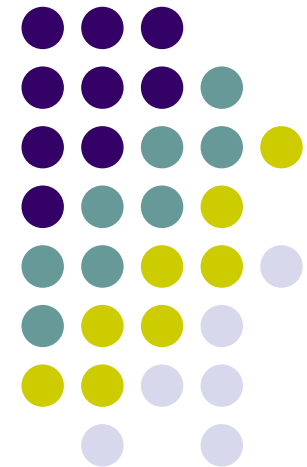


Korea-Japan Workshop on the Industrial Productivity Database

Growth Accounting, Productivity Analysis, and Purchasing Power Parity in Korea (1984-2000)

February 28, 2004

Hak K. Pyo, Keun-Hee Rhee, and Bong Chan Ha



Contents



1. Gross Output Data from National Account and IO Table
2. Measurement of Capital Input
 - National Wealth Survey(NWS) - 1968, 1977, 1987,1997
 - Estimating Method
 - Measurement of Capital Prices
3. Measurement of Labor Input
 - Quantity Factor
 - Quality Factor – Sex, Educational Attainment, Age
4. Characteristic of Korean Database for KLEM Model
5. Gross Output Growth Accounting for Korea (1984-1997)
6. Trends in Productivity and Capital-Output
 - Coefficient in Korea (1984-2000)

Table 1. Input-Output Tables in Korea (1970-2000)



1. Transaction Tables at Producers' Prices (number of sector classification)

year	basic	small	medium	large
1970		153	56	
1973*		153	56	
1975	392	164	60	
1978*		164	60	
1980	396	162	64	19
1983*	396	162	64	19
1985	402	161	65	20
1986*		161	65	20
1987*		161	65	20
1988*		161	65	20
1990	405	163	75	26
1993*		163	75	26
1995	402	168	77	28
1998*		168	77	28
2000	404	168	77	28

* Extended I-O tables with sector classification of the preceding main I-O tables.



Input-Output Tables in Korea (1970-2000)

2. Linked Input-Output Tables (number of sector classification)

year	small	median	large
1975-80-85	161	65	20
1980-85-90	161	75	
1985-90-95	168	77	28

3. Supporting Tables

- (1) Employment Table: 1980 1983 1985 1986 1990* 1995* 1998* 2000*
(*including employment matrix)
- (2) Fixed Capital Formation Table: 1990 1995

4. U-Table and V-Table (22 industries including 9 Manufacturing industries)

Annual U-Table at 1995 constant prices and annual V-Table in both current and constant prices for 1990-1997 are available in 1999 National Accounts.

Generated Input-Output Tables



1. Data

: Gross Output, Value-added, Intermediate input,
Energy Input, Input share

2. Matrix Balancing

Scaling - RAS Method

Optimization – KEO-RAS, Entropy Method

Capital Input



1. Data on Capital Stock

(1) National Wealth Survey(NWS): 1968, 1977, 1987, 1997

(2) Estimation of Net and Gross Capital Stock

(a) Period before 1968

(b) Period before 1968-1997

(c) Period after 1997



2. Measurement of Capital Price

- Translog function of the services of individual assets ($K_i^j(t)$)

$$\ln K^j(t) - \ln K^j(t-1) = \sum_i \bar{v}_i [\ln K_i^j(t) - \ln K_i^j(t-1)]$$

where,

$$\bar{v}_i = \frac{1}{2} [v_i(t) + v_i(t-1)] \quad \bar{v}_i(t) = \frac{p_i(t)K_i(t)}{\sum_i p_i(t)K_i(t)}$$

$P_i(t)$: the rental price of capital services from asset type i

- the rental price of capital services from asset type

$$P_i(t) = \{[r(t) - \Pi_i(t)] + [1 + \Pi_i(t)\delta_i]\}q_i(t-1)$$

where,

$r(t)$: the rate of return

$q_i(t)$: the acquisition price of investment good with $\Pi_i(t) = \frac{[q_i(t) - q_i(t-1)]}{q_i(t-1)}$,

which is the rate of inflation in the price of investment good .



