Chap 4. productivity growth and Manufacturing Employment Contraction
(original title is "Big firms and R&D: Can Korea succeed as a knowledge based economy?"

Key issue: who created jobs and who raised productivity?

Section 1: Facts
Section 2: decomposition result:
Section 3: productivity growth –evidence from establishment panel
Section 4: workers

1. Issues
   1) Manufacturing employment reduced very quickly.
      A. Summarize the trend
      B. What is its pattern? Reduction by industries or by type of workers
         i. Here, naturally one sees if exit/entry created jobs or downsizing reduced jobs
      C. If so, although Korea can make a transition toward a knowledge economy, mfg will not be able to function as a key industry of job creation.
         i. HOW WOULD YOU DEFINE A KNOWLEDGE ECONOMY. HOW CAN YOU TELL KOERA IS MAKING A TRANSITION TOWARDS A KNOWLEDGE ECONOMYH OR NOT?
   2) Gap between large firms' and small firms' productivity widened
      A. Summarize facts
      B. How? By industries? Because there still exist a lot of blue collar workers in small firms?
   3) Enlarging productivity gap between mfg and services
      A. Summarize facts.
      B. How much is due to semi-conductors?
      C.

   4) Productivity growth in services was sluggish
      A. What is the problem with services industry productivity
      B. On the claim that labor movement from mfg to services results in sluggish productivity growth in the services
   5) Big question is, what can I say about the issue of "can korea succeed as a knowledge based economy?"
   6)
2. 1)

1) very quick reduction of manufacturing employment
2) expanding gap between high productivity large companies and low productivity small firms
3) sluggish productivity growth in services
4) expanding gap between manufacturing and services
   A. Very unique to Korea. In US and EU, the gap between services and manufacturing not large.
5) Wages: US mfg < ser, the old trend reversed. What about korea?

1. Introduction

Around the late 1980s, employment growth rate of Korea turned around to a decreasing trend. The major reason for such a turnaround was the rapid reduction of manufacturing employment. The reduction continued into the 21st century, dropping the employment share of manufacturing from xx.x% in 1989 to xx.x% in 2005. However, it did not mean a deindustrialization of Korea. Manufacturing's output share did not decline and it actually rose even faster than before. The

result was a widening gap in labor productivity between manufacturing and services.

The conventional wisdom points to the loss of competitive edge in low wage labor intensive industries of the Korean economy in the world market due to rapid increase of wages, and also the exchange rate policies which suppress appreciation for a long time, only resulting a only a

In this paper, we codify the striking facts and look into the facts.

Facts

1. Very rapid reduction of manufacturing employment

The change of the Korean labor market since the 1990s was first driven by manufacturing employment reduction. Korea's manufacturing employment reached its peak of 5.2 million in 1991. However, manufacturing employment steadily reduced since then and by 2005 it stood at 4.2 million. Its share dropped to 18.5% from its peak of 27.6%. As documented in …, the precursor of this volume, manufacturing sector has served as the major job growth engine for Korea in the 1970s and 1980s. Its size was a meager 1.3 million with its share at 13.2% in 1970. During the development era of the 1970s, it grew up to 3.0 million and its share reached 21,6% by 1980. The expansion continued consistently in the 1980s, with its size at 4.9 million and its share at 27.2%. Up to the 1980s Korea's manufacturing job growth pattern was typical of a developing country that tries to attain job creation with exports of labor intensive manufacturing goods utilizing its abundant low-wage labor. However, along with the transition of its major exporting industries from labor-intensive light industries towards heavy and chemical industries that begun in the 1980 and income growth, the manufacturing labor market quickly transformed from a low wage based one to a productivity based one.

