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An Episode of Rapid Productivity Convergence and Stagnation : Korea (1954-2002)*

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Abstract

I advance a set of propositions and hypotheses that may provide us not a single theory or episode but multiples of them together with which we could possibly lay out analytic narratives for Korea's fast productivity convergence. The episode was made possible by successful adoption of development strategy based on incremental comparative advantage and industrial restructuring by the government initiative. It was a consequence of interaction between market forces and government intervention. In theoretical terms, no single growth or development theory can explain such episodes but a combination of new instituionalists' views and neoclassical models of trade and growth can provide theoretical conjectures. I advance a proposition that the two-tier system of human capital which is a unique historical heritage of Korea by the increased primary school enrollment ratio in 1930's and in mid-1950's was the cornerstone for its success in late industrialization. The present paper explores a search for theoretical models for not only the rapid productivity convergence but also stagnation in East Asia.

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1. Introduction

In the literature of growth and productivity convergence, the Republic of Korea (hereinafter called Korea) has been one of the most often-cited countries (see, for example, Lucas(1993), Young(1994), Baumol, Nelson and Wolff(1994) and Rodrik(2003)). There seem to be mainly three reasons why the Korean case has attracted a great deal of attention from the researchers of growth and productivity. The first reason is naturally Korea's episode of rapid growth over the period of 35 years (1962-1997), which was termed as "economic miracle" by Lucas (1993). The second reason is relatively well-maintained available data on basic growth and productivity performance such as GDP, employment, and investment etc. as documented in Pyo (2002). The Bank of Korea published National Income Accounts for the period of 1953-1970(old accounts) and 1970-2003(new accounts). The National Statistical Office has published national wealth survey (capital stock) for four benchmark years (1968, 1977, 1987 and 1997). The third reason could be its recent episode of financial crisis in 1997 with sudden slump of productivity and growth. In these respects, the Korean episode of rapid growth and sudden slump seems to warrant a renewed analysis and explanation.

Lucas (1993) has suggested that we need a theory that incorporates the possibility of rapid growth episodes and that such theory should be able to explain why Korea experienced rapid growth since the mid-1960s while the Philippines experienced no such growth; although both economies started from roughly similar socio-economic conditions. Since then multiple theories of new growth have followed but they seem to have emphasized only a particular aspect (for example, externality, human capital, learning-by doing or threshold aspect) not multiple significant aspects of growth.

In what follows, I attempt to provide not another new growth theory but rather significant episodes of productivity change and rapid productivity convergence based on observations of Korea during last four decades. In theoretical terms, no single growth or development theory can explain such episodes but a combination of new institutionalists' views and neoclassical models of trade and growth can provide theoretical conjectures.

My explanation of significant episodes is based on two keywords: potential initial conditions and structural change and transformation. By potential initial conditions, I mean that we need to identify the state of initial conditions of the country not only by visible and quantifiable indicators but also by often-hidden indicators. These hidden indicators are so-called deep determinants (Rodrik et al., 2002) typically of social, religious and political nature. Among the potential initial conditions, I argue that historical heritages which are often embodied in institutions and commercial practices are the most important determinant because they ultimately shape policy environments and determine the success or failure of later development programs.

In case of Korea, I can single out three such initial conditions among hundreds of potential list. The first is a colonial heritage that the primary school enrollment ratio was once increased from less than 5 percent to 30 percent level in 1930's. The second is the episode of an early land reform after independence before interest groups could be formed and allied. The third is the expansion of primary education in mid-1950's under the influence of American mass-education system. The first and the third element combined formed the basis of what I define the two-tier system of human capital which is a unique historical heritage of Korea.

Even though Lucas (1993) has observed that both the Philippines and South Korea started from "roughly similar socio-economic conditions", the potential initial conditions were quite different between the two economies in the early 1960's. First, while there was an extensive agricultural land reform in Korea on March 25, 1950 five years after its independence from Japan in 1945, there was almost no significant agricultural land reform in the Philippines. While there was almost no large landlord class as a ruling class in Korea, there were large agricultural oligarchies in the Philippines. Second, there existed a significant difference in the state of income distribution between the two economies. According to World Bank, *Social Indicators of Development 1988*, the income received by highest 10 % of households in the Philippines were 40 % (1965) and 39 % (1975), while that in Korea was 28 % (1975). In terms of primary school enrollment rates, two economies were identically over 100 % by 1965. But the enrollment rates of secondary and tertiary schools began to diverge from 1970's. In the Philippines, the secondary school enrollment rate improved from 46 % in 1970 to 73 % in 1990 and the tertiary school enrollment rate increased from

3 % to 27 %. On the other hand in the Republic of Korea, two rates improved at much faster rates from 42 % to 87 % and from 16 % to 39 % respectively.

The second key element in explaining significant episodes of productivity change and convergence in Korea is the social capacity to transform from agriculture-based economy to manufacturing one at earlier stage and from labor-intensive manufacturing to capital-intensive and technology-intensive manufacturing industries at later stages. Such a social capacity could exist as potential capacity unless some kind of development shock comes through. Naturally, it is this reason why the role of government is important because it can generate domestically a development shock or absorb a foreign shock and internalize it into a domestic one.

The present paper is organized as follows. In section 2, we will analyze productivity change during four decades and discuss significant episodes of productivity convergence by Korea. In section 3, assessments on the major determinants of productivity will be made and its link to productivity change will be examined. Section 4 will present policy aspects of productivity growth. Section 5 discusses the financial crisis of 1997 and the post-crisis recovery and stagnation. Final section deals with theoretical search for modeling rapid convergence and stagnation.

2. An Account of Productivity Change over Five Decades (1953-2003)

The actual time span of the period to be covered by the present paper can be divided into three stages as follows:

1) The First Stage (1953-1974):

The Korean economy after the independence from the Japanese colonial rule in 1945 had gone through division of peninsula in 1948 and the Korean War (1950-1953). The period of 1953-1961 was the reconstruction period from war based on US aid and import substitution policy. The First Five-year Economic Development Plan was launched by President Park in 1962. Under the Plan, Korea has invested in basic infrastructure (highway and ports etc) and basic industries (steel and cement etc) and light manufactures (clothing and electronics etc) until the first oil crisis (1974).

2) The Second Stage (1975-1987):

The period involves Korea's investment in heavy and chemical industries and regime-change from President Park to Post-Park authoritarian regime under President Chun. During this period, Korean conglomerates had gone through restructuring of heavy and chemical industries and had entered into semi-conductor industries.

3) The Third Stage (1988-2003):

The period is Korea's turbulent transition period after hosting 1988 Olympic Games toward more democratic regimes and trade and financial liberalization including accession to WTO and OECD until the financial crisis in 1997. The post-crisis recovery has been attempted but the stagnation of investment continues while on the other hand IT revolution creates a new socio-political environment.

2.1 The Aggregate Productivity Growth

The overall productivity performance of Korea during the period of 1954-2002 can be summarized from Table 1 in terms of average annual growth rates in constant 1995 prices as follows:

Aggregate Economy

GDP growth (DY) = 7.04 %	Capital growth (DK) = 10.21 %
Labor growth (DL) = 3.07 %	TFP growth (DTFP) = 0.32 %

Manufacturing

GDP growth (DYM) = 12.76 %	Capital growth (DKM) =12.87 %
Labor growth (DLM) = 5.20 %	TFP growth (DTFP) = 4.08 %

From the UNIDO list of 17 developing countries during the period of 1962-2000, Korea has recorded the highest growth rate (7.89%) of GDP in constant 1996 PPP prices. It had recorded negative growth in 1980 (- 3.38 %) after the second oil crisis and in 1998 (- 8.21 %) after the Asian financial crisis. Except these two years, it has succeeded in achieving a remarkably high growth for four decades.

The decomposition of economy-wide aggregate growth accounting in per-capita terms from the UNIDO data set (1962-2000) can be made as follows:

$$DLP\ (5.11\ \%) = SK\ (0.55) \times DKL\ (8.43\ \%) + DTFP\ (0.43\ \%) \quad (1)$$

where SK is the average share of capital income in total GDP which is imputed as 0.55 (55%) from the estimates of DLP, DKL and DTFP using the above identity.

Alternatively, the decomposition of GDP growth can be made as follows:

$$DY\ (7.89\ \%) = SK\ (0.55) \times DK\ (11.21\ \%) + SL\ (0.45) \times DL\ (2.78\ \%) + DTFP\ (0.43\ \%) \quad (2)$$

where DK is the average growth rate of capital, SL is the average share of labor income in total GDP and DL is the average growth rate of labor employment. From UNIDO estimates of DY, DLP and DKL, we have imputed DK and DL using the following identity:

$$DLP\ (5.11\ \%) = DY\ (7.89\ \%) - DL\ (2.78\ \%) \quad (3)$$

$$DKL\ (8.43\ \%) = DK(11.21\ \%) - DL(2.78\ \%) \quad (4)$$

Even though we have obtained shares of labor income as share of wages and salaries in gross national income from National Accounts in principle there are two alternative ways of estimation. One way is to estimate the average of the ratio of wages and salaries to value-added in aggregate economy over the full period and the other is to take the average of changing annual wage shares in aggregate economy from the annual National Income Accounts statistics. However, both estimates of labor income will underestimate the contribution of labor input relative to capital input because it does not incorporate the contribution of farmers' own labor and proprietors' labor in retail and wholesale sector etc. As a consequence, for the aggregate economy of Korea where capital deepening has dominated the total factor input, the underestimation of the labor share(SL) and, therefore, the overestimation of the capital share(SK) tend to bias upward the contribution of total factor input and accordingly, bias downward the contribution of total factor productivity.

(Table 1) Estimates of TFP Growth Rates from National accounts : Korea (1954-2002)

	GDP Growth rate (%)		Labor Growth rate (%)		Capital Growth rate (%)		SL	SK	SLM	SKM	DTFP	DTFPM
Year	Aggregate (DY)	Manufacturing (DMY)	Aggregate (DL)	Manufacturing (DML)	Aggregate (DK)	Manufacturing (DMK)	Share of Labor Income	Share of Capital Income	Manufacturing Share of Labor Income	Manufacturing Share of Capital Income	TFP Growth rate	Manufacturing TFP Growth rate
1954	5.60	18.10	4.11	5.62	4.20	11.06	0.328	0.672	0.451	0.549	1.43	9.49
1955	4.50	21.30	3.95	5.57	5.06	11.48	0.314	0.686	0.444	0.556	-0.21	12.44
1956	-1.30	15.20	-1.61	0.00	5.47	11.50	0.298	0.702	0.436	0.564	-4.66	8.71
1957	7.60	7.10	5.39	7.13	6.14	11.83	0.316	0.684	0.445	0.555	1.70	-2.64
1958	5.50	10.30	4.23	5.58	5.15	10.54	0.356	0.644	0.467	0.533	0.68	2.08
1959	3.90	9.20	5.60	7.32	5.01	10.12	0.403	0.597	0.492	0.508	-1.34	0.46
1960	1.20	8.20	10.27	11.60	5.15	10.01	0.390	0.610	0.485	0.515	-5.95	-2.58
1961	5.90	4.00	3.65	5.25	5.01	9.65	0.360	0.640	0.469	0.531	1.38	-3.59
1962	2.10	11.70	3.78	5.15	6.74	11.17	0.377	0.623	0.478	0.522	-3.52	3.41
1963	9.10	16.10	3.79	6.27	8.50	12.74	0.320	0.680	0.447	0.553	2.11	6.26
1964	9.70	9.90	1.77	4.71	6.66	10.73	0.293	0.707	0.433	0.567	4.47	1.78
1965	5.70	20.50	5.24	19.28	8.40	12.31	0.332	0.668	0.454	0.546	-1.65	5.03
1966	12.20	17.30	2.59	6.95	13.32	17.09	0.344	0.656	0.460	0.540	2.57	4.88
1967	5.90	21.60	3.53	20.07	14.43	18.05	0.383	0.617	0.481	0.519	-4.35	2.58
1968	11.30	27.20	4.94	14.14	36.60	31.09	0.391	0.609	0.486	0.514	-12.92	4.34
1969	13.80	21.60	2.44	5.57	12.23	18.00	0.404	0.596	0.492	0.508	5.52	9.72
1970	8.80	19.90	3.51	3.94	11.32	16.41	0.412	0.588	0.472	0.528	0.70	9.38
1971	8.60	18.50	3.36	4.92	10.76	16.91	0.414	0.586	0.484	0.516	0.90	7.40
1972	4.90	14.30	4.26	6.04	10.12	15.79	0.406	0.594	0.451	0.549	-2.84	2.91
1973	12.30	29.30	5.28	20.21	11.39	21.37	0.408	0.592	0.473	0.527	3.40	8.48
1974	7.40	16.60	4.28	13.23	11.73	15.50	0.391	0.609	0.495	0.505	-1.42	2.22
1975	6.50	12.90	2.34	9.54	11.44	14.05	0.402	0.598	0.475	0.525	-1.28	0.99
1976	11.20	23.10	5.98	19.53	12.20	13.71	0.417	0.583	0.497	0.503	1.59	6.50
1977	10.00	14.40	3.17	4.44	13.52	17.98	0.438	0.562	0.530	0.470	1.01	3.60
1978	9.00	20.80	4.58	7.73	15.62	16.80	0.459	0.541	0.557	0.443	-1.55	9.06
1979	7.10	9.50	1.41	3.71	14.84	16.80	0.486	0.514	0.578	0.422	-1.21	0.27
1980	-2.10	-0.90	0.59	-4.76	12.21	14.30	0.513	0.487	0.579	0.421	-8.35	-4.16
1981	6.50	9.50	2.45	-3.30	10.88	12.98	0.509	0.491	0.576	0.424	-0.09	5.90

1982	7.20	5.70	2.51	5.91	10.81	14.41	0.521	0.479	0.582	0.418	0.71	-3.76
1983	10.70	14.40	0.87	7.40	11.19	12.80	0.540	0.460	0.582	0.418	5.08	4.74
1984	8.20	16.30	-0.53	2.48	11.05	11.86	0.539	0.461	0.583	0.417	3.39	9.91
1985	6.50	6.00	3.68	4.55	10.53	13.98	0.540	0.460	0.562	0.438	-0.33	-2.69
1986	11.00	18.70	3.51	8.79	10.49	15.35	0.528	0.472	0.535	0.465	4.19	6.86
1987	11.00	18.30	5.33	14.34	10.89	12.70	0.537	0.463	0.564	0.436	3.10	4.67
1988	10.50	12.10	3.10	5.53	10.61	10.28	0.552	0.448	0.598	0.402	4.04	4.66
1989	6.10	3.50	4.01	4.50	11.05	9.32	0.578	0.422	0.619	0.381	-0.88	-2.84
1990	9.00	9.20	2.95	0.59	12.20	10.75	0.591	0.409	0.632	0.368	2.27	4.87
1991	9.20	9.50	3.07	4.87	12.33	10.00	0.598	0.402	0.622	0.378	2.41	2.69
1992	5.40	5.30	1.91	-3.35	11.32	11.64	0.598	0.402	0.623	0.377	-0.29	3.01
1993	5.50	5.40	1.18	-5.48	11.00	12.77	0.596	0.404	0.603	0.397	0.35	3.63
1994	8.30	10.80	3.14	0.80	11.01	11.88	0.595	0.405	0.585	0.415	1.97	5.40
1995	8.90	11.30	2.81	1.25	11.11	11.50	0.617	0.383	0.630	0.370	2.91	6.26
1996	6.80	6.80	2.13	-1.95	10.90	11.10	0.642	0.358	0.664	0.336	1.53	4.36
1997	5.00	6.60	1.72	-4.06	10.09	10.84	0.628	0.372	0.597	0.403	0.17	4.65
1998	-6.70	-7.40	-6.20	-14.69	4.82	4.26	0.616	0.384	0.533	0.467	-4.73	-1.56
1999	10.90	21.00	1.75	2.77	4.77	4.80	0.597	0.403	0.523	0.477	7.93	17.26
2000	9.30	15.90	4.17	6.42	5.07	5.53	0.594	0.406	0.517	0.483	4.76	9.91
2001	3.10	2.10	1.95	-0.63	8.00	8.00	0.620	0.380	0.576	0.424	-1.15	-0.93
2002	6.30	6.30	2.73	-0.61	6.93	6.93	0.609	0.391	0.602	0.398	1.93	3.90
Average (1954 ~2002)	7.043	12.755	3.075	5.202	10.209	12.871	0.471	0.529	0.529	0.471	0.316	4.080

Sources: Bank of Korea, National Accounts, The National Statistics Office
Note: 1995 constant prices

2.2 Manufacturing Productivity Growth

On the other hand, we have estimated corresponding estimates in Korea's Manufacturing sector during the period of 1964-2000 from the UNIDO data set as follows:

$$DLPM\ (8.24\ \%) = SKM\ (0.46) \times DKLM\ (8.35\ \%) + DTFPM\ (4.40\ \%) \quad (5)$$

where DLPM is the average annual growth rate of labor productivity in Manufacturing; SKM is the share of capital income in Manufacturing GDP; DKLM is the average annual growth rate of per capita capital in Manufacturing; and DTFPM is the growth rate of total factor productivity in Manufacturing.

$$DYM(13.39\%) = SKM(0.46)\times DKM(13.67\%)+SLM(0.54)\times DLM(5.32\%)+DTFPM(4.40\%) \quad (6)$$

where DYM is the average annual growth rate of real Manufacturing GDP; DKM is the growth rate of capital stock in Manufacturing; SLM is the average share of labor income in Manufacturing; and DLM is the growth rate of labor input in Manufacturing.

The comparison of growth accounting between economy-wide aggregate one and Manufacturing sector reveals several characteristics in Korea's productivity performance as follows:

1) The growth accounting at the economy-wide aggregate level over the period of 1954-2002 in Korea has exhibited a capital-input driven growth rather than TFP-led growth confirming the Krugman(1994) proposition. The relative contribution of TFP growth to total GDP growth was only 5.5 percent. It also confirms Nadiri's (1972) proposition that relative contribution of TFP to output growth is small in developing economies as compared to its critical importance in industrialized economies.