Measurement of Capital Price

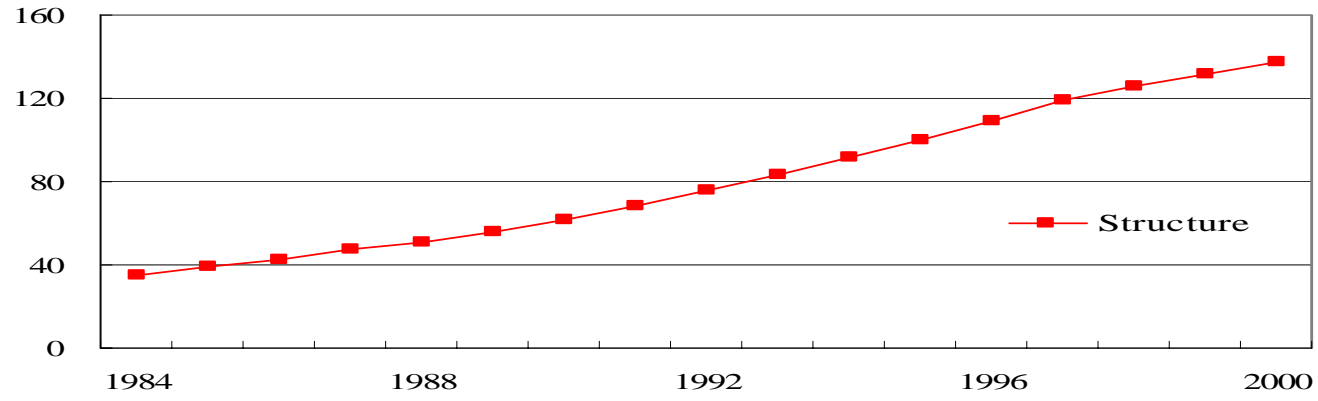
- indirect method of imputing rental price of capital in j-sector from the annualized I/O Table

$$P_K^j = P_K^j K^j / K^j$$

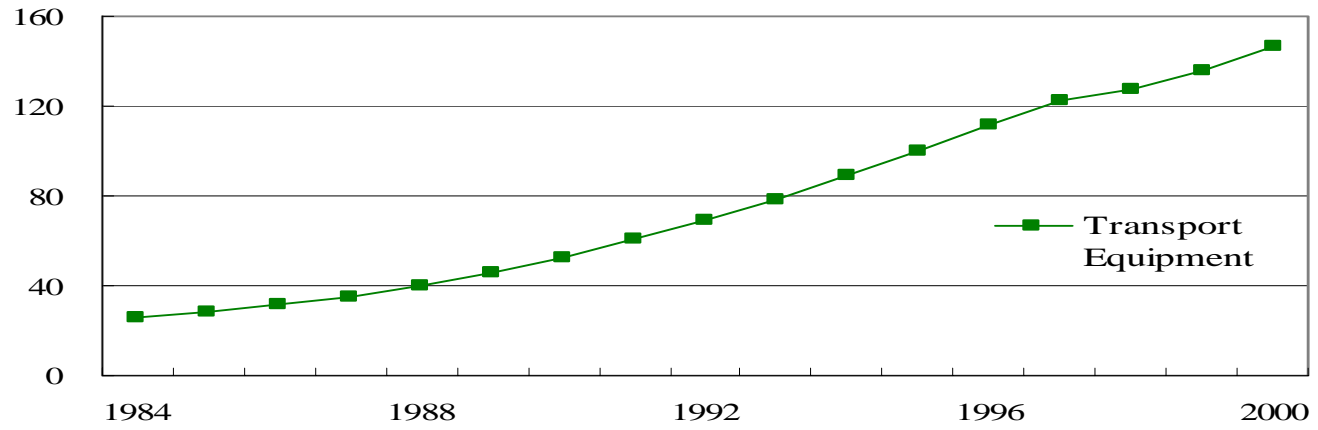
where, K^j : our estimates of capital stock in j-sector in constant prices