<table 1>

Table 1. Employment by Industry (in millions)

	1980	1985	1990	1995	2000	2005
Total	13.7	15.0	18.1	20.4	21.2	22.9
Agriculture, Fishery, Mining	4.8	3.9	3.3	2.4	2.3	1.8
Manufacturing	3.0	3.5	4.9	4.8	4.3	4.2
Construction and SOC	0.9	1.0	1.4	2.0	1.6	1.9
Services	5.1	6.6	8.4	11.2	13.0	14.9

Source: KNSO, EAPS data sets. (note: chap4.xls)

manufacturing employment shares by countries (Unit: %)

	KOR	CAN	FRA	DEU	GBR	JPN	ITA	SWE	USA
1970	14.2	22.9	24.8			26.2	27.6	27.4	22.2
1980	22.7	19.1	23.3		24.7	23.4	29.1	23.7	18.9
1990	27.9	15.6	18.7	27.4*	17.8	23.4	24.7	20.2	14.7
2000	20.3	14.6	15.2	20.7	14.3	19.1	21.8	18.4	12.7
2005	18.5	13.0	13.4	19.3	10.8	17.2	20.5	16.5	10.3

Note: * Germany : as of 1991
Source: OECD Structural Analysis database (STAN), 2008.
File: STAN!sheet2

A trendy manufacturing employment reduction is commonly found in all industrialized countries. Table 2 compares the trend of manufacturing employment shares among OECD countries. In most countries, the trend began in the 1960s and by the 1970s manufacturing employment share declined in all developed countries. The downward trend in advanced countries has been attributed to differential productivity growth between manufacturing and service sectors and shifts of domestic demand patterns.[1] Except in some low-wage industries, namely food, beverage, and tobacco; textiles and apparel; wood and cork products, etc, the effects of trade on manufacturing employment reduction is not very significantly recognized.

As a developing economy relying on export-oriented growth strategy, Korea expanded its manufacturing employment until the 1980s. But as soon as the manufacturing employment share reached its peak in 1991, the decline of manufacturing employment was even faster than any other country. By 2005, Korea's manufacturing employment share is 18.5%, which is even lower than Germany's 19.3% and Italy's 20.5%, and at a similar level as with Japan and Sweden. In 1990, Korea was a country for which manufacturing was a low wage, jobs creation sector, but after 15 years, its manufacturing employment share dropped to a level that is common in advanced manufacturing countries, resulting a massive labor mobility from manufacturing to services.

Korea's manufacturing job expansion and contraction was quicker than in advanced countries and it was concentrated in the low-tech manufacturing sector. Figure x shows Korea's employment changes in the period 1981 to 2006 by industries classified according to the technology level following OECD STAN classification. OECD classifies manufacturing industries into four categories according to the industry's R&D intensity levels.[2] (Detailed description is provided in the footnote.) The low-tech manufacturing sector, namely food and beverage, tobacco, textiles, apparel, leather, wood, and paper industries, grew fast during the 1970s and 1980s and it peaked in 1989, but since then it reduced quickly and by 2006 it returned almost to its previous, pre-industrialization level of 1970. In 1970, its employment size was 0.9 million, it almost doubled to reach 1.7 million in 1981, attained a peak at 2.4 million in 1989, and then reduced to 1.1 million in 2006. On the other hand, job growth in other industries was more stable. It steadily expanded throughout the 1980s and stabilized since the mid-1990s. At the early stage of industrialization, in 1970, the low-tech industries accounted for two-thirds of total manufacturing employment. But the share has dropped to about 60% in 1981, and during the 1990s, its rapid decline and growth of other industries made it share to decline all the way down to 25.7% by 2006.[3]

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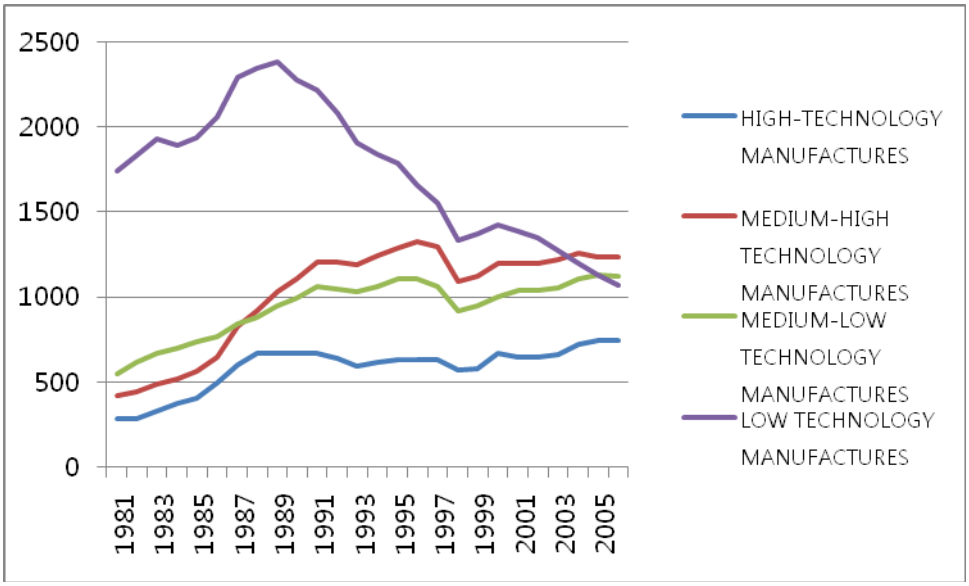
[1] Fuchs, 신관호 참조.