2) The manufacturing sector in Korea has accumulated capital at a faster rate (12.87 %) than the aggregate economy (10.21 %) and has increased employment too at a faster rate (5.20 %) than the aggregate economy (3.08 %). Its growth rate in capital deepening (7.67 %) is slightly higher than the economy-wide growth rate (7.14 %). But the relative contribution of TFP in manufacturing (32.0 %) is much more significant than that at the aggregate economy-wide level (4.5 %). Therefore, Korea's rapid growth was manufacturing-led growth and the significant contribution of its TFP seemed to have exercised a spill-over effect into other sectors such as the primary sector and the service sector mitigating their lower TFP.

3) The estimated share of labor income in manufacturing (0.53) was higher than that in the aggregate economy (0.47) due to higher rates of growth in employment even though the average wage rate in manufacturing was lower than the rest of sectors. According to Korea National Statistical Office, the industrial differences in wages are as follows in 1980 and 2000 where index of Manufacturing wage is treated as base index (100):

Table 2. Index of Industrial Differences in Wages

	1980	2000
Agriculture, Forestry and Fishery	138.4	110.8
Mining	145.4	106.7
Manufacturing	100.0	100.0
Electricity, Gas and Water	179.5	153.9
Construction	197.2	108.1
Wholesale, Retail, Restaurants and Hotels	139.1	95.7
Transport, Storage and Communication	136.9	111.8
Finance, Insurance, Real Estate and Business Service	170.6	121.7
Community, Social and Personal services	187.4	105.3

Sources: Korea National Statistical Office*, Social Indicators in Korea*, 2001

The wage differential between Manufacturing and Non-Manufacturing had been reduced from 1980 (100: 161.8) to 2000 (100: 114.2). There was a significant catch-up

of Manufacturing wages to Non-Manufacturing wages level due to the changes into productivity-based compensation policy, strong union activity in Manufacturing and increase in skill-intensity in Manufacturing labor. The overall productivity trends at both the aggregate economy-wide level and Manufacturing level seem to suggest the growth of TFP may not seem significant in the aggregate sense but it played a crucial role indirectly through lifting up productivity of manufacturing sector. The relative contribution of TFP in Manufacturing(32.9 %) was a lot bigger than that in the aggregate economy( ). Now it is apparent that in case of the Republic of Korea, the overall productivity gain was driven by manufacturing sector and the sector's growth was driven not only by the fast accumulation of rival inputs (capital and labor) which accounted for two-thirds of the manufacturing GDP growth but also by the growth of TFP which accounted for the remaining one-third of the manufacturing growth.

In summary, we can argue that in case of Korea, the growth of TFP may not seem significant in the aggregate sense but it played a crucial role indirectly through lifting up productivity of manufacturing sector. In particular, the growth in technical efficiency and technical change in manufacturing sector must have worked in two directions to lift up productivity in the rest of sectors: one is a direct effect to manufactures-user industries and the other is indirect effect of spillover and learning-by-doing. For example, computer manufacturing and assembly causes lifting up the productivity of computer-using service industries and the computer manufacturing itself generates spillover effect and induces learning-by-doing to other industries' manpower.

2.3 The Productivity Convergence

The data provided by UNIDO indicates the following convergence of Korea's labor productivity relative to US:

Korea's Labor Productivity relative to US 1961: 15.27
Korea's Labor Productivity relative to US 2000: 48.40

(Table 3) Productivity Convergence by Per Capita Income

	Per Capita Income			Relative to US (=100)	
	KOR	**JPN**	**USA**	**KOR**	**JPN**
1953	1328	2839	11598	11.45	24.48
1954	1350	2962	11290	11.96	26.24
1955	1459	3161	11964	12.19	26.42
1956	1456	3371	11993	12.14	28.11
1957	1552	3605	11942	13.00	30.19
1958	1539	3728	11599	13.27	32.14
1959	1513	4040	12169	12.43	33.20
1960	1495	4545	12273	12.18	37.03
1961	1542	5105	12319	12.52	41.44
1962	1536	5493	12895	11.91	42.60
1963	1672	5918	13310	12.56	44.46
1964	1756	6559	13930	12.60	47.08
1965	1803	6839	14686	12.27	46.57
1966	2009	7515	15397	13.05	48.81
1967	2077	8324	15534	13.37	53.58
1968	2289	9411	16141	14.18	58.31
1969	2564	10385	16525	15.52	62.84
1970	2716	11474	16351	16.61	70.17
1971	2894	11850	16826	17.20	70.43
1972	2963	12691	17685	16.75	71.76
1973	3299	13414	18670	17.67	71.85
1974	3501	13018	18546	18.88	70.20
1975	3657	13164	18041	20.27	72.97
1976	4022	13544	19065	21.10	71.04
1977	4396	13997	20001	21.98	69.98
1978	4746	14614	21004	22.60	69.58
1979	5035	15282	21535	23.38	70.96
1980	4790	15619	21336	22.45	73.20
1981	5018	15958	21666	23.16	73.65
1982	5313	16312	20759	25.59	78.58
1983	5816	16523	21463	27.10	76.98
1984	6237	17071	23057	27.05	74.04
1985	6569	17743	23624	27.81	75.11
1986	7213	18160	24172	29.84	75.13
1987	7946	18909	24831	32.00	76.15
1988	8715	20119	25608	34.03	78.57
1989	9190	21127	26279	34.97	80.40
1990	9952	22220	26458	37.62	83.98
1991	10804	22847	25898	41.72	88.22
1992	11243	22921	26489	42.44	86.53
1993	11717	22906	26956	43.47	84.98
1994	12584	23033	27878	45.14	82.62
1995	13552	23268	28409	47.70	81.91
1996	14320	24047	29194	49.05	82.37
1997	14786	24428	30190	48.98	80.91
1998	13444	24058	31091	43.24	77.38
1999	14810	24150	32128	46.10	75.17
2000	15876	24675	33293	47.69	74.12

Source: Penn World Table

(Table 4) Productivity Convergence by Per Capita Income (PPP-adjusted)

	Per Capita Income (PPP-adjusted)			Relative to US (=100)	
	KOR	**JPN**	**USA**	**KOR**	**JPN**
1953	2839	7011	11598	24.48	60.45
1954	2166	7083	11290	19.19	62.74
1955	4088	7622	11964	34.17	63.71
1956	3187	7921	11993	26.58	66.05
1957	3035	8255	11942	25.42	69.12
1958	3069	9035	11599	26.46	77.90
1959	2925	9724	12169	24.04	79.91
1960	3378	10432	12273	27.53	85.00
1961	6098	10989	12319	49.50	89.21
1962	5354	11467	12895	41.52	88.93
1963	4678	11808	13310	35.15	88.72
1964	6208	12713	13930	44.57	91.26
1965	7594	12898	14686	51.71	87.83
1966	7783	13944	15397	50.55	90.56
1967	7088	15047	15534	45.63	96.86
1968	7125	16947	16141	44.14	105.00
1969	7693	18825	16525	46.55	113.92
1970	7862	20643	16351	48.08	126.25
1971	8550	20645	16826	50.82	122.69
1972	8945	18789	17685	50.58	106.24
1973	9374	16416	18670	50.21	87.93
1974	7969	15204	18546	42.97	81.98
1975	8763	16054	18041	48.57	88.98
1976	8675	16038	19065	45.50	84.13
1977	8762	14889	20001	43.81	74.44
1978	8115	12508	21004	38.63	59.55
1979	7708	14033	21535	35.79	65.16
1980	7750	15141	21336	36.32	70.96
1981	8489	15839	21666	39.18	73.10
1982	9922	19219	20759	47.79	92.58
1983	11388	18926	21463	53.06	88.18
1984	12429	19594	23057	53.91	84.98
1985	14003	20758	23624	59.28	87.87
1986	15645	15320	24172	64.73	63.38
1987	15933	14122	24831	64.16	56.87
1988	15032	13724	25608	58.70	53.59
1989	14150	15737	26279	53.85	59.88
1990	14927	17477	26458	56.42	66.06
1991	15874	17034	25898	61.29	65.77
1992	16566	16020	26489	62.54	60.48
1993	17001	14244	26956	63.07	52.84
1994	17300	13339	27878	62.06	47.85
1995	16921	12681	28409	59.56	44.64
1996	17953	15499	29194	61.50	53.09
1997	20985	17676	30190	69.51	58.55
1998	26816	19044	31091	86.25	61.25
1999	24829	17008	32128	77.28	52.94
2000	24519	17038	33293	73.65	51.17

Source: Penn World Table

Figure 1. PPP-unadjusted Per Capita Income Index (US=100)

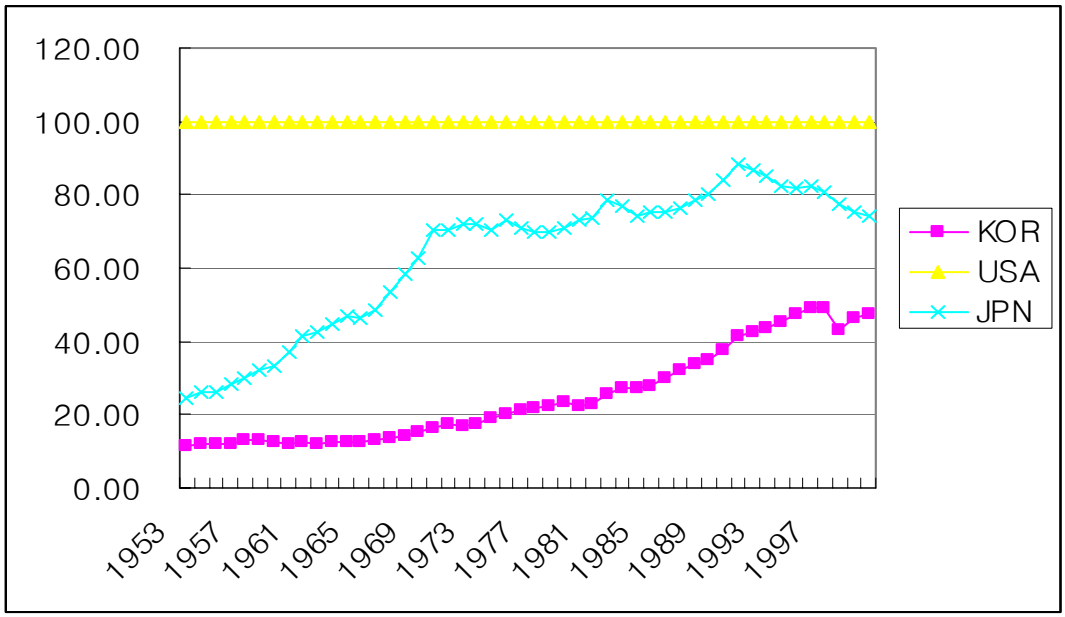
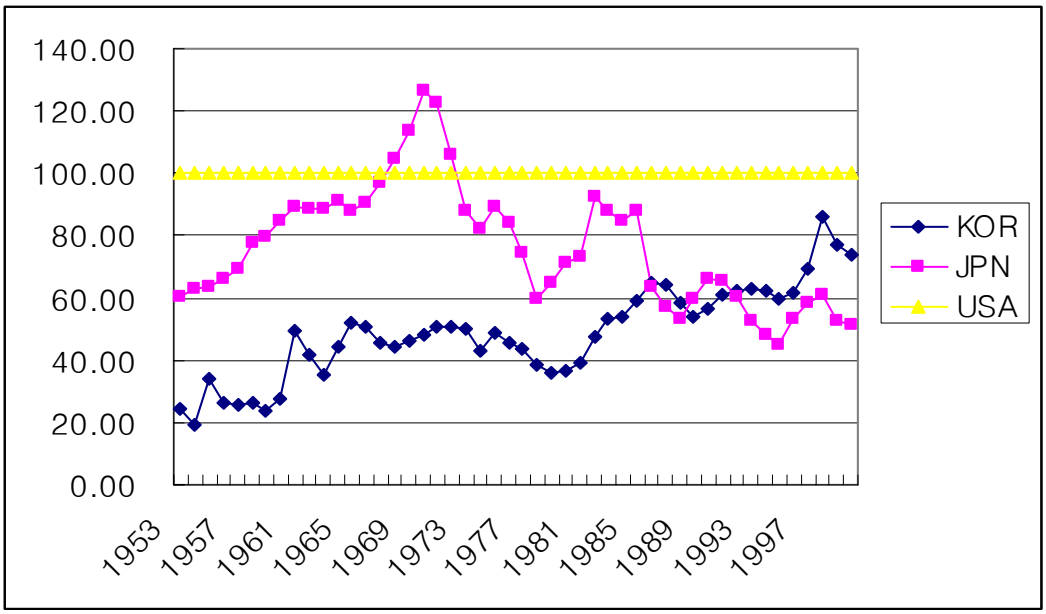


Figure 2. PPP-adjusted Per Capita Income Index (US=100)



It provides an episode of rapid productivity convergence: Korea's per-employee income in 1961 was about 15.27 percent of US' per-employee income but it reached to the level of 48.4 percent of US' per-employee income over four decades.

On the other hand, the data by Penn World Table provides the following convergence of Korea's and Japan's per-capita income relative to US:

Korea's Per-Capita Income relative to US 1961(=100):12.52, 49.50 (PPP-adjusted)
Korea's Per-Capita Income relative to US 2000(=100): 47.69, 73.65(PPP-adjusted)

Japan's Per-Capita Income relative to US 1961(=100): 41.44, 89.21 (PPP-adjusted)
Japan's Per-Capita Income relative to US 2000(=100): 74.12, 51.17 (PPP-adjusted)

As pointed out by Lucas (1993), we need a growth theory that incorporates the possibility of rapid growth episodes and productivity convergence. No single theory could explain this episode because it involves more than growth of an aggregate economy; it should deal with complex story of development with late industrialization. It would be tempting to say that everything the Korean Government had done was appropriate and timely and that the interaction between government and market in Korea was well-coordinated. However, a careful examination of the past development history of Korea reveals that there had been pros and cons and ups and downs and that the episode of fast growth had been far from being smooth. The Korean economy had to go through very turbulent periods as witnessed in 1980-1981 following the second oil crisis and the assassination of President Park and 1997-1998 in the middle of Asian financial crisis.

In what follows, I advance a set of propositions and hypotheses that may provide us not a single theory or episode but multiples of them together with which we could possibly lay out analytic narratives for Korea's fast productivity convergence. I will do so by following three stages of Korean development in historical terms.

The First stage (1953-1974)

(1) Reconstruction and Import Substitution (1953-1961)

In order to set the First Stage in the right perspective, it seems necessary to briefly overview the Korean economy after Korean War. The period of 1953-1961 can be called as Reconstruction Period. As a consequence of devastating war which lasted three years, the magnitude of war destruction was immense. According to Lee (2001), in agricultural sector, total land that can be used for production has been damaged by 27.4 percent and rice harvest has declined by 40 percent from 1948. The magnitude of destruction in industrial sector is estimated to be about 60 percent on average. In particular, the destruction of light manufacturing facilities had worsened the shortage of basic industrial products such as foods, clothing and other basic necessities.

It was a period in which Korean government relied heavily on foreign aid to stabilize domestic economy and carry out a minimum reconstruction investment. During the period, total foreign aid received occupied 71.3 percent of total imports and was used to purchase raw materials, semi-manufactured intermediate goods and machinery and equipment for private sectors. The government allocated its foreign reserves to finance extra portion of imports.

Since it was a period when Korean government used foreign aid to finance current account deficit and to support defense budget (34.8 %) and fiscal investment and finance (64.2 %), the utmost importance was given to restrict imports and promote import substitution. The direct subsidy policy for exports was almost non-existent until 1961. During the period, the allocation of foreign exchange was centrally controlled by the Bank of Korea and both quantitative import restriction and tariff policy were administered to save foreign exchange and promote import substitution. The Ministry of Commerce and Industry announced bi-annually from 1955 the list of import items subject to three categories: 1) Automatic Approval Items 2) Restricted Items and 3) Prohibited Items. The representative import substitutes such as cotton fabric and wheat flour and milling products were prohibited from importing since 1955. The tariff structure was a typical escalation system: Basic Necessities in shortage and non-producible products (10 %), Domestically produced unfinished products (20 %), Domestically non producible finished products (30 %), Domestically produced finished products (40 %), Semi-

Luxury Goods (50-90 %) and Luxury Goods (over 100 %). The average tariff rate by 1957 was 40 percent.

During this period of 1953-1961, the foreign aid total reached 2,284.6 million US dollars. The largest source was US ICA& AID with 1,743.7 million US dollars (76.3 %) and the second and the third largest source were CRIK and US PL480 with 218 million US dollars (9.5 %) and 202.7 million US dollars (8.9 %) respectively.

On the fiscal side, the fiscal revenue was mostly decomposed by foreign aid (39.6%) and tax revenue (38.2 %) in 1961. The fiscal expenditure in 1961 was decomposed by General Operating Expenditure (41.3 %), Fiscal Investment and Finance (29.7 %) and Defense Expenditure (29.0 %). The fiscal investments in 1959 were decomposed by import of investment goods (36.6 %), agriculture (22.2 %) and public construction (17.9 %). On the other hand, fiscal financing was decomposed by category: General Industrial Fund (68.2 %) mostly administered through Korea Development Bank, Water Management and Agriculture Fund (21.2 %) administered by Korea Agricultural Bank, Small and Medium Enterprise Loan (5.9 %), Housing Loan (3.9 %) and Export Promotion Loan (0.8 %).

Lastly on the financial policy side, it was the period in which there was always excess demand for loans. While the bank interest rate was put a ceiling rate of 20 percent, the unsecured private curb-market rate was in the range of 48-120 percent. In particular, the interest rate charged by Korea Development Bank was lower than other commercial banks' lending rate. The Korea Development Bank's loan occupied 40 percent of entire bank loans and 70 percent of total equipment loans. The share of manufacturing loans in total KDB loans had increased from 37 percent in 1954 to 64 percent in 1960. It was mostly financed to import-substitution industries such as textile, fertilizer, cotton and yarn, wheat flours and sugar etc.

