of reforms without major zigs or zags in various policy arenas. Korea's long-run pattern is broadly similar, but there are also

important differences. For one, Korea paid relatively less attention to the agricultural sector and rural industry early on and was more tempted by the notion that large-scale urban-oriented activities could pull the economy along. High growth rates were achieved by the successful shift to external orientation; however, the financing of that growth was not supported by agriculture and therefore required a larger volume of foreign capital, leading to debt problems and a more capital intensive industrialization path.

While the emphasis on vocational education was somewhat less pronounced in Korea, there is underlying similarity in both the human capital and labor market dimensions. One thing that might be noted is that while the policy trend was generally linear in Korea as well, it was less consistently so than in Taiwan, partly as a consequence of greater political instability, partly because of the larger exposure to international shocks. There were indeed times when Korea's behavior temporarily resembled that of the more typical LDC, characterized by growth activism, resort to large-scale borrowing, high levels of inflation, including at times a somewhat more active union movement. However, in contrast to most developing country experience, these deviations were temporary, with the system showing a capacity to return to a steady liberalization trend. Consequently, the long-run performance of Korea has undoubtedly been highly successful by any international standard -- even if the results, in terms of income distribution, for example, have not been as good as for Taiwan. What marks off Korea from the more typical LDC case is

the remarkable ability of the authorities to recognize mistakes and to quickly take appropriate corrective action.

The East Asian experience indicates that the gradual sequencing of policy change can work and the system can put up with the maintenance of some discretionary controls for some time, and still be quite successful in the total transition effort. For example, in Taiwan, while it is important to remember that tariffication and harmonization took place early, only relatively small steps towards tariff reduction and full import liberalization were taken in the 60s and 70s. Not until 1983 was the principle of the survival of the fittest through the discipline of international import competition fully accepted. Thus a pragmatic effort at policy change which is maintained more or less consistently has been demonstrated to be much superior to the more frequently encountered fluctuation pattern, alternating between periods of relatively doctrinaire interventionism and equally doctrinaire free-market episodes. Parenthetically, the experience with sustained gradualism in East Asian policy reforms and the complementary direct actions of government is also, I believe, relevant to the current debate over the relevant advantages of gradual vs. cold-turkey reforms in the East European context.

Taiwan's public policies can be said to have worked consistently through, rather than attempting to replace markets. Unlike Korea, Taiwan has never engaged in anything remotely resembling central planning, witness the relative weakness of the CEPD and its predecessor agencies relative to Korea's Economic

Planning Bureau, a super ministry headed by the Deputy Prime Minister. Looking backward, one can say that Taiwan's policy makers have understood from the beginning that the ever-increasing complexity of development requires an ever-increasing reliance on indirect controls and across-the-board policies rather than highly selective direct interventions by government.

The East Asian experience certainly confirms the necessity of government intervention in both agricultural research and S&M development, where the appropriability of the returns from science and technology is usually restricted by the inherent competitiveness of the activity. Second, there were critical government interventions in fashioning the appropriate organizational and institutional structure, reducing transactions costs, and in providing infrastructural facilities and policies to ease the gradual transition from inward to outward orientation. Third, the need to create temporary innovation profits in private hands in the large-scale non-agricultural sector through R&D and the strengthening of patents and other intellectual property rights was increasingly recognized.

The same can be said for the continuing redirection of educational investments, as well as the government's science and technology structure poised to be flexibly supportive of the changing demands of the market. Third world public sector scientific institutes often lay claim to a substantial volume of human and fiscal resources. Mobilizing these resources on behalf of private sector innovative activity, especially in the current science and technology-oriented era, represents an important

institutional contribution to successful development in the East Asian case. What is, I believe, particularly instructive, is that, in spite of the one-party, apparently highly centralized public sectors of East Asia, there actually was, particularly in Taiwan, a good deal of decentralization of decision-making at work, public and private, yielding both growth and equity.

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