OECD(1992), "Structural Change and Industrial Performance: A Seven Country Growth Decomposition Study," Paris.

[2] Low tech manufacturing, according to OECD STAN database classification, are (ISIC rev3.) 15-22 and 36-37. High tech are 2423. 30, 32, 33, 353, medium-high tech are 24 less 2423, 29, 31, 34, 352+359, medium low tech are 23, 25-28, 351.(OECD STAN industry list, www.oecd.org/sti/stan)

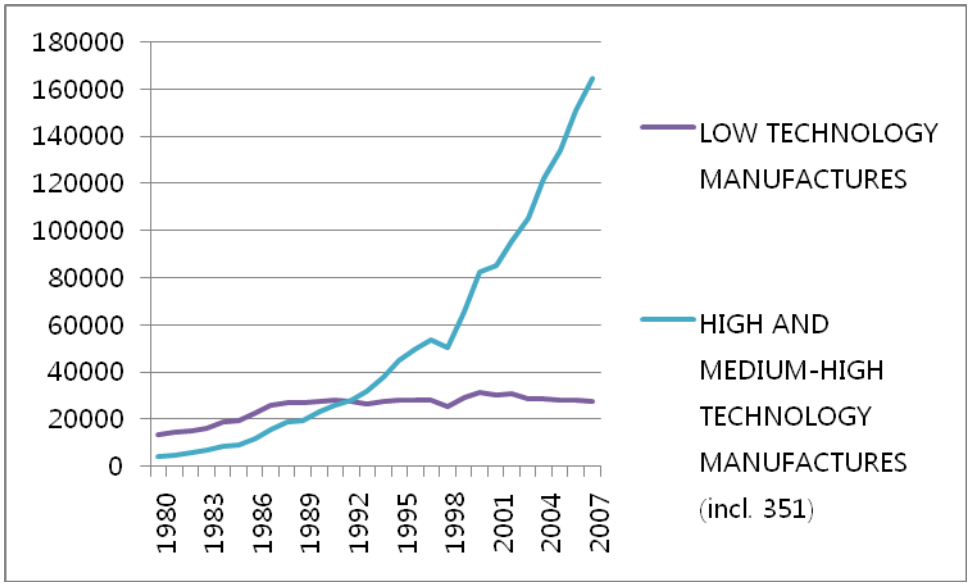
[3] Ironically, now the employment share of Korea's low tech manufacturing is even lower than those in Japan and US. Currently, as of 2005 the level is 26.7% in Korea, where as they are 34.9% and 42.0% in the US.

Employment Change by Tech Level: data OECD STAN



Source: OECD STAN data sets, 2008.

File: chap4.xls sheet2



Output trend: value added in volume

The pattern of rapid reduction of low-tech manufacturing employment of Korea is different from those in advanced industrialized countries. In advanced countries, low-tech manufacturing employment reduction was not as quick, and manufacturing employment contraction was not concentrated in low-tech industries. In the US, low-tech manufacturing job decreased very slowly during 1970-2000 although the overall manufacturing employment dropped rapidly. The average annual growth rate of US low-tech manufacturing employment was -1.2% between 1970 and 1980, -1.1% between 1980 and 1990. But it accelerated to -2.6% in the 1990s and further to -16.1% in 2000-2005.[4] In France, UK, Germany, and Italy, low-tech manufacturing employment reduced by roughly 15-20% during the 1980s and 1990. Even in Japan, which is a textiles exporting country,

[4] According to the OECD STAN database, US employment growth in low-tech mfg is -1.2% during 1970-80, -1.1% in 1980-90, -2,6% in 1990-2000, but -16.1% in 2000-05.

low-tech manufacturing employment reduced by 20.5% during the 1990s and 16.9% in 2000-05. But in Korea, the size of reduction was 37.5% during 1990-2000, and 20.7% during 2000-2005.