Table 5. Principal Economic Indicators during Reconstruction Period (1953-1961)

Year	GNP (million US$)	GDP per Capita (US$)	Investment Rate	Savings Rate		Inflation Rate	Real GDP Growth Rate
				Domestic	Foreign		
1953	1,353	67	15.4	8.8	6.6	-	-
1954	1,452	70	11.9	6.6	5.3	31.8	5.1
1955	1,395	65	12.3	5.2	7.1	62.1	4.5
1956	1,450	66	8.9	-1.9	10.9	34.0	-1.4
1957	1,666	74	15.3	5.5	9.8	22.2	7.6

1958	1,875	80	12.9	4.9	8.0	-1.3	5.5
1959	1,949	81	11.1	4.2	6.9	1.3	3.8
1960	1,948	80	10.9	0.8	8.6	11.7	1.1
1961	2,103	82	13.2	2.9	8.6	14.0	5.6
Average			12.4	4.1	6.7	22.0	

Source: Korea Development Institute (1991b: 475)

(2) Five-Year Economic Development Plans

The First Five-Year Economic Development Plan was originally drafted at the end of the Rhee government but it was revised and implemented by the Park government. The first feature of the First Plan was to promote basic industries such as steel and cement to help build infrastructure and therefore, had an element of import substitution policy. Pohang Steel Co. Ltd was established as public enterprise but cement companies were established by private firms who were awarded project loans from industrial banks. So there was mixture of public enterprises and private firms who were commissioned to carry out the projects.

The second feature of the First Plan was the promotion of light manufacturing industries which can produce labor intensive products and can export to overseas market. Plywood, garments, simple assembly of electronics and wigs were the main products and most of production were left to private industries. Typically the General Trading Companies (GTC) by major conglomerates known *Chaebol* played the role of subcontracting export orders to smaller domestic firms, financing them through export financing or domestic credit system by guaranteeing their loans to domestic banks, and marketing the products in export market. The public enterprises and private firms started absorbing labor force and the shortage of labor force in manufacturing had induced rural-urban migration. Korea seemed to have passed the Lewisian turning point by 1974-1975 after passing the take-off stage in late 1960's.

The government had adopted an implicit rule of game or at times explicit decree or announcement or set of directives and regulations that announced "Export Priority". At the time of launching the First Plan there was internal debate between bureaucrats and scholars about the mode of development financing. It happened to coincide with Korea-Japan Agreement on normalizing the bilateral relationship and the Japanese grants and aids were being negotiated.

In general, it was a period when nationalistic movement was very high. The foreign direct investments did not receive much credit due to strong anti-Japanese sentiment and therefore, the Park government opted for inducing project loans from Asian Development Bank and World Bank and using them for basic industries such as steel and cement and social infrastructure such as highways and railroads and power plants etc. Most of private projects were awarded to private firms usually to qualified conglomerates through Korea Development Bank, Korea Export Import Bank, Korea Medium and Small Enterprise Bank and other commercial banks through syndicated loans or government-subsidized policy loans. For getting next-round loans, one of the most important criteria was export performance by the loan-awarded companies.

Both the government and banks were monitoring the company's performance. This criterion of export-performance had exercised a constant pressure on private firms and their owners and entrepreneurs so that they were almost obsessed with how to sell their products in overseas market. Even though there must have been a lot of distortion effect, the explicit criterion of export priority had reduced the arbitrariness by bureaucrats and bankers and had made the monitoring system relatively more transparent than that under import substitution system.

The First Five-Year Development period (1962-1966) can be characterized as a period of explosive export growth. As shown in Appendix Table 4, export amount in current US dollars increased from 54.8 million dollars in 1962 to 253.7 million dollars by about five times. Helped by extraordinary export performance, the annual average GDP growth rate increased at 8.5 percent exceeding the target rate (7.1 %).

The growth momentum built under the First Five-Year Development Plan was carried over to two consecutive Five-Year Development Plans until 1976 despite the first oil crisis in 1974. The actual GDP growth rates in the Second (9.7 %) and the Third Five-Year Development Plan (10.1 %) exceeded target rates (7.0 % and 8.6 % respectively). By end of the First Stage in 1976, export (7,815 million US$) was not far off from import (8,405 million US$). During the First Stage, the domestic savings rate increased from 0.8 percent in 1962 to 23.1 percent in 1976, which was instrumental to Korea's productivity convergence. Industrial structure transformed from the Primary (33.4 %), the Secondary (21.7 %), and the Tertiary (44.9 %) in

1962 to the Primary (24.0 %), the Secondary (29.5 %), and the Tertiary (46.5 %) in 1976.

In summary, it was a truly remarkable export-led and manufacturing –oriented extensive growth, which has made the productivity convergence in unprecedented speed.

The Second Stage (1975-1986)

While the first stage (1953-1974) of Korean development was characterized by the rural-urban migration and the inter-industry transformation from the primary sector to light manufacturing sector, the second stage (1975-1986) can be described as a period of intra-manufacturing transformation from labor intensive industries to capital and technology intensive industries. The quadrupled oil prices in 1974 oil crisis and the increasing wage rate after passing the Lewisian turning point when the period of unlimited supply of labor was over had forced the Korean government and private firms to look for alternative industries and product lines for more value-added. GTC-based conglomerates started looking for investing in automobiles, ship building, petroleum and chemical industries and metals and industrial machinery industries. But since some of these industries were more import-substituting industries rather than export-promoting industries, the monitoring system became less transparent.

In early 1980's, Korean economy experienced the second oil crisis and had to go through restructuring the investments in heavy and chemical industries made during late 1970's. But it was this period when major conglomerates such as Samsung, Lucky Goldstar (LG) and Hyundai started investing in semi-conductor industries because they anticipated the technology frontier in that industry and the government wanted to promote competition in the industry as outlined in Pyo (2000). During this period Korean government has moved from direct industrial support policy to indirect support policy. For example, they tried to shift the paradigm of industrial promotion from directly subsidizing an industry such as steel or automobile to indirectly promoting investments in energy saving, preserving environments and introducing new technologies through enhanced R&D programs. It was also a period in which trade liberalization before capital market opening was

seriously deliberated as a backdrop against rising wages and unionism as discussed in Pyo (1990).

During the Second stage, the performance of GDP growth was mixed between the Fourth Plan period (5.5 % annual average below the target rate of 9.2 %) and Fifth Plan period (8.4 % annual average above the target rate of 7.6 %). We also note an excessive investment drive during the Fourth Plan period in which the actual investment rate (35.5 %) exceeded the planned rate (26.2 %) by large margin. This excessive over-investment was combined with the second oil crisis and the assassination of President Park in late 1979 and the subsequent political instability in 1980 making the Korean economy experience a negative growth (- 6.2 %) in the year for the first time since 1962. By end of the Fifth Five-Year Development Plan in 1986, Korean government has stopped drafting Five-Year Development Plans and has moved toward a sort of indicative planning with annual projection and mid-term projection of three years or so.

The Third Stage (1987-2003)

The Third stage (1987-2003) is characterized by turbulent transition from authoritarian regime to a more democratic one. It is a period in which Korea had pursued import liberalization and capital market opening by joining WTO and OECD. It was a period when Korean conglomerates engaged in excess competition in a pattern of monopolistic competition across industries. Many of them had invested in pre-emptive investment projects in non-tradable sectors to stay alive against increasing foreign and domestic competition.

The monitoring system by both government and banks became less transparent and a lax financial supervision created a vast network of moral hazard. It was also the period of rapidly declining rates of return on capital in Korea as observed in Pyo and Nam (1998). As Independent Evaluation Office of IMF had described it, the Korean financial crisis of 1997 was a twin crisis; foreign exchange crisis and domestic credit crunch. During the post-crisis IMF programs, there were both corporate and financial restructuring and about two-thirds of top-30 conglomerates went bankrupt. But toward the end of this stage, Korean economy was affected by New Economy and IT revolution. There was substitution of investments from

conventional non-IT sectors to IT sectors but the employment absorption by IT sectors was rather weak and once IT boom was over by 1999, the investment became quite stagnant casting doubt on new sources of sustainable growth for Korean economy.

2.4 An Episode of Rapid Productivity Convergence

So far we have reviewed productivity change in Korea and its fast productivity convergence mostly in quantitative terms with historical perspectives. As reviewed before, Korea was basically an agricultural economy by early 1960's.According to my long-run data base of Korea (Pyo, 2001), the share of the primary sector (Agriculture, Fishery and Forestry) in total value added has changed: 62.6 % (1911), 47.1 % (1938), 40.4 % (1953) and 41.1 % (1961). The share of the primary sector in total employment is estimated to have changed: 87.4 % (1911), 82.5 % (1938), 70.4 % (1953) and 64.2 % (1961).

The episode of productivity change has begun by a concerted effort of government and private sector. After the Rhee government was toppled by student demonstration on April 19, 1960, a weak cabinet government was formed but economic and political instability followed until President Park consolidated power through a military *coup* on May 16, 1961. The Park government was very weak in legitimacy and therefore, had to establish themselves by solving nation's economic hardship and eliminating poverty. They announced a series of economic stabilization measures including Freezing of High-interest Loans to farmers and fishery households on May 25, 1961. By the measure, farmers and fishers were supposed to pay back their loans to National Agricultural Cooperative Federation (public bank) at reduced annual interest rate (12 %) over extended period of time (5 years). In turn, National Agricultural Cooperative Federation issued Agriculture Finance Bond to lenders which were supposed to be paid back at 20 % annual interest rate over 4 year-period after a one-year grace period. Under the measure, a total of 53.7 billion Hwan was registered as high-interest loans and 29.6 billion Hwan was ruled as eligible loans and 23.7 billion Hwan was paid back through the bond. Since at the time farmers and

fishers were trapped by high-interest (at times over 40 %) curb-market loans which they had incurred as operating expense and child education fees etc., the measure was taken as a significant relief to them and became instrumental in their mobility to manufacturing sector.

The Economic Planning Board (EPB) was established in July 1961 as up-scaled Ministry independent of Ministry of Finance specializing in drafting and administering economic development plans and it was also given budgeting power and supervising role of public enterprises. The Deputy Prime Minister was appointed to head EPB and the planning and implementation of economic development plan was centralized. EPB drafted the First Five-year Economic Development Plan (FEDP) by end of 1961 and announced on January 5, 1962. Under the plan, two-types of industries were chosen as strategic industries. One is labor-intensive manufacturing sector such as plywood, wigs, simple assembly of home electronics and textile & apparel which have best potential for exports. The other is so-called basic industries for constructing infrastructure and providing basic materials for other industries such as steel & iron, cement, and electric power plants etc. which are import-substitutes.

During the First (1962-1966) and Second Five-year Economic Development Plan (1967-1971), the industrial restructuring has taken the form of inter-industry transformation mostly migration from Agriculture, Forestry and Fishery to Mining and Manufacturing and Services. When the first oil crisis shocked the country in 1974, the Korean government started realizing that exports of simple assembled manufactures may become no longer viable. In addition to material and intermediate product cost-inflation due to quadrupled oil prices, there was a substantial wage increase as the Korean economy passed Lewisian turning point around 1975 ending a period of unlimited labor supply.

According to Nurkse (1961), if the source of growth of an economy lies in the growth of a factor, one of the most important tasks is to allocate the factor to the industries with “incremental comparative advantage”. Nurkse (1961, P.308) made distinction between “established” and “incremental” comparative advantage, which becomes necessary as soon as we apply the central concept of international trade theory to the problem of economic growth. After distinguishing between two types of

industrialization, export promotion of manufactured goods to industrial countries and production for domestic markets, he then argued:

"It is to make use of growing resources which cannot with comparative advantage be absorbed by expansion in the traditional sectors that industrialization becomes really necessary. We therefore envisage industrial activities, whether for export or for home use, as being set up on top of the existing export sectors, so long as in these sectors a country still enjoys a high "established" comparative advantage even though, as a consequence of sluggish expansion of external demand, its "incremental " comparative advantage in these lines may be low."

In other words, it is necessary to view comparative advantage in a dynamic setting for development strategy based on export promotion through industrialization. In case of Korea, the inter-industry transformation in the form of migration from traditional sector to Manufacturing has taken place during the period of 1962-1974. Then it was substituted by intra-manufacturing transformation and restructuring during the period of 1975-1979 from unskilled labor-intensive industries to skilled-labor intensive industries and more capital-intensive industries. This restructuring was provoked by the first oil crisis in 1973-74.

The second restructuring was carried out mainly during 1980's in order to rectify some of the investments which were ill-conceived or mismanaged. After President Park was assassinated in October 1979, there was a brief period of political instability and also the second oil crisis in 1980 followed. The growth rate of real GDP dropped from 9.3 percent in 1978 and 6.8 percent in 1979 to – 1.5 percent in 1980. The regime of President Chun coming from military background also had to seek a political legitimacy by improving economic conditions. One of the policy doctrines by President Chun was to follow President Park's principle of keeping economic policies independent of political and military influence. Most of major economic policy decisions were left to expert bureaucrats who had decided that there was a need to carry out a major industrial restructuring and reduce foreign debt.

During the period of 1975-79, some of the conglomerates carried out pre-emptive investments in heavy and chemical industries such as automobile, shipbuilding, cement, iron and steel, and refinery and petrochemical industries following the Government policy direction to restructure economy from light

industries to heavy and chemical industries. Many of such projects had become white-elephants in early 1980's and no longer viable. Some of the major conglomerates had to give up several projects and consolidation of excessive investment had become inevitable. The government initiated restructuring through government-controlled banks such as Korea Development Bank which had provided loans to major heavy and chemical industries projects.

During the period of 1980's there were some important policy shifts to help restructuring economy. The first shift was to promote technology-intensive industries after learning lessons from over-investing in heavy and chemical capital-intensive industries. From early 1980's Samsung entered into semi-conductor investments and Lucky-Goldstar (LG) and Hyundai followed Samsung. The second shift was made by Ministry of Commerce and Industry (MCI) which changed industrial support policy from direct support system to indirect support system. For example, in the 1970's MCI tried to identify so-called strategic export sector and promoted the industry by providing various incentive tax-cum subsidy system and easy access to loans by government controlled banks. But in the 1980's the direct support system was slowly replaced by indirect support system. For example, there was R&D support system and investment tax credit system for investments in energy-saving machinery and equipments and facilities. The third shift was to move toward import liberalization in commodity markets as documented in Pyo (1990). The trade liberalization effort in the 1980's had provided a significant incentive for industrial restructuring by reducing inflationary pressure and therefore, reducing financial distortion which existed in the form of the gap between official bank lending rate and unofficial curb-market rate.

The third industrial restructuring was made as a consequence of IMF bail-out measure after the December 1977 financial crisis. As documented in IMF (2003), it was a basically twin-crisis: a combination of domestic banking crisis and foreign exchange crisis. Under the system of IMF mandated bail-out, Korean industries had to go through a massive restructuring. As I have outlined in Pyo (2004), in 1997 there were thirteen *Chaebols* out of top-thirty *Chaebols* that went under court-supervised restructuring. The fundamental cause of the 1997 crisis in Korea was pre-emptive over-investments by major conglomerates while there was a significant reduction in

rates of return. As I defined in Pyo (2000), it was the failure of excess competition model as a consequence of unchecked financial liberalization and lax bank supervision.

The excess competition occurred not because *chaebols* were not interested in profits but because they began to realize that their protected market and regulatory regime was being threatened by the change in political economy between the government and chaebols and by increased foreign competition through full-scale trade and financial liberalization by Korea's accession to WTO and OECD. The change in political economy was inevitable because Korea was going through a very turbulent period of democratization in transition from quasi-military authoritarian regimes of Presidents Chun(1981-1987) and Roh (1988-1992) to a truly civilian government of President Kim (1993-1997). The transition implies a transformation from a strong government with more control power to a weaker government with less control power. In other words the alliance between the government and big business through exchange of political contribution and favoritism has been weakened creating an environment where chaebols are no longer well-protected in their respective markets. And the impending foreign competition had accentuated this trend and had made many conglomerates impatient and nervous and caused them to over-react or over-invest recklessly.

The industrial restructuring after 1998 has taken form of M&A and big-deals among troubled major conglomerates as reviewed in Pyo (2004). In addition, as IT boom followed after the financial crisis, Korean industries have invested in IT sector and venture capital as analyzed in Ha and Pyo (2004). But the investment stagnation was followed and therefore, the long-run prospect of productivity growth is quite uncertain at this point. After a massive restructuring in the form of cuts in employment and working hours, the labor productivity has improved but the overall gain in total factor productivity is not observed yet. But the recovery after the crisis was made possible by some productivity gain through industrial restructuring under IMF- mandated programs.

In summary, the episode of rapid productivity convergence in Korea was made possible by successful adoption of development strategy based on incremental

comparative advantage and industrial restructuring by the government initiative. It was a consequence of interaction between market forces and government intervention.

3. An Assessment of the Major Determinants of Productivity

3.1. Creation, Transmission and Absorption of Knowledge

The fruits of knowledge which is frequently hidden and intangible by its nature have been important determinant in Korea's productivity growth. The stock of knowledge at the beginning stage of development plans was very shallow such that it did not reach to the threshold level where externality can be put into effect.

(1) Adoption of New Technology

As in many developing countries, Korea relied on imported foreign technology to carry out construction and operation of major manufacturing facilities. At the beginning stage, the imported technology came in the form of machineries and equipments mostly from the United States and Japan. The operation manuals by the Japanese producers could be well-interpreted because there were many senior engineers who were trained in the colonial period. One of the reasons why the Japanese machines and equipments were popular at the beginning stage of development is this familiarity with the system and know-how. Another reason is easy access to after-service because of the proximity to Japan. As the engineers and scientists trained in late 1950's and 1960's from the United States started returning home in late 1960's and 1970's, their familiarity with US machines and equipments has slowly substituted Japanese machines and equipments for US machines and equipments.