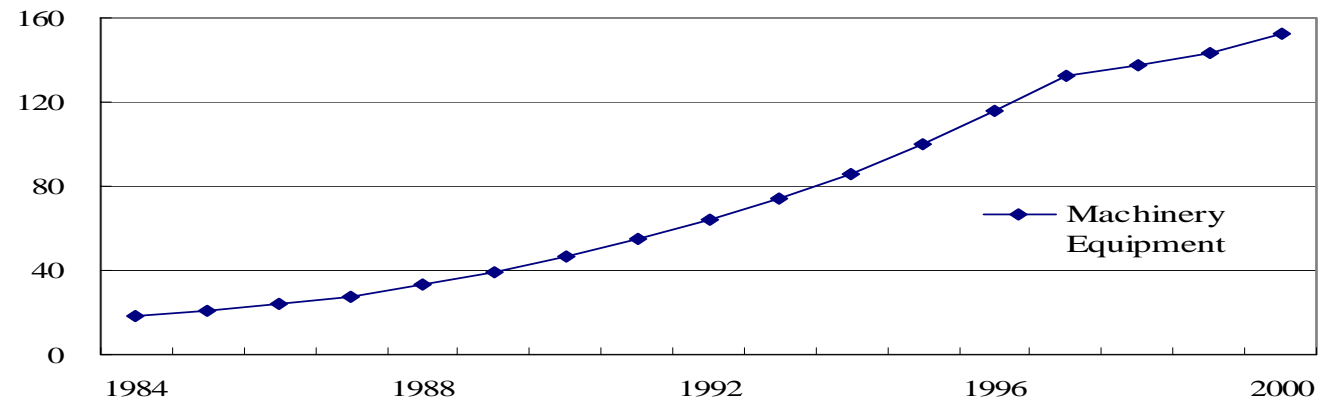
Structure



Transport Equipment



Machinery Equipments





Year	Structure	Transport Equipment	Machinery Equipment
1984	35.0946	25.5263	18.4485
1985	38.8206	28.3387	20.8522
1986	42.7534	31.5348	23.8907
1987	47.2253	35.0529	27.5775
1988	51.2445	40.1079	33.0070
1989	55.9261	45.7661	39.3313
1990	61.9486	52.8521	46.7165
1991	68.7454	60.7903	55.3544
1992	75.6301	69.2826	64.4908
1993	83.2423	78.0714	74.2615
1994	91.2642	88.9207	85.9452
1995	100.0000	100.0000	100.0000
1996	109.3747	112.0274	115.8168
1997	119.1530	122.5036	132.1943
1998	125.8970	127.4984	137.2088
1999	131.9063	135.8352	143.7201
2000	137.6533	146.5290	152.6655

Labor Input



1. Data

(1) Ministry of Labor

- 3 digit classification
- wage data

(2) National Statistical Office

- 2 digit classification
- agricultural and government sector data

2. Quality Adjustment

- sex, educational attainment, age



Measurement of Labor Input

- In order to make quality adjustment to the employment data, we have taken the follow steps;

1) Defining variables.

P_{Li}^j : wage rate for j -sector and l -type category of labor

$v_{Li}^j = \frac{P_{Li}^j L_i^j}{\sum P_{Li}^j L_i^j}$: the share of labor income by l -type category of labor is j -sector

$\bar{v}_{Li}^j = \frac{1}{2} [v_{Li}^j(t) + v_{Li}^j(t-1)]$: the average weight of j -sector and l -type labor income during the period of $(t-1)$ and t



Measurement of Labor Input

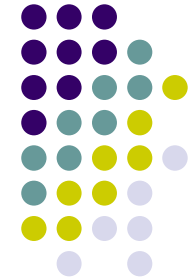
- 2) Decomposed labor input of j -sector and l -type.

$$L_i^j(t) = d_i^j(t)M_i^j(t)H_i^j(t)$$

- 3) Computing the growth rate of j -sector labor input

$$\begin{aligned} \ln L^j(t) - \ln L^j(t-1) &= [\ln M^j(t) - \ln M^j(t-1)] + [\ln H^j(t) - \ln H^j(t-1)] \\ &\quad + \sum_l \bar{v}_{Ll}^j [\ln d^j(t) - \ln d^j(t-1)] \quad j = 1, 2, \dots, J \end{aligned}$$

Characteristics of Korean Database for KLEM Model



<p>Gross output</p> <p>National Accounts Input-Output Table (1980,1985,1990,1995) U-Table and V-Table Annual tables (1990-1997)</p>	<p>Number of Sectors</p> <p>21 64-77 or 20-28 22</p>
<p>Capital stock (capital services)</p> <p>Gross and Net Stock data: National Wealth Survey (1987)(1997) Capital Formation data: National Accounts(1999) Annual Gross and Net Stock by Industries and by Types of Assets and Estimated Depreciation Rates are available in Pyo (2001) Net stock and Investment data: Mining and Manufacturing Census Mining and Manufacturing Survey - Types of assets: residential building, nonresidential building, other construction, transport equipment, machinery equipment</p>	<p>5 types of assets and 10 large industries with 28 sub-manufacturing Industries</p>

Characteristics of Korean Database for KLEM Model



<p>Labor input (days worked) Report of Monthly Labor Survey (NSO) Survey Report on Wage Structure (Ministry of Labor) -<i>sex</i> (male/female) -<i>educational attainment</i> (middle school graduates, high school graduates and college above) -<i>age classes</i> (16~34, 35~54, and 55 above)</p>	<p>18 types 2 types 3 types 3 types</p>
<p>Intermediate inputs National Accounts Input-Output Table(1980, 1985, 1990, 1995) U-Table and V-Table Annual Tables(1990-1997) Energy Input; sectors 2, 4, 14, 28, and 29</p>	
<p>PPP -prices of outputs of each industry in both Korea and the reference economy and exchange rate</p>	<p>21 sector by V-Table</p>