In other tech level industries, manufacturing employment did not reduce in Korea since the 1990. It actually increased, though the magnitudes are not large. But in advanced industrialized countries, manufacturing employment generally decreased at all tech-levels of manufacturing industries. In the US, during 1980-2000, medium-high tech industries suffered the greatest job loss of 600 thousand, which is about 12% of its 1980 level. Medium-low tech manufacturing lost 7.4%, high-tech 3.2%, and low-tech manufacturing lost 3.7% of their 1980 number of jobs.[5] The situation is similar in France: between 1980 to 2000, 10.5% of high-tech mfg jobs, 29.7% of medium-high tech mfg jobs, and 31.4% of medium-low tech jobs disappeared. Even in Japan, employment reduction in high-tech, medium-high tech, and medium-low tech manufacturing is about 15% between 1990 and 2000 and the reduction trend continued in 2000-2005.

As the general trend indicates, in the 1990s, Korean manufacturing made a transition from a low-wage labor intensive industry to a capital and technology intensive industry. In this respect, its change is very different from what happened in the advanced countries during the same time span. Unlike in advanced countries, the Korean low-tech manufacturing industries, especially textiles, registered a very rapid expansion because it utilized the foreign demand. For the same reason, as the exports curb, the industry suffered a very rapid employment loss, with a very uneven impact on the groups of workers then hired in the manufacturing. In 1990, 12.2% or 600 thousand of manufacturing workers was female with age under 25. By 2005, just 3.9% or 165 thousand of them are female with age under 25. Even if we count in those under age 35 to consider the trend of lengthened education, the share of female aged under 35 among manufacturing workers is 34.0% in 1990 and 10.9% in 2005. Such a big difference is a result of retardation of low-tech industry as we will see shortly.

The employment reduction trend in manufacturing also made workers older. As the industry shrinks, young job seekers found jobs in services and those remaining gets older, the age structure of workers naturally shifted upwards. The share of workers with age under 35 in manufacturing was 58.9% but it dropped to 36.0% in 2005.

<Table: worker composition in manufacturing by age and sex>
(unit: thousand, %)
Source: KNSO, EAPS micro datasets.

		1990	1995	2000	2005
male	15-24	412	357	213	167
	25-34	1,302	1,269	979	893
	35-44	665	882	971	937
	45-54	353	368	428	597
	55+	106	180	167	226
female	15-24	599	360	181	165
	25-34	581	450	385	298
	35-44	462	521	548	454
	45-54	278	264	284	364
	55+	152	167	137	132
		4,911	4,818	4,293	4,234
		59			36
	Year	1,990	1,995	2,000	2,005
male	15-24	8.4	7.4	5.0	3.9
	25-34	26.5	26.3	22.8	21.1
	35-44	13.5	18.3	22.6	22.1
	45-54	7.2	7.6	10.0	14.1
	55+	2.2	3.7	3.9	5.3
female	15-24	12.2	7.5	4.2	3.9
	25-34	11.8	9.3	9.0	7.0