The R&D and technology imports are two important windows of technology adoption in many developing countries. But the success of late industrialization ultimately depends on the country's indigenous technological capacity to absorb new technologies at the right time. In general, technology buyers in developing countries are given multiple choices of different technologies by technology sellers in advanced countries for a given plant construction or processing know-how.

Usually the choice of the right technology at the right price and at the right timing is the most crucial part to the success of the project. And without indigenous technological capacity, industries in developing countries can not make optimal choice of technology.

In case of Korea, this role of choosing the right technology at the right time was left to entrepreneurs and engineers not to bureaucrats. Most of engineers have been foreign-educated and consulted domestic R&D centers to acquire knowledge on technology in question. In other words, the indigenous technological capacity itself was a human capital.

Even though it is difficult to identify statistically the growth of indigenous technological capacity, the patent statistics can provide us with one source of indicators. According to statistics compiled by Korea Patent Office, the number of patent applications increased exponentially from 1948 (169 cases) to 1960 (611 cases), 1980 (5,070 cases) and 1997 (92,734 cases). The composition by applicant's nationality is as follows: 1948 (Korean 100%), 1960 (Korean 89.2 %, USA 2.7 %, West Germany 1.6 %), 1980 (Korean 24.5%, USA 22.7 %, Japan 32.0 %) and 1997 (Korean 72.6 %, USA 7.9 %, Japan 12.0 % , Germany 2.5 %). In summary, Japan and United States have been two dominant foreign patent applicants but Korean share which was once declined to the level of 24.5 % in 1980 has been kept up at over 70 % level in mid-1990's. It is one indication of indigenous technology build-up.

There are two additional indicators for the development of indigenous technological capacity. One is the status of national technical certificates and the other is the status of vocational training. According to Ministry of Labor's Yearbook of Labor Statistics, total national technical certificate holders increased from 122,833 persons in 1978 to 541,544 persons in 2000. The composition by kinds of national certificates was Craftsman (54.8 %), Industrial Engineer (24.6 %), Assistant Craftsman (11.9 %), Engineer (8.5 %) and Professional Engineer (0.3 %) in 1978. It changed in 2000 to Craftsman (78.0 %), Industrial Engineer (10.2 %), Assistant Craftsman (2.2 %), Engineer (9.0 %), Professional Engineer (0.4 %) and Master Craftsman (0.1 %). It indicates while professional engineers and engineers certificate holders did not increase much in recent years because the market demand

for their service is limited, the supply of craftsman certificate holders increased significantly both in numbers and in shares.

(2) Research and Development

One of the maintained hypotheses that I would propose is that the main R&D activities in Korea were pioneered by the first generation of scientists and engineers who have been educated and trained from the United States and Europe. They include the founding members of KAIST and Korea Defense Research Institute etc. Since at that time, private firms R&D facilities were fragile and often lacked the right equipment and facilities and financial compensations were also low. Therefore, the bulk of major scientists and engineers preferred the government think-tanks. It was only in the 1990s when the prestigious private R&D centers run by major conglomerates could offer better salaries and non-salary remunerations.

R&D activities at both government and private sector level needs to be assessed. In general, R&D expenditure can be decomposed into two categories; public R&D and private R&D. In case of Korea, the role of public R&D was dominant at the beginning of its development plan in 1960s. However, public R&D could not satisfy technology and engineering demand by private firms as the industrial structure is transformed from light industries to heavy and chemical industries during 1970's. The private R&D which was motivated by various tax incentives by the government had been oriented toward more application and adaptation technologies and engineering know-how. Therefore, there seem to have been a complementary relationship between public R&D and private R&D during 1960s and 1970s in Korea.

On the other hand, the role of private R&D started to dominate public R&D in Korea from mid-1980's when Korea's industrial policy shifted from direct industry-specific support policy to indirect functional support policy. It was also the time when major Korean conglomerates started investing semi-conductors, higher-value added steel and metal products, and machinery and equipments including automobiles. In the 1990's, the public R&D played an important role in telecommunication industries. For example, ETRI (Electronic Telecommunication Research Institute) and KISDI (Korean Information Society Development Institute)

are representative examples. And public R&D and private R&D started having not only complementary elements but also competitive elements.

The differential role of public R&D and private R&D in the evolution of Korea's R&D policy needs to be carefully examined and its relationship with productivity performance in key sectors should be evaluated. For example, according to Ministry of Science and Technology and Electronics and Telecommunications Research Institute, the R&D expenditure on Information and Telecommunication has occupied 20 percent of total R&D expenditure and 0.39 percent of GDP in 1991 but increased by 2000 to 49.2 percent and 1.32 percent level respectively. The sector's R&D expenditure was decomposed between public and private by the ratio of 18 percent and 82 percent respectively in 1991 but changed to the ratio of 10 percent and 90 percent in 2000.

The overall trend in R&D expenditure shows a remarkable upward trend both in terms of absolute amount being put in and the relative share to GDP as shown in appendix Table. The total expenditure increased from 1.2 billion Won (0.24 % of GDP) in 1963 to 13,848 billion Won (2.67 % of GDP) in 2000. The sustained productivity growth was made possible by building up its own indigenous technological capacity through division of work between public R&D and private R&D.

The number of R&D institutes increased from 72 in 1963 to 2,856 in 1996 and R&D manpower increased from 1,750 persons to 132,023 persons during the same period. In 1996, 11.7 percent of R&D manpower was with research institutes, 34.3 percent was with universities and the remaining 54 percent was with private firms. The decomposition of R&D expenditure by function shows: basic R&D (18.2 %), applied R&D (28.9 %) and product development (53.0 %) in 1983 and basic R&D (12.6 %), applied R&D (24.3 %) and product development (63.1 %) in 2000 as shown in Appendix Table. The relative weight of R&D expenditure in product development became larger than basic or applied R&D expenditure in recent years. It indicates the private R&D expenditure has become more important than public R&D and Korea's R&D has become more commercially oriented expenditure.

(3) Technology Transfer

Regarding technology import policy, Korea has adopted the promotion of R&D and technology import as a prime policy to enhance productivity increase which can be linked to a good export performance. Korea's development strategy from the very beginning of 1960's aimed at inducing syndicate loans from World Bank, Asian Development Bank, and commercial banks and then, reallocated them to project-qualified companies through government controlled banks such as Korea Development Bank, Korea Small and Medium Enterprise Bank, Korea Export and Import Bank, etc. Therefore, the role of direct foreign investment was relatively insignificant, which was different from the development strategies of Singapore, Hong Kong, and Taiwan.

Under the system, the project-awarded qualified companies had to meet the government standard of export performance and cost-benefit requirements by substantially improving productivity performance. They have had relatively little time for endogenous R&D effort and had to rely on imported technology. Most of imported technology had been in the form of imported know-how and manuals which come with the purchase of imported machinery and equipments. Later on most of imported technologies were in the form of purchased licensing agreements and intellectual property rights. But most of firms had to invest in minimum R&D in order to build their own technology-adoption capacity typically by building their own laboratories and sending their engineers abroad for further training. Indigenous R&D came much later as most of firms have accumulated enough level of adoption technology. Therefore, the government policy aiming at promotion of R&D and liberal technology import policy must have affected positively on the productivity performance of project-awarded firms.

According to Science and Technology Yearbook by the Ministry of Science and Technology, the number of technology import cases reported was 285 cases during 1967-1971: Electrical & Electronics (65 cases), Refinery & Chemical (59 cases) and Machinery (58 cases) among other industries. The number increased sharply during the period of Korea's investment in heavy and chemical industries (1972-1976) to a total of 434 cases: Machinery (116 cases), Refinery and Chemical (85 cases) and Electrical & Electronics (84 cases). However, as the Korean economy started to increase investment for technology intensive sectors such as semi-

conductors and IT sectors from mid-1980's the industrial composition also changed. The total number of technology import cases (5,830 cases) during the period of 1985-1996 is decomposed as Electrical and Electronics (2,016 cases, 34.6 %), Machinery (1,714 cases, 29.4 %) and Refinery & Chemical (979 cases, 16.8 %).

In terms of statistics on technology licensing payments by countries, the United States was dominant donor country during 1962-1966 with 0.5 million US$ (71.4 %) out of a total of 0.7 million US$. After the diplomatic relationship with Japan was restored in mid-1960's, Japan became the second largest technology supplier: During 1967-1972, a total of 26.6 million US$ was paid as technology fee to the United States (11.0 million US$, 41.4 %) and Japan (10.5 million US$, 39.5 %). In 1996 just before the financial crisis of 1997, the total technology fee payment reached a record high level of 2,297.2 million US$ with the decomposition by the United States (1,160.0 million US$, 50.5 %) and Japan (723.9 million US$, 31.5 %). So the United States and Japan continued to be two dominant suppliers of technology to Korean industries.

3.2. Factor Supply and Allocation

Korea's policies affecting productivity can be categorized as (1) input-driven policies such as investment promotion, export-subsidy, and mass education policy, (2) R&D and Technology Import Policy, and (3) Policies aimed at improving overall socio-economic infrastructure.

The mechanism of input-driven policies and productivity performance needs to be examined in depth because it is the core of policy-productivity relationship knowing that the Korean economy has been the beneficiary of input-driven policies rather than that of total factor productivity increase. First, on the theoretical side, I would explain the mechanism as a regulatory equilibrium in which monopolistic competition across industries prevails. As I have outlined in Pyo (2000), in such an imperfect competition model, the role of government serves two purposes: exit and entry regulator for each monopolistic competition market and performance-monitor for the distribution of policy loans though government-controlled financial intermediaries.

I hypothesize that one of the key success elements in Korea's input-driven policies is the fact that the government relied on the conglomerates' export performance as the prime target criteria for awarding next round projects and further policy loan allocations. In other words, they have avoided their own way of subjective judgment system which quite often entails bureaucratic corruption and political favoritism.

In fact, one of the main reasons behind the 1997 financial crisis in Korea was the failure of deregulation in financial industries with appropriate financial supervision mechanism. As outlined in Pyo (2000), the system of regulatory equilibrium with tight government control on entry-exit of firms and financial intermediaries could be no longer maintained in early 1990s as Korea went through a turbulent period of transition from authoritarian military regimes to a more democratic one.

In what follows, we review determinants of input-driven productivity growth in turn from human capital, labor supply, physical capital and infrastructure.

(1) Human Capital

In terms of human capital accumulation, we should note a remarkable feature in the history of modern Korea. That is the introduction of mass-education in primary schools at unprecedented rates and at the time of starvation and political unrest. According to Kimura (1986), the overall primary enrolment ratio for boys in 1911 was 15.2-19.1 percent at the end of Yi Dynasty. And a survey of national illiteracy conducted by the colonial government as part of population census in 1930 showed the overall illiteracy rates of 50.4 percent for males and 89.8 percent for females.

The primary school enrolment ratio, which has been frequently used as a proxy for human capital in recent growth literature, had been lifted up twice remarkably in modern history of Korea. The first jump occurred during 1930's after the Colonial Government of Imperial Japan had adopted a conciliatory policy to integrate Koreans into mainland Japanese. They started introducing the Japanese system of education in place of traditional apprenticeship-like Korean system called *Seodang*. By 1940, the primary school enrolment ratio ascended to about 60 percent and 30 percent for boys and girls respectively. But a survey conducted by the post-colonial

government in 1945 found that 77 percent of adults over 13 years old still did not have the skills of reading and writing in Korean language, *Hangul.* The US military government and the succeeding Rhee government had to make intensive efforts to eradicate adult illiteracy. The second jump occurred around 1957 when the Rhee government started introducing American system of mass education and the primary school enrollment ratio had ascended to 70 % level without too much differential between boys and girls.

By 1960, the primary school enrolment ratio had reached 99.8 percent level as shown in Appendix Table. However, the composition of population by educational attainment (25 years old and over) in 1966 shows that 79.6 percent of population were primary school graduates or under and only 3.7 percent were college graduates and over. Thus the initial condition of educational attainment in Korea in 1960's can be summarized as the vast expansion of primary education with very limited higher education. On the other hand, Korea has adopted education policy in which public education plays greater role in primary and secondary education than in tertiary education. The college-level education was left for competition between public and private colleges and universities.

The hypothesis that I put forward here is that the beneficiaries of mass education in the 1930's have become manager classes and those of mass education in the 1950's have become major force of production and office workers in the later development periods of 1960's and 1970's. This seemingly two-tier system of human capital has been the core of Korea's success in late industrialization, which distinguishes itself from other developing countries.

As shown in Appendix Table A4, the composition of population of 25 years old and over by educational attainment show: Primary School Graduates and under (79.6%), Middle School Graduates (11.1 %), High School Graduates (5.6 %) and college Graduates and over (3.7 %) in 1966 and the corresponding rates became 23.0 %, 13.3 %, 39.4 % and 24.3 % in 2000. So the fast and large-scale expansion of primary school education in the late 1950's has been instrumental to developing indigenous R&D capacity, enhancing technology adoption skills and building up human capital through advances into higher education.

As I have shown in Pyo (1998), the role of human capital in Korea in its earlier development stage was as a productive input rather than as accumulated knowledge to provide externality. The growth miracle of South Korea is not a miracle but the result of sustained accumulation and use of human capital.

(2) Labor Supply

Considering the unfavorable initial conditions such as lack of natural resources, high population density, existing twin gaps and war-devastated socio-economic infrastructures by early 1960's, Korean government had to rely on relatively abundant labor force to start up its engine for late development from 1962.

Other than educational indicators, the initial conditions in Korea around early 1960's were far from being favorable. The unemployment rate was high (8.1 %) in 1963 and the dominant portion (63.0 %) of population were still left at Agriculture, Forestry and Fishing. Since the primary sector's production share in 1963 GDP was only 43.4 percent, the economy was being dominated by a low-productivity primary sector.

The employment statistic by industry shows a typical pattern of rural-urban migration and primary-manufacturing shift during the period of 1960-1974. As the economy passed the Lewisian turning point and the period of unlimited supply of labor was over around 1974, the unemployment rate was reduced from 8.1 percent in 1963 to 5 percent level in 1974. The proportion of employed persons in the primary sector declined very fast from 63 percent in 1963 to 34.0 percent in 1980 and 10.9 percent in 2000 while that of manufacturing increased fast between 1963 and 1980 from 7.9 percent to 21.6 percent but remained flat until 2000 (20.2 %).

The shift in labor supply from the primary sector to the secondary sector was made possible by various tax and subsidy incentives provided to manufacturing export industries. For example, there were tax incentives and at times subsidies in the construction of dormitory housing for plant workers and in the supply of wages-in-kind such as free or low-cost meals and clothing etc. Many elementary workers particularly women employees found the dormitory life safer and more convenient with modern facilities such as TV sets and refrigerators. Of course, the primary motivation of the labor shift came from higher wages and salaries in manufacturing

and the job security. In the primary sector of agriculture and fishery, there were wide-spread disguised unemployment and the employment in the sector was very much cyclical and seasonal so that rural workers started dreaming of obtaining secured employment in urban setting. A various OJT programs offered by firms eliminated the fear of urban employment by migrated workers from rural area.

In summary, the pattern of labor supply in Korea during last four decades can be characterized as follows. At the first stage (1960-1974), the vent-for-surplus type quantity of labor supply helped by the rapid expansion of primary education has dominated the scene. Also at this stage, the shift from the primary sector to the secondary sector was made being helped by rural-urban migration. Then in the second stage (1975-1987) there was major intra-industrial labor shift within manufacturing from labor intensive manufacturing to heavy and chemical manufacturing as shown in Row 8 of the Appendix Table. In the third stage (1988-2000), as the Korean economy moved into a more information and technology intensive structure and service-oriented economy, quality of labor rather than quantity of labor became more important than before.

(3) Physical Capital

The rate of growth in physical capital in Korea during last four decades is truly an unprecedented one. UNIDO estimate of 11.21 percent is quite similar to my own estimate of 11.39 percent even though the method of estimation is different. I have used the polynomial benchmark equation method linking four benchmark years' data rather than perpetual estimation method assuming 13.3 percent depreciation rate. My estimates of economic depreciation rate for the aggregate capital stock were lower than 13.3 percent; 9.4 percent during 1977-1987 and 7.8 percent during 1987-1997.

The growth rate in Korea was higher than the growth rate (10.3 %) of gross capital stock in Japan in its high growth period (1964-1985) and that of net stock in Taiwan(1960-1987) as I noted in Pyo (1996, Table 4). Such a rapid accumulation of physical capital can be made possible under the two conditions. One is a sustained continuation of high rates of return and the other is a continued rise in savings rate

in particular private savings rate. As observed in Pyo and Nam (1999), Korea's before-tax gross rate of return (gross operating surplus/ gross capital stock) was as high as 33.7 % in 1971 higher than Japan's gross rate of return (31.2 %), which led Harberger to term two economies as "outliers". At the same time, two economies had maintained higher than OECD average savings rate. Even though both Japan and Korea experienced the rapid decline of rate of return from 1975 and from 1985 respectively and their rates ultimately converged to OECD average level by early 1990's, they had met these two conditions for the rapid accumulation of physical capital.

The high rates of return in Korea during the 1970's and the1980's was made possible by the combination of two factors. One factor was the relative suppression on labor movement and wage increase and the continued incentive for internal corporate retained earnings through low-dividend policy. The other factor was households' preference for higher savings and lower consumption for educational purpose and investment in housing to guard themselves from hyper-inflation.

The expansion of primary education during late 1950's had opened up the possibility of moving up the ladder of higher education for many beneficiaries of primary education. They had been taught about the virtue of savings for higher education and for securing housing. The private savings rate in 1960 was only 5 percent but has more than doubled within a decade and more than tripled within two decades. The gross savings rate increased from 9.0 percent level in 1960 to 18 percent level in 1970, 24.4 percent in 1980 and 32.4 percent in 2000. The domestic gross investment ratio started off at 10.0 percent level in 1960 but increased fast to the level of 36.2 percent in 1980 exceeding gross domestic savings rate but reduced to the level of 28.3 percent in 2000. The sustainable productivity growth over four decades since 1960 in Korea was made possible by the sustained growth of gross domestic savings particularly private domestic savings, which were channeled into sustained domestic investment. Otherwise, Korea might have experienced foreign debt problem as many Latin American countries in the 1980's.