Table 3. Characteristics of KLEM Database in Korea(1984-2000)



year	Gross Output billion Won	K billion Won	L 10000 hour	E billion Won	M billion Won
1984	278148	533761	109794	25227	139325
1985	294601	593025	109870	24318	149136
1986	344750	658641	114382	21288	175803
1987	399397	734392	132499	23769	204804
1988	456631	816559	136940	23647	232905
1989	496413	911981	132431	24647	251339
1990	556380	1030335	134602	26872	281359
1991	615542	1165511	126097	31615	305115
1992	657531	1305141	134962	34963	323404
1993	703166	1456944	139271	40015	336708
1994	766040	1626579	141029	39728	368744
1995	839337	1817780	147609	40070	405804
1996	907542	2027206	144852	50394	434832
1997	963556	2242411	142013	54722	463201
1998	956724	2353239	132303	63595	454926
1999	984104	2468150	154855	68706	474948
2000	1049237	2596497	159016	76255	512637
Average growth rate	8.32	9.96	2.49	6.05	8.21

(in 1995 prices)

Table 11. Gross Output Growth Accounting for Korea (1984-1997)



	Growth output	Capital Input	Labor Input	Energy Input	Material Input	TFP
1 Agriculture	1.66	7.10	-2.43	4.70	2.07	-2.85
2 coal mining	-10.37	-2.46	-11.90	-9.66	-7.81	-0.86
3 Metal non-metal	3.75	-15.95	-5.90	5.11	4.12	10.76
4 Oil and gas	0.00	-0.85	0.00	0.00	0.00	0.02
5 Construction	5.40	13.08	7.01	-3.53	5.18	-1.55
6 Food	3.07	7.73	0.90	3.06	2.75	-0.52
7 Textile	2.30	5.19	-5.08	2.70	1.01	1.52
8 Apparels	3.54	4.10	-6.98	3.45	3.60	1.72
9 lumber and wood	6.70	4.63	-5.22	5.65	5.56	2.62
10 Furniture	9.49	10.28	-2.21	8.02	9.02	2.16
11 paper allied	6.84	13.06	0.50	6.38	6.33	0.19
12 printing,publishing,allied	7.88	8.09	2.22	5.83	8.16	1.32
13 Chemicals	7.94	11.48	-0.01	9.94	7.46	0.25
14 petroleum products	6.04	11.79	-0.01	3.76	6.12	0.31
15 Leather	0.38	0.70	-20.38	1.19	-0.37	4.07
16 stone,clay,glass	6.48	9.14	-2.27	3.59	6.54	1.27
17 primary metal	7.29	9.10	3.33	5.24	6.84	0.51

Table 11. Gross Output Growth Accounting for Korea (1984-1997)



	Growth output	Capital Input	Labor Input	Energy Input	Material Input	TFP
18 fabricated metal	7.38	11.96	0.09	5.86	6.32	1.36
19 Machinery	10.60	7.58	5.67	8.02	10.59	1.39
20 electrical machinery	14.24	14.40	-1.99	9.66	14.13	2.13
21 Motor	14.39	12.05	5.08	7.16	15.22	1.12
22 transportation equip.	3.05	21.29	5.08	-10.88	3.66	-2.66
23 Instrument	10.87	11.01	0.80	7.67	11.05	1.64
24 Rubber	11.39	12.07	-4.76	11.85	11.19	2.89
25 misc.manufacturing	1.53	23.95	-5.59	1.74	1.02	-2.20
26 transportation	6.66	7.12	2.55	4.79	8.59	0.68
27 communication	13.66	12.29	2.54	10.13	17.67	3.41
28 electric utility	6.65	8.28	7.07	2.93	8.53	-0.02
29 gas utility	17.44	17.90	7.06	19.63	10.49	1.22
30 Trade	8.19	12.16	11.37	6.18	10.00	-2.93
31 Finance and real estate	13.54	8.09	9.07	13.74	14.07	3.55
32 other private service	8.85	11.86	9.91	8.73	9.12	-1.17
33 Public service	7.46	11.36	1.81	0.35	2.06	5.41
Total	8.32	9.96	2.49	6.05	8.21	1.04



Table 12. Trends in Productivity and Capital-Output Coefficients in Korea(1984-2000)