[5] File: STAN_selected.xlsx, sheet: low-tech comparison

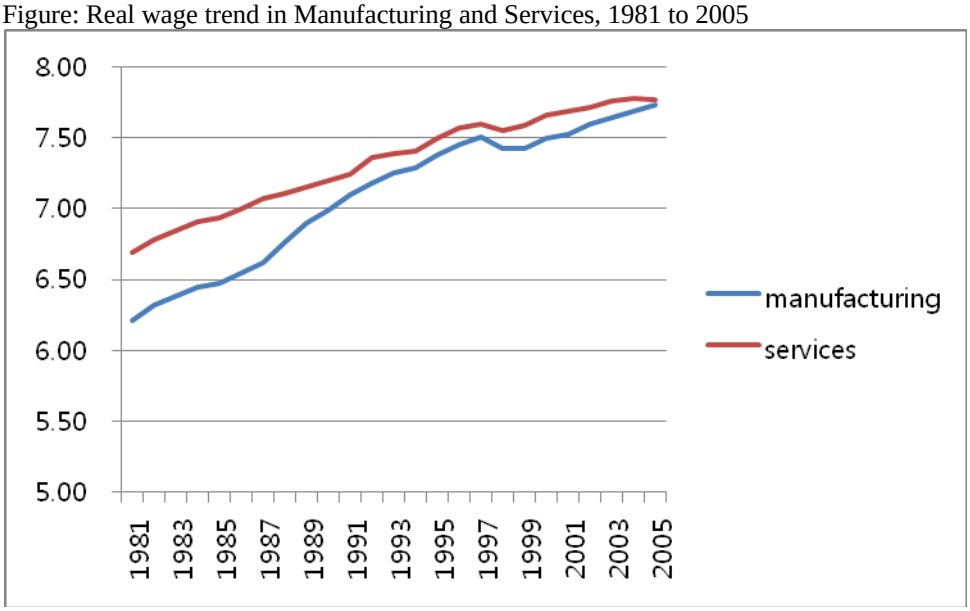
35-44	9.4	10.8	12.8	10.7
45-54	5.7	5.5	6.6	8.6
55+	3.1	3.5	3.2	3.1

Fuchs, Victor, et al.(1969) Production and Productivity in the Service Industries, New York: Columbia University Press for National Bureau of Economic Research

Baumol, William (1967), “The Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis,” American Economic Review 57, 416-426.

As manufacturing shifts from a labor intensive industry to a capital and technology intensive industry, the wage differential between manufacturing and services disappears by the 2000s. The wage data is from OWS data set and the graphs are the trend of log of real average monthly wage for workers at establishments with 10 or more workers. The comparison is between workers in manufacturing and services.[6] The Figure shows that in the 1980s manufacturing industry wages were 40% lower than those in the services, but the gap has narrowed down to 10 percent in the 1990, and by 2005 it has all but disappeared. Considering that the share of wage / salaried workers are lower in services and there are many small workplaces in services, the average wages in manufacturing are presumable higher than those in services, and the old trend of manufacturing wages below the services wage may have already been reversed. The role of manufacturing as a low wage job creation sector in the Korea economy has all but disappeared by the end of the 20th century.

Figure: Real wage trend in Manufacturing and Services, 1981 to 2005



Real wage is defined as regular and overtime pay plus 1/12 of special pay of the previous year.
Construction, SOC, and utilities industries are not included in services.
Source: OWS datasets, establishment with 10+ workers
File: wage trend is in 0613 mfg-logwage.xls

COMPARE COMPOSITION OF MFG WORKERS BY TECH LEVEL

Ironically, now the employment share of Korea's low tech manufacturing is even lower than those in Japan and US. Currently, as of 2005 the level is 26.7% in Korea, where as they are 34.9% and 42.0% in the US.

EXPORT GOODS?

DOES KOREA MOVING INTO A HIGH TECH, KNOWLEDGE BASED ECONOMY?

[6] Excluding construction, SOC, and utilities.

Section 2. Productivity and Wages: Why Did Low Tech Go Down So Fast?

Candidates:
1. Wage hike – no, female wages did not go up so fast
2. Exchange rate – no wrong timing
3. Foreign competition – new low wage countries came in
4. Productivity – exogenous. If E drops a lot , VA does not go down fast, then (VA/E) goes up a lot

As explained in the previous section, the retreat of low-tech industries employment was the principal factor in the process of Korean manufacturing job decrease. Several views has been raised to account for this phenomena. A most common explanation for the sharp retreat of the manufacturing employment in Korea is the wage hike around the late 1980s and early 1990s. Manufacturing workers' wages have risen too fast, allowing little time for the Korean industries to adjust, and forced them to lose international competitiveness and led to retreat of the Koran manufacturing. Another explanation is mismanagement of the exchange rates. The Korean won has been maintained at a very low level throughout the 1970s and the 1980s as a part of export-oriented growth strategy. It may have contributed to export expansion, but as it has been at such a low level for a suspended period time, which ultimately led to tremendous trade surplus at the end of the 1980s, only resulting a very sharp appreciation of the Korean Won at the early 1990s, and led to quick demise of light industries whose international competitive edge were only the low cost. These explanations points to the changes in internal conditions as the cause for the loss of international competitiveness edge.