According to Economic Planning Board's Main Economic Indicators (1980), out of total gross domestic capital formation (100%) the share of government savings declined from 37.8 percent in 1960 to 19.4 percent in 1979 while the share

of households' and non-profit organizations' savings increased from – 16.9 percent to 29.2 percent. Williamson (1977) pointed out that Korean households' financial savings were low because of low interest rate policy by the government and high inflation rates thus making real interest rate low. However, they saved in the form of housing without mortgage loans and other forms of savings in non-financial intermediaries.

The allocation of capital through credit control and policy loan schemes in earlier period and more liberalized financial system in later period must have contributed to the accumulation of physical capital because the waste of capital was closely monitored by both government and banks controlled by government.

(4) Infrastructure

There was very little social overhead capital too as a consequence of the devastating Korean War by early 1960's as summarized in Appendix Table. The number of telephone subscribers per 100 persons was only 0.3 persons and the ratio of running water supply was only 16.8 percent. The electric power consumption per capita was only 46 Kwh. The number of registered motor vehicles per 1,000 persons was only 1.3 vehicles.

However, Korean government has allocated long-term and lower-interest loans from international lending institutions through Korea Development Bank and Korea Housing Bank etc. to public corporations and enterprises such as Korea Highway Corp., Korea Railroad Corp., Korea Electric Power Corp., and Korea Marine and Port Management Corp. etc. The provision of social infrastructure was not always adequate and sufficient because the demand for social overhead services always exceeded their supply because the speed of growth in other sectors such as manufacturing, export service, import service, and transportation and telecommunication has been tremendously fast.

The public corporations and enterprises which have provided utility services and other social overhead services have been closely monitored and evaluated by the government ministries in charge of the sector. From mid 1980's their salaries and other benefit system was linked to their performance, which were evaluated by an independent commission. They also began to be privatized from mid-1990's to

increase their efficiency. In general, there was not major bottleneck in the provision of social overhead services particularly in the supply of water, electric power and other vital services such as telecommunications to support manufacturing activity. The electric power consumption per capita in 2000 became 5,067 Kwh. Water supply ratio reached 87.1 percent. Main telephone lines in operation per 100 persons reached 44.1 in 2000, which is comparable level with that of Japan (55.8 in 1999). Mobile telephone subscribers per 100 persons reached 54.9, which exceeded that of Japan (49.4).

3.3. Institutions, Integration and Invariants

The recent growth literature such as Hall and Jones (1999) and Rodrik (2003) go beyond a mechanical explanation of factor accumulation for productivity growth and emphasize the importance of deep determinants such as geography, integration and institutions. However, these deep determinants are frequently historical endowments and set initial conditions that cannot be altered by the development authorities at the time of launching a development plan.

Historical Endowments and Initial Conditions

The Republic of Korea (hereinafter called Korea for brevity) had remained as a hermit kingdom of Lee Dynasty up until 1910 when it was annexed to Imperial Japan as a colony. The colonial experience under the Japanese rule has affected tremendously Korea's post-1945 development and the initial conditions at the time of launching successive Five-Year Development Plans under President Park in 1962.

There have been both positive and negative evaluations on Korea's colonial experience and its impacts on late industrialization. Some have argued that the forced annexation by Imperial Japan had deprived Koreans of the opportunity for an indigenous formation of capitalist state and had ultimately invited the division of the Korean peninsula between North Korea and South Korea as a consequence of emerging Cold War. They argue that modernization and industrialization under the Japanese colonial rule served for the imperialistic purpose and therefore they produced distorted growth without national capitalism. On the other hand, others

have argued that even though there was a massive human rights violation and oppression, the colonial government of Japan had introduced mass-education in primary schools and had planted a form of industrialization through breeding manufacturing and laying out social overhead capital.

The Korean experience after the turbulent period of independence in 1945, the establishment of the Republic of Korea in South Korea in 1948 and Korean War during 1950-1953 have all affected the initial conditions at the time of development planning stage and the pattern of late industrialization. There was very little physical capital to start with in 1962 due to the complete discontinuity in investments during the period of 1942-1953. There was war preparation by the Japanese Government (1942-1945), which is followed by turmoil and massive immigration following independence in 1945. Then the Korean War broke out in 1950 with devastating effects on both physical and human capital. Even after the Korean War, the Korean Government had to rely on US aids to avoid starvation and carry out minimum reconstruction from the devastating war.

Korea's historical endowments and initial conditions in early 1960s can be characterized as typical twin gaps, investment-savings gap and foreign exchange gap. In 1960, the domestic gross investment ratio was 10.0 percent while gross savings ratio and private savings ratio were 9.0 percent and 5.0 percent respectively. The ratio of imports to GDP was 12.7 percent while the ratio of exports was only 4.1 percent. Therefore, one can conclude that Korea's initial conditions in early 1960's were typical of an economy being trapped in twin gaps.

It has been often the case that the political economy of Korea's economic development was ignored or treated as exogenous factor. For example, the role of dictatorship in economic development has not been fully addressed. While the social and institutional set-up in Korea in the 1960's and 1970's certainly require the in-depth study on the interaction of politics and economics, we have not paid due attention to the impact of political suppression on economic development.

The period of economic development (1961-1979) under President Park after he consolidated power through a coup on May 16, 1961 can be characterized as development under a typical development dictatorship. Its regime can be defined as authoritarian regime. The period under President Chun (1980-1987) and President

Roh (1988-2002) both with military background can be characterized as semi-authoritarian regime with lesser degree of dictatorship but still with the mode of authoritarian regime in planning and implementing development policies.

The role of dictatorship in economic development in Korea has been controversial as that of the Japanese colonial rule. The positive aspect of dictatorship is that it mobilizes resources easily and allocates them among strategic sectors efficiently if there is relatively less corruption. However, it cannot continue for sustained period of time even though it did over three decades in case of Korea because of two reasons. One is the so-called Lipset phenomenon that economic growth ultimately invites democracy as I discussed at length in Pyo (1993). The other is the tendency that absolute dictatorship is endangered by corruption and collusion between government and business. Therefore, the dictatorship could be a necessary evil at certain earlier stages of economic development. The longer it stays, the deeper its distortionary effects on entire sectors of economy and therefore, it would take longer period of time to recover itself and restore the growth momentum. This could be a lesson for China which has been growing quickly under an authoritarian regime.

Integration

At the time of launching Economic Development Plans, Korea's integration to the world economy was very shallow and fragile. It was somewhat land-locked by Communist China, Soviet Union, and North Korea in cold war era. The trade with Japan had been lagging because of sour relationship with the country in the past: a full diplomatic relationship with Japan was restored only in 1963. The United States was regarded as the source of foreign aids rather than as trading partner.

In 1961, the shares of export (38.6 million US dollars) and import (103.1 million US dollars) in GNP (2,103 million US dollars) were only 1.8 percent and 4.9 percent respectively. Gross savings rate of 11.7 percent was decomposed by domestic savings rate of 2.9 percent and foreign savings rate of 8.6 percent. Investment from abroad was 47.4 million US dollars during the five year period of 1962-1966 of which 25 million US dollars (52.7 %) was from the United States.

However by end of the First Five-year Economic Development Plan in 1966, the export and import increased to the level of 253.7 million US dollars and 673.2

million US dollars respectively by about 5 times and 6.6 times respectively from 1961 level. Thus, Korea's main window of integration was export and import. The export promotion policy under the slogan of "Export First" could not be maintained without import increase because of lower domestic contents of most of export items at the time. But it opened the window to integrate Korea to world market. Integration through trade was followed by technology imports to support export-oriented manufacturing and commercial loans and foreign direct investments throughout 1970's and 1980's.

The success of Korea's integration by exporting can be viewed by a combination of many factors: the availability of both unskilled labor at earlier stage and skilled labor at later stage through the expansion of education system and credit rationing in favor of policy loans in the sectors strategically chosen. But at the same time, it should be emphasized that the transparency of well-monitored export system itself was the most important element in the mechanics of self-generating export performance. The export regime adopted by the Park government during 1962-1979 was a basically incentive system in favor of good-performing exporters whose performance are judged not by the corrupted bureaucrats but by the international market which demands a system of transparency. It also let entrepreneurship grow because without it export market cannot be developed and maintained.

One of the most important means of integration was education and training abroad and the brain drain in earlier period and the reverse brain drain in later period. Even though there are few statistics on the magnitude of education abroad and the brain drain, a recent report by the Bank of Korea provides a startling statistic. The report estimates the total expenses of education and training in foreign countries including living expenses of accompanying families as 6 billion US$ in 2003, which exceeds the official remittance (1.85 billion US$) reported in Balance of Payments by over three times. This amount is about one-third of the total household expenditure on education (22.2 trillion won, 18.6 billion US$ at the average exchange rate of 1,191.9 Won per US dollar).

In terms of economic integration with other countries through Free Trade agreements (FTA), Korea has been latecomer. FTA with Chile in 2003 was the first FTA. FTA with Japan is at initiation stage. However, integration by joining OECD

and WTO in mid-1990's has influenced the nation tremendously. As I have argued in Pyo (2000), the 1997 financial crisis in Korea was the consequence of adjustment failure under the pressure by WTO and OECD of opening up domestic economy in both trade and finance. It was more or less institutional failure due to lax bank supervision on corporate financing and mismanagement of short-term debt.

3.4 Competition, Social Dimension and Environment

Korea has maintained a competitive environment in social mobility through education. It has also pursued egalitarian social and economic policies which may have helped the productivity growth.

The constant inflow of scientists and engineers from abroad was made possible as Korea's economic development passed the Lewisian turning-point in mid-1970s and since then followed the sustainable long-term high-growth. In the background of such constant inflow lies the mass-education but a very competitive education system. In such a social environment, promoting one's human capital was commensurate with promoting one's physical and financial wealth.

On the other hand in terms of industrial policy, the government has deliberately introduced limited competition by lowering entry barriers over time and by monitoring market failures by major conglomerates in order to maximize efficiency of limited resources as I have outlined in Pyo (2000). In other words, the government has played the role of competition promoter and supervisor through government-controlled banks which are part of quasi-internal organization. In this regard, the system has promoted monopolistic competition across industries. That is why one observes in Korea a larger number of automobile manufacturers, telecommunication equipment producers, mobile phone companies and so on than those normally observed in many developing countries or smaller advanced countries. For example, in automobiles there were at least three producers and in electronics there were always more than three competitors. In case of semiconductor industry, Samsung entered to the market in the early 1980's following the Japanese semiconductor manufacturers. But then the Korean government allowed market entry by Lucky-Gold Star (LG) and Hyundai to promote the competition. Such an example is not limited to export

industries. The monopoly of Korean Airline Group in airline business was broken when government allowed the second airline's (Asiana) market entry in mid 1980's. In case of mobile telecommunication, the government tried to break the monopoly of SK in cellular phone service by issuing another license to a cellular operator called Shinsegi and then introduced further competition issuing licenses to three PCS service providers. The bureaucrats wanted to avoid such blame that they are bribed or lobbied by a certain business conglomerate.

Together with abundant reserve labor force with minimum education level, the social environment in a relatively egalitarian state seems to have interacted positively toward gearing up launching an economic development plan. As outlined in Pyo (1996), the ruling class in the colonial period was discredited after gaining independence from Japan and most of land owners lost power after the land reform in 1949 and the subsequent Korean War. The social environment in early 1960's of Korea was pretty much a classless society in which average household regarded a better education for their children as best investment for upward social mobility. The Confucian tradition in favor of education must have acted positively too but it should be noted that the household's choice of educational investment was a rational economic choice rather than a cultural or religious one. The parents have expected higher rates of return on education of their children because in a classless society, upward social mobility is determined by education.

While there was a strong notion that Korea started off in the early 1960's as a relatively egalitarian society, the rapid accumulation of capital after the launching of development plan could have made income distribution worse than before. There are no reliable statistics of income distribution in 1970's and early 1980's. The Family Income and Expenditure Survey by National Statistical Office provide index of concentration (Gini Coefficient) starting from 1985 and Urban Wage Earners' Households Income from 1993. These two sources of income distribution statistics show a conflicting pattern. The former Gini coefficient has improved from 0.345 in 1985 to 0.295 in 1996 just before Korea's financial crisis of 1997 as shown in Appendix Table. On the other hand, the latter Gini coefficient has deteriorated from 0.281 in 1993 to 0.291 in 1996 and 0.317 in 2000. The latter Gini coefficient seems more reliable because it reflects the impact of a financial crisis on income distribution:

in general, a financial crisis worsens income distribution because of increase in unemployment and high interest policy ensuing after the crisis which makes the rich richer and the poor poorer because the former has financial assets while the latter has financial debts.

Alternatively, we can examine the trend of labor income share in both aggregate economy and manufacturing as an indirect indicator of functional income distribution. The share of labor income in the aggregate economy estimated by the Bank of Korea shows an increasing trend from 1953 (0.27) to 1960 (0.39), 1980 (0.51) and 2000 (0.59).

My estimate of labor income share in manufacturing shows also a steady upward trend but with some fluctuation from 1953 (0.42) to 1960 (0.49), 1980 (0.58), 1996 (0.66) and 2000 (0.52). The reduction of labor income share from 1996 to 2000 reflects the impact of the financial crisis in 1997 and is consistent with the worsened Gini coefficient of urban wage earners' Household income. At the same time, it is a manifestation of factor price equalization theorem in the long-run that as a relatively labor-abundant country engages in free trade, the wage increases relative to price of capital; the free trade benefits the relatively abundant factor of the trading country.

Other social network policies include minimum wage law which was adopted in early 1980's after 20 years of carrying out economic development plans. They also include labor relations law and welfare policy for the handicapped and the households below absolute poverty income level. Even though these welfare policies still lag for behind industrial nations they must have helped in improving overall socio-economic infrastructure and improving productivity at family-level.

Looking at labor union statistics from Appendix Table, we note that unit unions and union members increased between 1981 and 2000 from 2,141 units to 5,698 units and from 967,000 persons to 1,527,000 persons respectively. However, the union membership rate declined from 20.8 percent to 12.0 percent during the same period. Both number of labor dispute cases and working days lost have improved from the peak year of 1988 to 2000.

Lastly policies aimed at improving overall socio-economic infrastructure may include Social Overhead Capital (SOC) policy, Land and Rural Development policy and Education and other Social Network policy. The Korean government has directed

most of project loans from international public lending institutions such as the World Bank and Asian Development Bank to Social Overhead Capital Sector: highways, port facilities, railroad, water supply and highways, hospitals and other health facilities through public enterprises because their loans tend to be long-term loans with lower interest rates.

Land and Rural Development Policy aimed at avoiding excessive urbanization particularly in Seoul metropolitan area in order to reduce inflation in land and housing prices. New Village Movement under President Park had aimed at improving agricultural productivity by carrying out a rural development program.

3.5. Issues specific to Korea

Korea-specific factors such as historic legacy coming from the Japanese Colonial Period (1910-1945) and the division of the Korean peninsula and the resulting national preoccupation with security issues should be addressed. Political environment and security issues should be added to provide broader picture of Korea's unique development history.

Defense budget in Korean government expenditure occupied 53.7 percent in 1953, 35.0 percent in 1960, 20.0 percent in 1990 and 11.2 percent in 1999. At the time of launching Economic Development Plan in early 1960's, the defense budget was an overhang to the economy. At times, the constant confrontation with North Korea was used as a means of political suppression by authoritarian regimes and suppression on union movements. However, the security issue has had some positive aspects in lifting up overall productivity of the economy. For example, national conscription system might have deprived from Korean youths of their opportunity to advance the next ladder of learning and training but it also provided them a minimum general education to read and write and most of all a discipline as workforce.

The vent-for-surplus type supply of labor force has been the cornerstone of Korea's rapid industrialization. But it was only a part of necessary conditions. There must have been interaction in a market economy between government and entrepreneurs. The government established after a military coup by President Park in

1961 lacked the legitimacy as a democratically elected government. Therefore, they sought for restoring the popularity of their regime by carrying out economic development plans successfully. In other words, their political stability depended on economic prosperity and most of all they had to create jobs for the urban unemployed and the vast disguised unemployed in the rural sector.

Economic development and late industrialization is often a complex interaction between endogenous historical heritages and imported institutional elements. It involves more than mechanical income-growth dynamics. Therefore, we want to go beyond the traditional explanations of the determinants of free market system and search for more cultural and historical aspects. The reason is that without expanding the boundaries of our research, we may not be able explain for the rising sentiments of anti-market movements and pro-socialist policy doctrines under increasingly unwarranted egalitarianism in recent years in Korea.

Recent researches on history and culture have argued that religious practices and beliefs had important consequences for economic development. They have argued that explanations for economic growth should go further to include a nation's culture. We have tended to ignore or underestimate the cultural and religious aspects of entrepreneurship which is the core of free enterprise system. As Barro and McCleary (2003) have demonstrated, religiosity affects economic growth and in turn, the pattern of economic growth will affect religiosity. For example, the percentage of population with religion in Korea has increased from 42.6 percent in 1985 to 53.6 percent in 1999 while per capita GNP increased from 2,242 US dollars to 9,438 US dollars.

According to Social Statistics Survey by National Statistical Office, there is religious pluralism in Korea: the decomposition of religion is Buddhism (49.0 %), Protestant (34.7 %), Catholics (13.0 %), Confucianism (1.3 %), and others (2.0 %). Such pluralism in religion combined with other cultural heritages must have affected not only work-ethics but also entrepreneurship.

During the process of rapid economic development, Korean people used to think that the remarkable achievement of growth is mainly due to either government's planning or work-ethics of the ordinary workers, without realizing the role of entrepreneur for finding the business opportunities. They regarded free-enterprise system is basically implanted system and viewed it as free-good in a capitalist society.