Year	YO/L	K/YO	K/L
1984	2.53	1.92	4.86
1985	2.68	2.01	5.40
1986	3.01	1.91	5.76
1987	3.01	1.84	5.54
1988	3.33	1.79	5.96
1989	3.75	1.84	6.89
1990	4.13	1.85	7.65
1991	4.88	1.89	9.24
1992	4.87	1.98	9.67
1993	5.05	2.07	10.46
1994	5.43	2.12	11.53
1995	5.69	2.17	12.31
1996	6.27	2.23	14.00
1997	6.78	2.33	15.79
1998	7.23	2.46	17.79
1999	6.36	2.51	15.94
2000	6.60	2.47	16.33
Average Growth Rate(%)	5.98	1.59	7.57



Figure 1. Labor Productivity

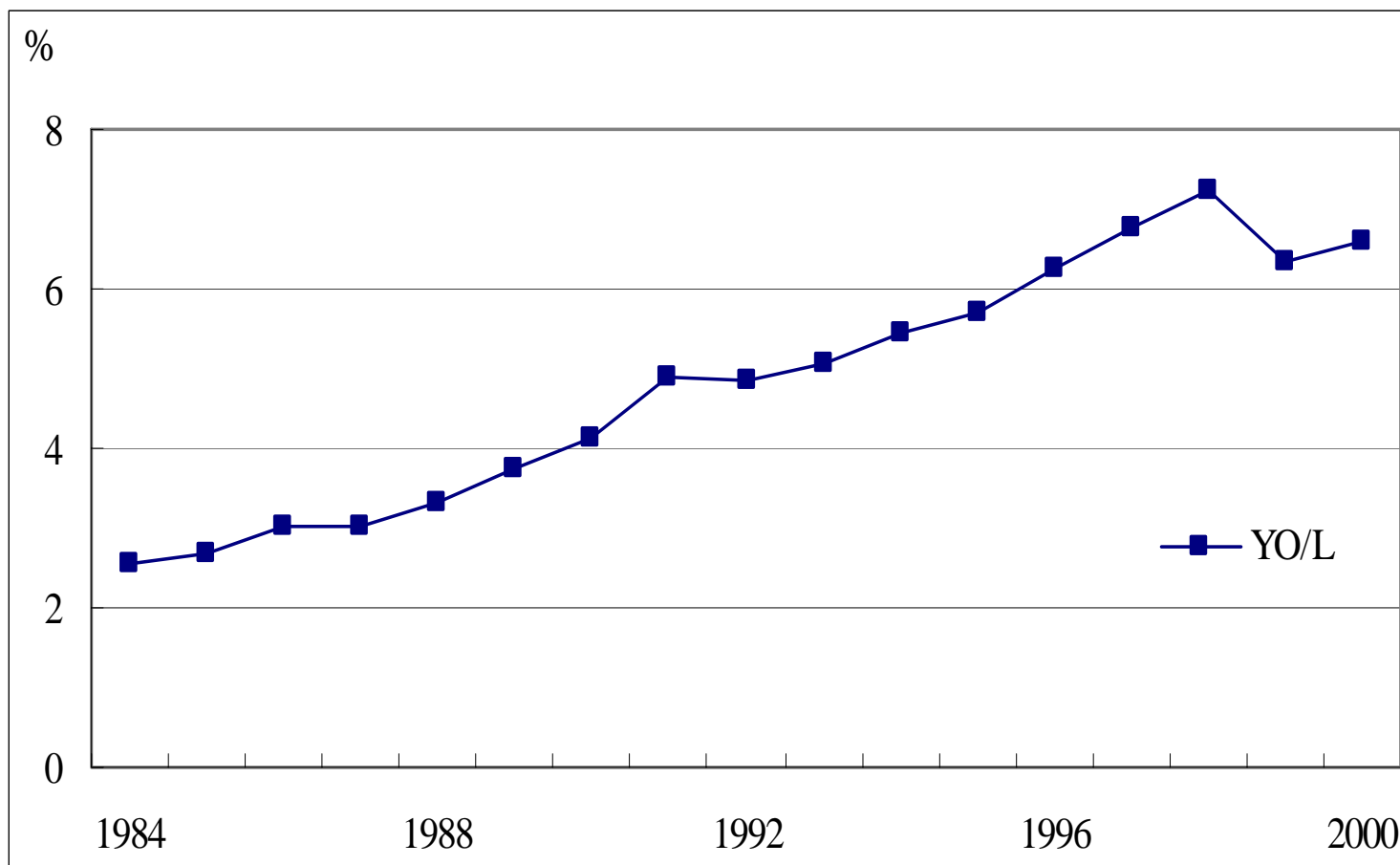




Figure 2. Capital-Output Coefficient / Capital-Labor Ratio