In recent years, while there are ample evidences of benefits of free enterprise system, some anti-market and anti-business sentiments have been growing among civil activists, intellectuals, and union leaders. We have begun to realize that free enterprise system is not free.

The free enterprise system and entrepreneurship is like two sides of coin: without one, the other cannot survive. As I argued before, one of the main reasons why Korea could grow so fast under dictatorship is because the dictatorship was relatively less-corrupted and it pursued export promotion maintaining a certain degree of transparency in who gets what and how. Through this system the entrepreneurship in Korea could be nurtured making one of the most successful story of late industrialization.

The current situation would become worse, as many international consulting organizations ascribe the poor performance in national competitiveness to environment and institutions hostile to business activities. This hostile environment inside Korea is a fatal problem for further growth, as international economies become more integrated: Korean firms tend to stop investing domestically and foreign investments do not flow into Korea.

In order to assess the strengths and weaknesses of Korea's development strategy and identify the policy-side determinants of Korea's productivity performance during last five decades, we need to review policy documents and directives by major Ministries such as Economic Planning Board (now Ministry of Finance and Economy), Ministry of Trade and Industry, and Ministry of Science and Technology etc. We also need to refer to policy survey literatures published by various government think-tanks such as Korea Development Institute (KDI), Korea Institute of Industrial Economy and Technology (KIET) and Korea Institute of International Economic Policy (KIEP) etc. We discuss these policy issues in the following section.

Policy documents and directives at each Ministry level and policy review papers and books by the Bank of Korea, industry associations, and think-tank research institutes will be analyzed. And if there is any apparent change in policy directions and regimes, it will also be explained.

Institutions which were established and promoted to pursue export-oriented regime will be documented and their roles will be assessed. Korea's regulatory

structure and bureaucratic capacity will also be analyzed in historical perspectives in light of productivity growth. Based on broad categories of policy directions and analysis which may have affected Korea's productivity performance, we will draw conclusions on the relationship between policy directions and productivity performance in Korea.

3.6 Ranking Relative Importance of Determinants

As outlined above, each determinant of productivity must have played different role in productivity growth and its rapid convergence. Among numerous determinants which must have mutually interacted, I would rate human capital determined by historical precondition as the most important determinant without hesitation. The enlargement of primary education and upward mobility in education system are the key elements in improving nation's stock of human capital. The human capital enhances knowledge, absorptive capacity, indigenous R&D efforts, and institutional environments.

The second most important determinant is the maturity in social institutions and political stability. Without maturity and stability in socio-economic institutions, a development program cannot be maintained. We can find numerous histories of failure in development programs in modern world history. Most of them failed not because there was lack of physical capital or resources but because there was social disruption and political instability.

4. Policy Aspects of Productivity Growth

4.1 Directly Productivity-Enhancing Policies

There have been policies impacting productivity increase in a direct manner in the Republic of Korea. Even though the modes of such policies varied over time, such policies have attempted the promotion of R&D, adoption of new technology and

industrial restructuring or targeting from lower-productivity sector to higher-productivity sector.

As we have outlined in the previous chapter, the policy direction by the Korean government during the period of 1953-1961 was the promotion of import-substituting manufacturing by means of allocation of foreign exchange earned through foreign aid. Therefore, there was very little aspect of direct productivity-enhancing policies during the period of 1953-1961.

The trend continued even after the formal launching of Five-Year Economic Development Plan in 1962. From 1962 to 1981, most of productivity-enhancing policies were of the second type: targeting strategic export-promoting sector, designating certain areas as Export Processing Zone (EPZ), and series of trade policies designed to promote export industries. There was very little policy attempt to improve R&D facilities and technology adoption until the early 1980's.

Most of R&D policies were formulated by Ministry of Science and Technology (MOST) in consultation with Economic Planning Board (EPB) and Ministry of Commerce and Industry (MCI). After experiencing two-rounds of oil crisis and the first year of negative real GDP growth(-2.1%) in 1980, the new government of the post-Park regime had realized the limitation of extensive growth based on factor accumulation and capacity expansion under the so-called " Heavy and Chemical Industrialization Policy " and started to seek for new sources of growth. According to MCI, the policy targets announced in February 1982 included export promotion with enhanced value-added, the upgrading and rationalizing of industrial structure and enhancement of industrial competitiveness through maintaining balanced growth among different sectors.

By the end of March 1982, MOST has selected a total of 108 Special R&D Projects which will be carried out by 80 private firms (a total of 7.2 million US dollars) and 28 government research institutions or enterprises (a total of 18.7 million US dollars).

In June 1982, MOST has announced Five-Year R&D Plan for Fine Chemical Industries selecting 200 projects in five areas of specialization (a total of 62.8 million US dollars of private funds and 77.5 million US dollars of government funds).

In February 1984, the government announced a plan to promote basic R&D to co-fund with the private sector a total of 100 million US dollars by 1988. In March of the same year, Ministry of Finance had announced to provide R&D Funds to not only hardware manufacturers but also software manufacturers. In September, the Bank of Korea announced to increase financial support to Small and Medium Industries (SMI) who adopt technology innovation plans and new technology development.

In January 1985, Ministry of Finance announced an ambitious plan of mobilizing a total of 243.7 million US dollars as R&D funds from five financial institutions for technology development including Korea Development Bank (KDB) and National Investment Fund (NIF). In August 1986, MCI announced a plan to support software industries by funding through Industrial Development Fund (IDF) as infant industries in order to prepare for import liberalization and intellectual property rights issue. On the other hand, MOST announced a plan to spend a total of 126.2 million US dollars as Special R&D Expenditure in three representative technology-intensive frontier industries: Fine Chemical, Semi-Conductor and New Material Industries.

In November 1986, MCI selected a total of 219 manufacturing processes which are in need of urgent R&D projects (837 cases) and announced to support those selected R&D projects to be completed in two years by 1988.

4.2 Indirectly Productivity-Enhancing Policies

One of the most important and effective productivity-enhancing policies is the incentive system for export promotion. After the First-Five Year Economic Development Plan was launched in January 1962 by President Park who had consolidated power after a military coup in May 1961, MCI introduced Export-Import Link System in January 1963. The system was designed to give incentives and favors to those who actually perform exporting by giving them license to import, which was often lucrative business. In March 1965, MCI announced Import Licensing System for Equipments of Export Industries based on installment payments.

A series of policies were followed to promote export. In March 1963, MCI asked exporters to report them export cases where they were suffering from delayed transportation and bottlenecks in cargo shipping. In September 1904, the bill for Export Industrial Complex was passed in National Assembly. In April 1965, Monetary Board of the Bank of Korea had established rules and regulations on opening L/C to raw material imports for export processing and construction and equipments for export industries using

Japanese private commercial loans of the amount, 20 million US dollars, which was a part of concessionary terms and conditions of restoring diplomatic relations with Japan was allocated to purchasing raw materials and machinery and equipments for export processing.

There were also sector-specific indirect policies to provide overall social overhead capital and financial capital to strategic industries. In July 1967, the first year of the Second Five-Year Economic Development Plan, the Government selected Pohang and Ulsan as industrial complex area for steel and petrochemical industries respectively. In November 1967, the Government decided to invest a total of 64.4 billion Won (foreign loan of 190 million US dollars and domestic loan of 34.8 billion Won) for the construction of the First Steel Manufacturing Plant.

In July 1968, MCI announced to promote electronics industry by earmarking 900 million Won from 1969 budget. In January 1969, MCI realigned Export Specialization Industries as 10 industries including electronics by supporting a total of 60 million US dollars of foreign capital and 973 million Won of domestic capital. In June 1969, MCI has announced Basic Plan for Promotion of Electronics Industry under Electronics Promotion Law. In June 1970, a total of 51 electronics items were selected for development in 1970 by providing 1.13 billion Won from Electronics Development Fund. In September 1969, EPB designated the city of Masan as Export Processing Zone (EPZ) inviting foreign capital into labor-intensive industries.

In November 1970, MCI added shipbuilding as strategic export industry and decided to increase the capacity to 100,000 ton level by 1971 and consolidating small and medium–sized shipbuilders to make them competitive. In April 1973, MCI drafted a long-term promotion plan of shipbuilding industry by providing 145.8

billion Won to make domestic demand fulfilled by domestic supply by 1976 and to become 10th largest ship-building nation.

In February 1972, MCI designated machinery industry as a target industry for localization and import substitution. It selected a total of 1,549 items for the promotion of domestic production by providing Machinery Industry Promotion Fund. In July 1972, MCI had selected 13 import-substituting industries such as oil products, paints, office machines and ceramics and transform them into export industries to diversify exports.

In May 1973, the government established Guidelines of Foreign Capital Inducement for Development of Heavy and Chemical Industries (HCI). The Guidelines stipulated the ratio of own capital to borrowed capital to be at minimum 30:70 and that in case of joint-ventures, the equity share of foreign investment cannot exceed 50 percent. Subsequently in August of the same year, the Government decided to induce foreign capital of 10 billion US dollars for the development of HCI and created National Investment Fund by issuing National Investment Bond to maximize mobilization of domestic resources for HCI. In September, the Government designated four industrial development areas (Onsan, Changwon, Yeosu and Kwangyang) for HCI. In October, the Government changed Korea Export Promotion Ltd. which was a government enterprise into a General Trading Company (GTC). Later major business groups followed it establishing their own GTCs as window firm for export marketing, finance and foreign investment. According to domestic financial plan drafted in February 1974, the share of HCI reached 68.4 percent while the remainder (31.6 %) would go to light manufacturing sector. In November 1981, the government decided to build the Second Integrated Steel Plant in Kwangyang by 1988 by investing a total of 2.7 billion US dollars (domestic investment of 1.6 billion US dollars and foreign loan of 1.1 billion US dollars).

On the side of labor policy, the cabinet approved Decree on Labor Dispute Coordination for Foreign Investment Companies in December 1969 to induce foreign capital. The Korean economy was approaching to the end of unlimited labor supply in early 1970's. Therefore, the government introduced a comprehensive On-the-Job Training (OJT) programs in May 1973 to help firms overcome the shortage of skilled labor during the Third Five-Year Development period (1972-1976).

The experience of the second oil shock and the first negative growth in 1980 in the political instability followed after the assassination of President Park had made the entire HCI plans reevaluated. The turning point in Korea's industrial policy came in 1983 when the government switched from direct industrial promotion to indirect and functional support system. In other words, the new industrial support system was designed to avoid sector-specific industrial promotion and targeting strategy and to introduce more competition through import liberalization. Under the new paradigm of industrial policy, for example instead of supporting specific industries such as cement and steel manufacturing, the government supported investments in energy-saving machinery and equipments by a variety of financial-incentive and tax-incentive system. At the same time, the relative importance in industrial targeting was switched from capital-intensive industries to technology-intensive industries. Samsung started investing semi-conductor manufacturing in order to catch up Japanese firms and the Korean government allowed LG and Hyundai to enter into semi-conductor market to promote competition. There was also active support into software industries to promote technology-intensive industries.

4.3 The Political Economy and Institutional Aspects

Both public and private institutions have been set up by interest groups reflecting the political economy of development plans at the time they were established. For example, the Federation of Korean Industries (FKI) was established in January 1961 by bigger business groups and conglomerates. The military coup in May 16, 1961 had made the drafting of economic development plan inevitable because the new government had to establish their legitimacy by appealing to the public that their coup was necessary to help save the nation's economy. Economic development rather than a full genuine democracy was advanced as foremost national goal.

The military government which had frozen all financial institutions on May 16 started to allow financial transactions on May 18 and introduced a series of reform measures. They announced basic economic policy plans on May 31 and the First Five

Year Economic Development Plan (1962-1966) on July 22. They also introduced a series of populist policies such as High-interest Loan Rescheduling Scheme for Agriculture and Fishery which was designed to soothe farmers and fishers who were suffering from high-interest curb-market loans. They also introduced Illegal Assets Liquidation Act which was forced upon a few business groups which were suspected of accumulating assets by rent-seeking and political connections.

On the institutional side, the military government had introduced several reform measures. They created Economic Planning Board (EPB) to implement economic development plan. They also established Agricultural Cooperative Federation and Small and Medium Enterprise Bank in 1961. In February 1962, Ulsan Industrial Area was designated and its construction started. On June 10, Emergency Monetary Reform Measure was announced by denominating currency unit from 10 Hwan to 1 Won to curb hyper-inflation and identify tax base.

In 1965, the government started introducing environmental measures to protect environments as the economic development plan gets underway. In May it announced seven-year Forestry Development Plan as part of the Second Five-year Economic Development Plan and the installation of 100,000 street lighting in rural area within the year. In June, the Ministry of Construction had drafted 10-year master plan for development of water Resources including the construction of multi-purpose dams for generating electric power and flood control system. In June 1970, as part of the Third Five-Year Economic Development Plan, Integrated Energy Development Plan was drafted including atomic power plant (600,000 KW).

In December 1970, the government decided to put 314 billion Won for the 10 years from 1971 to develop four largest river basin areas as part of water management policy. In March 1976, MCI announced a plan to lift up electrification rate of rural area from 65 percent to 77 percent by allocating fiscal and financial funds of 5.6 billion Won.

These policies aimed at balanced growth between urban and rural area in an attempt to mitigate the impacts of a rapid urbanization and industrialization.

The government introduced also several measures for foreign trade and foreign capital inducement. In March 1966, Korea-Japan Trade Agreement was signed and in July, Foreign Capital Inducement Act which integrated several decrees and laws was

passed by National Assembly. In March 1967, the government decided to join GATT. In June 1968, the government signed tariff concession schedules for 18 items through GATT Representative Office. In January 1968, MCI announced a plan to introduce export insurance system. In June 1969, Korea Export Import Bank was established to finance medium and long-term financing of export and import. In February 1972, EPB announced a plan to improve balance of payments by switching from direct tax system on item-by-item to indirect regulation through tariffs, exchange rates and import support. In 1973, the government abolished special tariff measures and introduced flexible tariff system and abolished direct tax exemption policy for export industries. The *ex ante* tariff exemption on raw material imports for export processing had been switched by *ex post* tariff rebate system. In April 1986, the government changed approval system on foreign capital inflow to registration system and enlarged the scope of positive system under which the list of permissible items was identified.

In order to promote competition among big firms, the Fair Trade Act was introduced in October 1971. In 1981, Fair Trade Commission designated a total of 666 firms in 14 industries as restricted from forming cartels. In June 1985, the government required C*haebols* to register their cartels in order to avoid their excessive concentration power. At the present time, Fair Trade Commission remains as a powerful watchdog to large conglomerates and *Chaebols.*

5. The Financial Crisis and Stagnation

The transition from authoritarian or semi-authoritarian regime to a democratic one was far from being smooth. At times Korea had to go through a very turbulent period both politically and economically. As I observed in Pyo (2000), a distinguishing feature of export-led growth in Korea was its unique industrial structure. The government policy protected bureaucrats from accusations of being linked to one or two conglomerates' interest but, at the same time, provided big conglomerates with irresistible incentives for horizontal diversification. The phenomenon of 'too big to be failed' set in because big conglomerates themselves were stockholders of many financial institutions and the moral hazard in financial institutions started eroding their competitiveness. The top 30 conglomerates were producing over half of Korea's GNP

and the top five conglomerates' share was as much as one-third of the country's total production.

The business groups called *'chaebol'* in Korea many look quite similar to the Japanese 'zaibatsu', but they are different in many respects. First, Korean *chaebols* had to rely on developing the export market more intensively than the Japanese firms because their domestic market size was less than 5 per cent of the Japanese domestic market size in 1975 (US$20.9 billion, as against US$499 billion, in term of GNP) and less than 9 per cent in 1995 (US$ 453 billion, as against $5156 billion, in terms of GNP). As a result, there could coexist in Japan two types of zaibatsu: one is a highly specialized technology leader in multinational markets (for example, Toyota, Sony and Toshiba) and the other is a business group of horizontally diversified firms (for example, Mitsubishi group, Mitsui group, Sumitomo group and Fuji group). But, in Korea, only the latter type (for example, Samsung, Hyundai and Lucky-Goldstar) could be established because specialization was riskier than diversification under the oligopolistic setting with the government regulation on entry and exit. In addition, diversification through cross-shareholding could generate higher economies of scale in a limited domestic market.

Second, the way the business groups are governed in Korea is quite different from that in Japan. As a result of dissolution of zaibatsu under the MacArthur administration, there were few dominant family groups which could own and manage zaibatsu. The corporate ownership structure in Japan is a more diversified one than that in Korea and the role of institutional investors is much more important in Japan than in Korea. As a result, the decision-making process and the corporate governance in Japan are much more consensus-based than those in Korea. Such a difference in ownership structure and governing pattern could make a substantial difference to the outcome of the excess competition because a more consensus-based system can survive better than an authoritarian owner-management system at the time of policy failure and can protect itself from overextension through a built-in system of checks and balances.

But now the model of monopolistic competition across industries in Korea had been subject to change both domestically and internationally. First of all, the so-called 'Lipset phenomenon' had arrived on the sociopolitical scene of Korea, as outlined in

Pyo (1993). The country's success in export-led growth had brought about increasing demands for democracy and the transition from an authoritarian regime to a democratic one has been turbulent rather than smooth. The increasing demand for higher wages and benefits by organized labor through, at times, violent disputes and strikes had placed an extra burden on firms' efforts at restructuring and 'downsizing'. But most important of all, in the face of increasing domestic and foreign competition, some monopolistic competitors had carried out a series of ill-fated pre-emptive strategic investments. As anticipated in Pyo et al, (1996), the potential impacts of the World Trade Organization (WTO) in a general equilibrium context had become much greater than those in a partial equilibrium context. One typical manifestation of such impacts was over-investment in non-tradable sectors and pre-emptive investment in some tradable sectors.

Considering the current market trend towards deregulation and privatization, it was difficult for the government to discourage the entry. Even though it did not materialize owing to the objections by the government and the subsequent financial turmoil, we could have seen another pattern of oligopolistic competition in the steel industry, too. Many Korean firms in the automobile industry and the semiconductor industry tried to put themselves in strategic positions in the global market. They seemed to take the view that there was increasing demand for their products from emerging markets and transition economies. They regarded their products as not necessarily top-quality goods but as reasonably priced, competitive products in such markets. Their success or failure depended on their income-generating capacities because they had to pay back interests and principals of the loans they had borrowed from domestic and foreign banks. This game of high-yield high-risk in strategic markets was to determine the substantiality of export-led growth in Korea. Such a game could not have been maintained if there was no moral hazard in the financial sector and if the government was strong enough to insulate its bureaucrats from the distributive politics among *chaebols* and other interest groups, including labor unions. But neither condition was met. In addition, the owner-management corporate governance without consensus building and internal checks and balances resulted in over-investment in existing business and caused excessive competition against a background of moral hazard in the financial sector and lax banking supervision by

weak government. In my judgment, this was the most fundamental cause of the financial crisis in Korea.

A recent report by the Independent Evaluation Office (IEO) of the IMF (2003) has characterized the financial crisis of 1997 in East Asia as a new type of balance of payments crisis which has been triggered by a massive capital inflows followed by a sudden capital outflows. In particular, the report has noted that the nature of the crisis in Korea and Indonesia was "twin crises" in which the external crisis coincided with a banking crisis. We can identify South Korea, Indonesia, Malaysia, Thailand, and the Philippines as five Asian-Crisis countries and Japan, Hong Kong, Singapore, Taiwan, and China as other five East Asian non-crisis countries.

The overall assessment on the macroeconomic performance by Asian-Crisis countries is that the rebound of growth over the period of 1999-2000 has slowed down in the subsequent period of 2001-2003 mainly because of stagnant demand for domestic investment across all crisis-inflicted economies. In particular, the domestic investment on Machinery and Equipment has been very disappointing. For example, in case of Korea, its average annual growth rate was 17 percent during the pre-crisis period of 1994-1996 and became negative during the crisis-years in 1997(-8.7%) and 1998(-38.8%). Then the average annual growth rate has become explosively positive in 1999 (36.3%) and 2000 (35.3%) but suddenly has dropped in 2001 (-9.6%), 2002 (6.8%) and 2003 (-1.4%).

There are two main issues at hand in examining the investment trend in the post-recovery period in Asian-Crisis countries. One issue is whether the stagnation in investment is a permanent phenomenon and, therefore, the period of "East Asian Miracle" is over. The other issue is why the volatility of investment is so large during the post-crisis period of 1999-2003.

In order to resume sustainable growth and renew the productivity convergence, Korea needs to find a new paradigm and system under drastically changed social and political landscapes. The Korean economy has been struggling in finding such a path under a non-authoritarian regime. It may take much longer time than expected because under the current mode of globalization, relying on market mechanism seems to be the only solution for a small open economy like Korea.

6. Theoretical Search for Rapid Convergence and Stagnation

As I have outlined so far, the episode of productivity convergence may not be modeled by a single theory or model. However, the distribution of credits in a few strategically chosen sectors can be viewed as the policy of putting more real money balances in those sectors on average. Yoo and Pyo (1986) modifying the model of Sidrauski (1976) has shown that real money balances can be treated as productive input as both consumer goods and producer goods. By adopting a policy of allocating more real money balances in producers sector, the economy can achieve higher rate of capital accumulation and productivity convergence.

On the contrary, the model can be extended to show that if for some reasons, the real money balance in production sector is wasted in for example, non-tradable sectors or if real money balances becomes bigger in consumption sector, there can be productivity stagnation. Another alternative model is a growth model with adjustment costs for investment explored in Barro and Sala-i-Martin (1995, PP 119-127). In an open economy, the presence of adjustment costs associated with the installation of capital which is defined as a composite of physical and human capital, implies that convergence of capital stocks and output would be less than instantaneous and therefore, may explain the stagnation. In Iwata and Miyagawa (2003), the debates on Japan's lost decade is presented. Hayashi and Prescott(2002) explains decline in Japan's TFP growth in the lost decade. Hayashi and Prescott (2004) argues the institutional rigidity in agriculture was the main cause of stagnation in the prewar Japanese economy. The search for the theoretical models which can explain not only Japan's lost decade but also Korea's stagnation after the financial crisis seems to be warranted to renew the East Asian miracle.

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Appendix

Table A1-1 Export Performance by Goods (%)

	1953	1954	1955	1956	1957	1958	1959	1960	1961
Agriculture, forestry, and fishery	11.8	15.0	23.4	22.9	24.3	21.7	27.7	29.8	18.7
Mining	73.9	61.9	51.5	59.4	53.5	44.2	44.2	35.7	38.3
Manufacturing	14.3	23.1	25.1	17.7	22.2	34.0	28.2	34.5	42.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Hong, Wontack (1975), *Factor Supply and Factor Intensity of Trade in Korea*, Seoul: KDI

Table A1-2 Imports of Aid by Sources (Unit: million US$)

Year	ECA & SEC	CRIK	UNKRA	ICA & AID	PL480	Sum	Total Imports	*Aid*/*Imports*
1953	0.2	158.8	29.6	5.6	0.0	194.2	345.4	56.2%
1954	0.0	50.2	21.3	82.4	0.0	153.9	243.3	63.3%
1955	0.0	8.7	22.2	205.8	0.0	236.7	341.1	69.4%
1956	0.0	0.3	22.4	271.0	33.0	326.7	386.1	84.6%
1957	0.0	0.0	14.1	323.2	45.5	382.8	442.1	86.6%
1958	0.0	0.0	7.7	265.6	47.9	321.2	378.2	84.9%
1959	0.0	0.0	2.5	208.3	11.4	222.2	303.8	73.1%
1960	0.0	0.0	0.2	225.2	20.0	245.4	343.5	71.4%
1961	0.0	0.0	0.0	156.6	44.9	201.5	421.8	47.8%
Total	0.2	218.0	120.0	1,743.7	202.7	2,284.6	3,205.3	71.3%

Source: The Bank of Korea, 『Economic Statistical Yearbook』

Table A2 Five-Year Economic Development Plan: Plan and Performance

Table A2-1. The First Five-Year Economic Development Plan: Plan and Performance

Type	1962		1963		1964		1965		1966		1962~1966 (annual average)	
	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance
GDP Growth Rate (%)	5.7	4.1	6.4	9.3	7.3	8.9	7.8	8.1	8.3	11.9	7.1	8.5
Population Growth Rate (%)	2.88	2.85	2.85	2.84	2.82	2.84	2.78	2.70	2.74	2.50	2.81	2.75
GDP per Capita												
Constant at 1960 (Won)	9,824	10,167	10,163	10,803	10,605	11,442	11,123	12,042	11,126	13,153	-	-
Constant at 1975 (US $)	-	239	-	247	-	271	-	280	-	307	-	-
Investment Rate (%)	20.1	12.4	23.0	18.1	24.1	13.5	23.3	13.2	22.7	18.2	22.6	15.1
Domestic Savings Rate (%)	3.7	0.8	7.3	7.0	10.3	6.5	12.0	5.8	12.9	10.5	9.2	6.1
Foreign Savings Rate (%)	16.4	11.2	15.7	11.1	13.8	7.4	11.3	6.9	9.8	7.2	13.4	8.8
Structure of Industries												
Agriculture, forestry, and fishery (%)	36.3	33.4	36.0	32.5	35.4	35.1	34.7	32.3	34.0	31.7	35.3	33.0
Mining and manufacturing (%)	20.3	21.7	21.6	23.0	23.4	22.3	25.1	24.8	27.2	25.7	23.5	23.5
Services (%)	43.4	44.9	42.4	44.5	41.2	42.6	40.2	42.9	38.8	42.6	41.2	43.5
Current accounts (Current million US $)	-309.8	-292.0	-315.1	-402.8	-296.1	-211.0	-263.1	-198.1	-246.6	-250.6	-	-
Exports	65.9	54.8	79.7	86.8	96.0	119.1	121.6	175.1	137.5	253.7	-	-
Imports	456.7	421.8	483.9	560.3	486.9	404.4	485.0	450.0	492.3	673.2	-	-

Table A2-2. The Second Five-Year Economic Development Plan: Plan and Performance

Type	1967		1968		1969		1970		1971		1967~1971 (annual average)	
	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance
GDP Growth Rate (%)	7.0	6.6	7.0	11.3	7.0	13.8	7.0	7.6	7.0	9.4	7.0	9.7
Population Growth Rate (%)	2.40	2.36	2.30	2.35	2.20	2.29	2.10	2.21	2.00	1.99	2.20	2.24
GDP per Capita												
Constant at 1960 (Won)	29,960	32,116	31,337	34,895	32,809	38,755	34,383	40,827	36,069	45,197	-	-
Constant at 1975 (US $)	-	320	-	348	-	387	-	408	-	437	-	-
Investment Rate (%)	17.9	20.2	18.5	24.7	19.1	30.8	19.7	28.1	19.9	28.1	19.0	26.4
Domestic Savings Rate (%)	8.8	10.8	9.9	12.1	11.6	15.5	13.1	14.1	14.4	13.2	11.6	13.1
Foreign Savings Rate (%)	9.1	9.2	8.6	12.8	7.5	13.6	6.6	13.3	5.5	15.4	7.5	12.9
Structure of Industries												
Agriculture, forestry, and fishery (%)	36.6	37.5	36.0	34.2	35.3	33.2	34.6	30.4	34.0	28.8	-	-
Mining and manufacturing (%)	23.4	15.1	24.2	16.7	25.1	17.5	26.0	19.5	26.8	20.9	-	-
Services (%)	40.0	47.4	39.8	49.1	39.6	49.3	39.4	50.1	39.2	50.3	-	-
Current accounts (Current million US $)	-116.3	-191.9	-126.8	-440.3	-115.0	-548.6	-102.6	-622.5	-95.8	-847.5	-	-
Exports	300	335	360	486	420	658	480	882	550	1,132	-	-
Imports	725	909	784	1,322	815	1,650	855	1,804	894	2,178	-	-

Table A2-3. The Third Five-Year Economic Development Plan: Plan and Performance

Type	1972		1973		1974		1975		1976		1972~1976 (annual average)	
	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance
GDP Growth Rate (%)	9.0	5.8	8.5	14.9	8.5	8.0	8.5	7.1	8.5	15.1	8.6	10.1
Population Growth Rate (%)	1.6	1.9	1.5	1.8	1.5	1.7	1.5	1.7	1.5	1.6	1.5	1.7
GDP per Capita												
Constant at 1970 (Won)	94,929	92,783	101,477	104,706	108,474	111,531	118,956	117,117	123,951	132,748	-	-
Constant at 1975 (US $)	-	454	-	513	-	544	-	574	-	650	-	-
Investment Rate (%)	25.3	24.2	24.8	26.9	24.6	30.7	24.7	29.4	24.9	27.6	24.9	27.8
Domestic Savings Rate (%)	17.7	13.2	18.5	18.0	19.4	17.9	20.4	18.6	21.5	23.1	19.5	18.2
Foreign Savings Rate (%)	7.6	9.5	6.36	8.2	5.2	14.4	4.3	10.4	3.4	6.3	5.4	9.8
Structure of Industries												
Agriculture, forestry, and fishery (%)	26.1	27.8	25.1	25.7	24.2	25.4	23.3	24.9	22.4	24.0	-	-
Mining and manufacturing (%)	24.0	22.3	25.0	25.0	26.0	26.6	26.9	28.0	27.9	29.5	-	-
Services (%)	49.9	49.9	49.9	49.3	49.8	48.0	49.8	47.1	49.7	46.5	-	-
Current accounts (Current million US $)	-591	-371	-544	-309	-472	-2,023	-421	-1,887	-359	-314	-	-
Exports	1,584	1,677	2,027	3,271	2,493	4,515	2,975	5,003	3,510	7,815	-	-
Imports	2,428	2,250	2,773	3,837	3,144	6,452	3,547	6,674	3,993	8,405	-	-

Table A2-4. The Fourth Five-Year Economic Development Plan: Plan and Performance

Type	1977		1978		1979		1980		1981		1977~1981 (annual average)	
	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance
GDP Growth Rate (%)	10.0	10.3	9.0	11.6	9.0	6.4	9.0	-6.2	9.0	6.4	9.2	5.5
Population Growth Rate (%)	1.61	1.57	1.60	1.53	1.58	1.53	1.58	1.57	1.60	1.57	1.59	1.55
GDP per Capita												
Current (In thousand won)	410	468	483	620	555	775	638	900	732	1,095	-	-
Current (US $)	847	966	999	1,330	1,147	1,546	1,317	1,481	1,512	1,607	-	-
Constant at 1975 (US $)	-	705	-	776	-	812	-	750	-	786	-	-
Investment Rate (%)	27.0	31.0	26.3	37.8	25.9	41.8	25.9	33.7	26.0	33.2	26.2	35.5
Domestic Savings Rate (%)	22.0	25.3	23.0	25.7	24.0	25.0	25.1	208	23.1	22.8	24.2	23.9
Foreign Savings Rate (%)	5.0	6.2	3.4	11.0	1.9	16.8	0.8	12.3	-0.1	9.6	2.0	11.2
Structure of Industries												
Agriculture, forestry, and fishery (%)	22.3	222	21.3	19.1	20.3	19.2	19.4	15.9	18.5	19.6	-	-
Mining and manufacturing (%)	34.9	30.6	36.5	32.9	38.0	33.8	39.5	35.7	40.9	31.3	-	-
Services (%)	42.8	47.2	42.2	48.0	41.7	47.0	41.1	48.4	40.6	49.1	-	-
Current accounts (Current million US $)	-634	12.3	-237	-1,085	235	-4,151	679	-5,321	1,172	-4,436	-	-
Exports	9,700	10,047	11,970	12,711	14,519	15,705	17,292	17,214	20,242	20,881	-	-
Imports	10,133	10,523	11,975	14,491	14,043	19,100	16,345	21,598	18,872	24,299	-	-

Table A2-5. The Fifth Five-Year Economic Development Plan: Plan and Performance

Type	1982		1983		1984		1985		1986		1982~1986 (annual average)	
	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance	Plan	Performance
GDP Growth Rate (%)	8.0	5.4	7.3	11.9	7.5	8.4	7.5	5.4	7.5	11.0	7.6	8.4
Population Growth Rate (%)	1.6	1.5	1.6	1.5	1.6	1.3	1.5	1.6	1.5	1.0	1.6	1.4
GDP per Capita												
Current (In thousand won)	1,061	1,289.8	1,142	1,477.3	1,209	1,639.2	1,280	1,761.4	1,355	2,250	-	-
Current (US $)	1,746	177.3	1,879	1,914	1,989	2,044	2,105	203.2	2,229	2,550	-	-
Constant at 1980 (US $)	1,800		1,880		1,979		2,159		2,331		-	-
Investment Rate (%)	27.0	28.6	27.6	29.9	28.7	31.9	29.1	31.1	29.5	29.4	28.4	30.2
Domestic Savings Rate (%)	22.4	20.9	24.1	25.3	26.7	27.9	28.1	28.6	29.3		26.1	
Foreign Savings Rate (%)	4.5	7.0	2.9	4.7	2.0	4.0	1.0	3.1	0.2		2.1	
Structure of Industries												
Agriculture, forestry, and fishery (%)	17.4	16.2	16.8	15.6	16.1	14.4	15.5	14.5	14.9	11.2	-	-
Mining and manufacturing (%)	30.9	30.7	31.8	30.9	31.7	32.6	32.2	32.2	32.7	31.9	-	-
Services (%)	51.7	53.1	52.0	53.5	52.2	53.0	52.3	53.3	52.4	56.9	-	-
Current accounts (Current million US $)	-2,650	-2,650	-1,607	-1,606	-1,000	-1,373	-300	-888	400	4,709.4	-	-
Exports	20,879	878	23,204	204	26,500	335	30,700	442	35,700	34,128.3	-	-
Imports	23,474	474	24,904	967	27,500	371	31,000	461	35,100	29,829.2	-	-

Sources: The Federation of Korean Industries, *The Overview of Korean Economic Development,* 1987

Table A3 Major Social and Economic Indicators of Korea (1960-2000)

Social and Economic Indicators	1953	1960	1980	2000
1. Population Trend (In thousand persons)				
Census Enumeration		24,989	37,436	46,136
Household (In thousand)		4,371	7,969	
Average number of member (In persons)		5.6	4.5	
Estimates of midyear population	20,527[1]	25,012	38,124	47,008
Male	10,083[1]	12,551	19,236	23,667
Female	10,443[1]	12,462	18,888	23,341
Sex ratio (per 100 female)	96.6[1]	100.7	101.8	101.4
Population density (persons per sq.Km)	208.5[1]	254.1	385.1	472.6
2. Summary of Economically Active Population				
Population 15-year old and over		14,551[2]	24,463	36,139
Economically active population		8,230[2]	14,431	21,950
Employed		7,563[2]	13,683	21,061
Unemployed		667[2]	748	889
Non-economically active population		6,321[2]	10,032	14,189
Unemployment rate (%)		8.1[2]	5.2	4.1
3. Employed Persons by Industry (%)				
Agriculture, Forestry and Fishing		63.0[3]	34.0	10.86
Mining and Manufacturing		8.7[3]	22.5	20.23
Manufacturing		7.9[3]	21.6	20.15
Social overhead capital and other services		28.3[3]	43.5	68.91
Construction		2.5[3]	6.2	7.5
Wholesale & retail trade, restaurants & hotels			19.2	27.2
Transport, storage & communication			4.5	6.0
Finance, Insurance, Real estate & Business, service			2.4	9.9
4. National Income (At current prices)				
GNI (Billion US $)	1.4[4]	1.9	60.9	635.4
GDP (Billion US $)	1.3	2.0	62.2	457.4
Per Capita GNI (US $)	67[5]	79	1,598	9,628
5. Growth rate by kind of economic activities [6](%)				
GNI	5.1[7]	1.1[8]	-5.3	3.6
GDP	5.6[7]	1.2[8]	-2.1	9.3
Agriculture, Forestry and Fishing	8.0[7]	-2.1[8]	-20.0	2.0
Mining and Manufacturing	11.5[7]	10.9[8]	-1.2	15.7
Manufacturing	18.1[7]	8.2[8]	-1.6	15.9
Electricity, gas and water	22.7[7]	-0.0[8]	-0.5	14.0
Services	1.2[7]	2.6[8]	2.2	9.5
Producers of government and non-profit services			4.4	0.3
Social and Economic Indicators	**1953**	**1960**	**1980**	**2000**
6. Production Structure (% at current price)				
Agriculture, Forestry and Fishing	47.3	36.8	14.7	4.7

[1] 1952
[2] 1963
[3] 1963
[4] Gross National Products
[5] Per Capita GNP
[6] Series at 1995 constant prices
[7] 1954
[8] Gross National Products

Mining and Manufacturing	10.1	15.9	29.7	31.6
Manufacturing	9.0	13.8	28.2	31.3
Electricity, gas and water	2.6	4.1	10.1	10.8
Services	40.0	43.2	36.0	43.1
Producers of government and non-profit services			9.5	9.8
Industrial Structure				
Light Industries	78.9	76.6	46.4	22.3
Heavy and Chemical Industries	21.1	23.4	53.6	77.7
7. Gross Output and Value-added of Manufacturing (In billion Won, %)				
Gross Output				
Manufacturing	25.3[9]	59.7	36,279.0	564,834.1
Food products, beverages and Tobacco	6.7[9]	12.7	4,979.4	41,129.3
(Composition ratio)	(26.48)	(21.27)	(13.73)	(7.28)
Textiles, Wearing apparel and Leather	9.0[9]	18.1	6,495.4	40,998.6
(Composition ratio)	(35.57)	(30.32)	(17.90)	(7.26)
Wood and products of wood & cork	1.7[9]	4.3	883.8	3,171.7
(Composition ratio)	(6.72)	(7.20)	(2.44)	(0.56)
Pulp, paper products, printing and publishing	1.5[9]	3.7	1,401.6	23,214.3
(Composition ratio)	(5.93)	(6.20)	(3.86)	(4.11)
Chemical products, refined petroleum products, Coke, Rubber and plastic products	2.7[9]	9.3	10,068.4	117,660.4
(Composition ratio)	(10.67)	(15.58)	(27.75)	(20.83)
Non-metallic mineral products	0.8[9]	3.6	1,601.6	16,983.3
(Composition ratio)	(3.16)	(6.03)	(4.41)	(3.01)
Basic metals	0.6[9]	1.8	3,387.3	44,590.8
(Composition ratio)	(2.37)	(3.02)	(9.34)	(7.89)
Fabricated metal products Machinery and equipment n.e.c.	1.9[9]	5.3	6,960.8	267,816.0
(Composition ratio)	(7.51)	(8.88)	(19.19)	(47.41)
Others	0.5[9]	0.9	500.7	9,269.6
(Composition ratio)	(1.98)	(1.51)	(1.38)	(1.64)
Value-added				
Manufacturing		21.9	11,856.60	219,424.60
Food products, beverages and Tobacco		4.2	1,968.30	18,117.70
(Composition ratio)		(7.04)	(5.43)	(3.21)
Textiles, Wearing apparel and Leather		6.4	2,311.20	17,561.10
(Composition ratio)		(10.72)	(6.37)	(3.11)
Wood and products of wood & cork		1.4	205.9	1,285.90
(Composition ratio)		(2.35)	(0.57)	(0.23)
Pulp, paper products, printing and publishing		1.7	526.6	10,558.20
(Composition ratio)		(2.85)	(1.45)	(1.87)
Chemical products, refined petroleum products, Coke, Rubber and plastic products		2.9	2,427.40	35,441.10
(Composition ratio)		(4.86)	(6.69)	(6.27)
Non-metallic mineral products		2.0	682.6	8,423.50
(Composition ratio)		(3.35)	(1.88)	(1.49)
Basic metals		0.5	924.1	13,917.40
(Composition ratio)		(0.84)	(2.55)	(2.46)
Fabricated metal products Machinery and equipment n.e.c.		2.3	2,587.70	110,190.70
(Composition ratio)		(3.85)	(7.13)	(19.51)
Others		0.4	222.8	3,927.90
(Composition ratio)		(0.67)	(0.61)	(0.70)
Social and Economic Indicators	**1953**	**1960**	**1980**	**2000**
8. Savings ratio and Investment ratio (%)				
Gross savings ratio	13.1	9.0	24.4	32.4
Private	11.1	5.0	19.1	19.3
Domestic gross investment ratio	14.7	10.0	36.2	28.3
Domestic gross fixed investment ratio	6.9	9.9	34.0	28.5

[9] 1955

Ratio of Investment to abroad	-1.6	0.4	-8.5	
Ratio of Exports and Imports to GNI	11.7	16.0	80.3	90.3
Exports	3.2	4.1	34.6	46.4
Imports	9.8	12.7	45.8	43.9
9. Electric Power (In GWh, %)				
Total power generated	736	1,697	37,239	266,400
Hydro	395	580	1,984	5,610
(Composition ratio)	(53.7)	(34.2)	(5.3)	(2.1)
Thermal	130	1,117	31,778	151,826
(Composition ratio)	(17.7)	(65.8)	(85.3)	(57.0)
Nuclear			3,477	108,964
(Composition ratio)			(9.3)	(40.9)
Power sold		1,154	32,734	239,535
Consumption per capita (Kwh)		46	859	5,067
10. Number of Registered Motor Vehicles (In thousand)				
Total	12.8	30.8	527.7	12,059.30
Passenger cars	3.7	128	249.1	8,083.90
(Composition ratio)	(28.6)	(41.5)	(47.2)	
Private	1.6	4.2	178.5	7,798.5
Truck	6.8	13.4	226.9	2,511.0
(Composition ratio)	(53.3)	(43.7)	(43.0)	
Buses	2.2	4.2	42.5	1,427.2
Special car	0.2	0.4	9.2	37.1
Number of Licensed Drivers			1,860.7	18,697.3
11. Communication System and Number of subscribers				
Number of communication systems (In thousand)	26	108	2,835	23,841[10]
Analog	26	108	2,815	
Digital			20	23,841[10]
Number of telephone subscribers (In thousand)	23	87	2,705	21,932
Business			971	
Households			1,734	
Telephone subscribers per 100 people (%)		0.3	7.1	47.5
Number of public telephone (In Each)		609	58,017	539,983
12. Overseas Direct Investments (In million US$)				
Total permitted			250.7[11]	
Total invested			145.2[11]	3,668.2
South-east Asia			52.9[11]	829.7
North America			32.7[11]	1,159.4
Europe			5.2[11]	142.1
Liquidation etc.			18.2[11]	191.3
Net invested			127.0[11]	3,476.9
Investment outstanding			127.0[11]	25,816.3
13. Investments from abroad (In million US$)				
Total		47.4[12]	143.1	15,696.7
U.S.A.		25.0[12]	70.6	2,922.3
Japan		8.3[12]	42.5	2,448.2
Hong Kong		2.8[12]	0.5	123.5
Germany		0.2[12]	8.6	1,599.4
United Kingdom		10.5[12]	2.3	84.3
France				607.2
Netherlands			1.8	1,768.4
Social and Economic Indicators	**1953**	**1960**	**1980**	**2000**
14. Elementary School				
Number of School	4,033	4,496	6,487	5,267
Number of Students	2,259,313	3,622,685	5,658,002	4,019,991
Female students (%)			48.5	
Enrollment ratio		99.8	102.9	98.7
Number of Teachers	35,059	61,605	119,064	140,000

[10] 1997
[11] 1968~1980
[12] 1962~1966

Female teachers (%)		22.0	36.8	
Number of Students per teacher	64.4	58.8	47.5	28.7
Number of Students in a class	57.6	57.0	51.5	35.8
15. Advance Rate of Graduates to Higher School Level (%)				
Advance Rate of primary school Graduates to middle school			95.8	99.9
Male			97.4	99.9
Female			94.1	99.9
Advance Rate of middle school Graduates to high school		70.2[13]	84.5	99.6
Male			87.5	99.6
Female			80.8	99.6
Advance Rate of high school Graduates to higher education		29.8[13]	23.7	68.0
Male			24.5	
Female			22.5	
16. Composition of Population by Education Attainment (25 Years Old & Over, %)				
Primary School Graduates and Under	91.8[14]	79.6[15]	55.3	23.0
Male	86.0[14]	68.9[15]	42.8	15.1
Female	97.1[14]	89.5[15]	67.0	30.4
Middle school Graduates	5.3[14]	11.1[15]	18.1	13.3
Male	8.9[14]	15.9[15]	19.8	12.3
Female	2.0[14]	6.6[15]	16.5	14.3
High school Graduates	1.7[14]	5.6[15]	18.9	39.4
Male	2.7[14]	8.5[15]	25.4	41.6
Female	0.7[14]	2.9[15]	12.9	37.3
College, University Graduates and Over	1.3[14]	3.7[15]	7.7	24.3
Male	2.4[14]	6.7[15]	12.0	31.0
Female	0.3[14]	1.0[15]	3.6	18.0
17. Private Institutes (In each, person)				
Institutes		1,136[16]	5,023	57,935
Liberal arts & sciences course		214[16]	381	14,043
Art course		193[16]	1,485	26,160
Management business field		92[16]	1,367	11,029
Attendants		52,009[16]	411,162	7,772,909
Liberal arts & sciences course			117,618	1,388,333
Art course			52,808	987,610
Management business field			123,922	565,350
Instructors			13,332	135,637
Social and Economic Indicators	**1953**	**1960**	**1980**	**2000**
18. Public Education Cost per capita (In thousand won)				
Elementary Schools		4.7[17]	118.5	2,023
Middle Schools		9.5[17]	157.2	2,690
High Schools		19.7[17]	149.7	2,841
Junior colleges		53.0[17]	708.0	3,095
National & Public		50.4[17]	893.3	2,471.0[18]
Teacher's College		44.2[17]	1,114.0	6,449
College & university		68.3[17]	1,036.3	5,526

[13] 1962
[14] 1955
[15] 1966
[16] 1965
[17] 1967
[18] 1997

National & Public		93.3[17]	1,198.2	4,673.8[18]
19. Institutions and Personnel Engaged in R&D				
Research activity performance Institutions		72[19]	647	4,635
Research Institutes			124	173
University & College			202	268
Companies			321	4,194
Researchers		1,750[19]	18,434	159,973
Research Institutes			4,598	
University & College			8,695	50,155
Companies			5,141	70,431
Researchers per 10,000		0.6[19]	4.8	
20. R&D Expenditures character of work (In billion won)				
Total		1.2[20]	621.7[21]	13,848.5
Ratio to GDP (%)		0.24[20]	0.97[21]	2.67
Basic research			113[21]	1,746.1
(Composition ratio, %)			(18.2)	(12.61)
Applied research			179.4[21]	3,370.1
(Composition ratio, %)			(28.9)	(24.34)
Experimental development			329.4[21]	8,732.3
(Composition ratio, %)			(53.0)	(63.06)
21. Water supply				
Water supply (In thousand)	3,451[22]	4,210	20,809	41,774
Water supply ratio (%)		16.8	54.6	87.1
Capacity (In thousand ton per day)	240[22]	517	6,756	26,980
Water supply per person a day (litter)	65[22]	99	256	380
Number of Regions with Water Supply (In each)	50[22]	58	243	861
22. Distribution of Income (Gini Coefficient)				
Family and Expenditure Survey			0.345	0.295
Urban Wage Earners' Households			0.291	0.317
23. Labor Union				
Number of Unit unions			2,141	5,698
Union Members (1,000 persons)			967	1,527
Union Membership Rate (%)			20.8	12.0
Number of Labor Dispute Cases			1,873	250
Working Days Lost(Days)			5,400,837	1,893,563

Sources: Korea National Statistical Office, Social Indicators in Korea (2001), Korea Statistical Yearbook (2001), and Changes in Social and Economic Life in Korea during last Five Decades (1998)

[19] 1963
[20] 1963
[21] 1983
[22] 1954

Table A4. Real GDP Per capita

level	KOREA	USA	JAPAN	level	KOREA	USA	JAPAN
1953	1327.7	11598.2	2839.0	**1977**	4396.4	20001.2	13997.3
1954	1350.0	11289.5	2962.3	**1978**	4746.1	21004.1	14614.4
1955	1458.7	11964.3	3161.3	**1979**	5035.4	21535.4	15282.2
1956	1455.9	11992.8	3370.9	**1980**	4789.8	21335.5	15618.7
1957	1552.4	11942.2	3605.5	**1981**	5018.2	21666.0	15958.0
1958	1538.7	11598.8	3728.0	**1982**	5312.9	20758.8	16311.7
1959	1512.6	12168.5	4039.9	**1983**	5815.8	21463.4	16523.2
1960	1495.2	12272.7	4544.5	**1984**	6236.6	23056.6	17070.7
1961	1542.2	12319.1	5105.1	**1985**	6568.9	23623.7	17743.0
1962	1536.1	12895.2	5493.3	**1986**	7213.4	24172.2	18160.3
1963	1672.1	13309.7	5918.1	**1987**	7945.7	24831.3	18908.5
1964	1755.8	13929.7	6558.6	**1988**	8714.8	25607.5	20118.6
1965	1802.7	14685.6	6839.2	**1989**	9189.9	26278.9	21127.4
1966	2009.3	15396.9	7515.0	**1990**	9952.4	26457.8	22220.2
1967	2077.5	15533.9	8323.7	**1991**	10804.0	25897.9	22847.1
1968	2289.2	16140.7	9411.4	**1992**	11242.8	26488.7	22920.6
1969	2564.2	16525.3	10385.0	**1993**	11717.3	26956.1	22906.2
1970	2715.6	16351.4	11473.6	**1994**	12583.9	27877.9	23032.9
1971	2894.2	16826.1	11849.8	**1995**	13551.6	28408.9	23268.3
1972	2963.0	17685.3	12690.7	**1996**	14319.9	29193.9	24046.5
1973	3299.2	18670.3	13413.9	**1997**	14785.9	30190.3	24427.9
1974	3501.2	18545.6	13018.4	**1998**	13443.8	31090.7	24057.9
1975	3656.5	18041.3	13163.8	**1999**	14809.7	32127.9	24149.9
1976	4022.2	19064.6	13543.5	**2000**	15875.8	33293.0	24675.3

Source: Penn World Table

Level

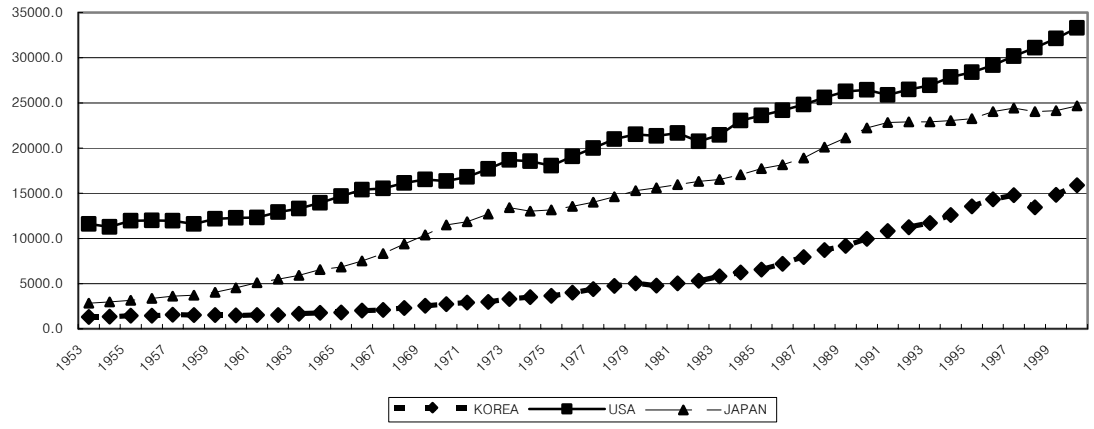

Table A5. Growth rate of GDP per capita

Growth	KOREA	USA	JAPAN	Growth	KOREA	USA	JAPAN
1953				**1977**	8.90	4.80	3.30
1954	1.67	-2.70	4.25	**1978**	7.65	4.89	4.31
1955	7.74	5.80	6.50	**1979**	5.92	2.50	4.47
1956	-0.19	0.24	6.42	**1980**	-5.00	-0.93	2.18
1957	6.42	-0.42	6.73	**1981**	4.66	1.54	2.15
1958	-0.89	-2.92	3.34	**1982**	5.71	-4.28	2.19
1959	-1.71	4.80	8.03	**1983**	9.04	3.34	1.29
1960	-1.15	0.85	11.77	**1984**	6.99	7.16	3.26
1961	3.09	0.38	11.63	**1985**	5.19	2.43	3.86
1962	-0.40	4.57	7.33	**1986**	9.36	2.30	2.32
1963	8.49	3.16	7.45	**1987**	9.67	2.69	4.04
1964	4.88	4.55	10.28	**1988**	9.24	3.08	6.20
1965	2.64	5.28	4.19	**1989**	5.31	2.59	4.89
1966	10.85	4.73	9.42	**1990**	7.97	0.68	5.04
1967	3.34	0.89	10.22	**1991**	8.21	-2.14	2.78
1968	9.71	3.83	12.28	**1992**	3.98	2.26	0.32
1969	11.34	2.35	9.84	**1993**	4.13	1.75	-0.06
1970	5.74	-1.06	9.97	**1994**	7.14	3.36	0.55
1971	6.37	2.86	3.23	**1995**	7.41	1.89	1.02
1972	2.35	4.98	6.86	**1996**	5.51	2.73	3.29
1973	10.75	5.42	5.54	**1997**	3.20	3.36	1.57
1974	5.94	-0.67	-2.99	**1998**	-9.52	2.94	-1.53
1975	4.34	-2.76	1.11	**1999**	9.68	3.28	0.38
1976	9.53	5.52	2.84	**2000**	6.95	3.56	2.15

Source: Penn World Table