But the changes in external conditions, that is the changes in global trade structure also provides a persuasive explanation. By the early 1990s, other late comer countries were joining the world market in the supply of labor intensive goods and such changes in world economy has forced Korea out as a supplier of low price labor intensive goods, and led the retardation of light industries. By the time, other Asian economies such as Malaysia, Indonesia, and the Philippines were actively adopting export-oriented growth strategies which have been previously so successfully worked in the Tiger economies (NICs), and Korea quickly lost its competitiveness in the industries.

Such explanations lead to exogenous productivity growth argument. For an economy like Korea, whose production technology growth has been exogenous after all by the catching-up process (growth by emulation not by innovation, as Amsden emphasized), the productivity growth in light industries has also been pre-determined exogenously. Given the technological progress in advanced countries in the industries, it was natural and also imperative for Korea to adopt the technologies if it is to maintain international competitiveness in the industries. According to such explanation, the decrease of light industry employment was inevitable sooner or later even without the sharp increase of wages, mismanagement of exchange rates, and the foreign competition—they only accelerated the changes which were inevitable.

We look into each of these causes:
1) Wage rise:
2) Exchange Rate Movements
3) Export Competition
4) Productivity Growth

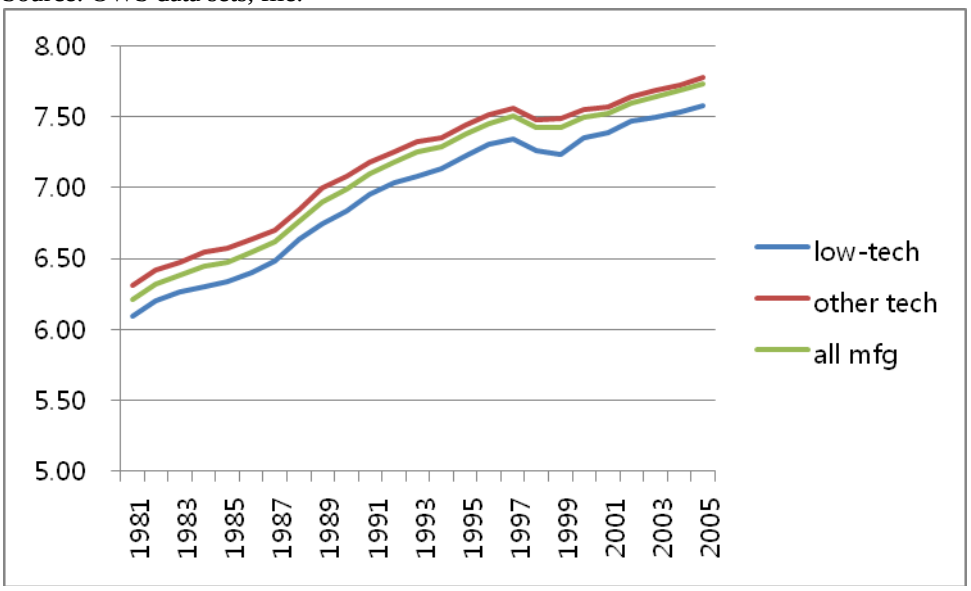
1) The trend of wage rise

Figure x compares the average log real wage trend in manufacturing. The wage rise was the sharpest during the late 1980s and early 1990s. The average wages in manufacturing rose xx% during …. But the margins of wage rise were of similar magnitude among different technology level industries in manufacturing. The trend of wage rise was parallel among industries. The wage rise was not especially high among low tech industries not they were limited to low-tech industries. The wage rise since the late 1980s was initiated by union activities in heavy industries and large companies. But its effect was not limited at those workplaces and rather evenly distributed among manufacturing industries. This shows that there was an economic force, that is supply and demand of labor, working behind the rapid wage rise at the period. Labor law reform and ensuing liberalization of union activities, and political democratization which made it possible in the first place provided an environment in which such forces are realized, but union activities are not sufficient to explain the rapid rise of wages in the period and the ensuing retardation of light industries.

Wage rise was also rather evenly distributed among different groups of workers. Table xx compares the wage rise among different group of workers among production workers in the low-tech industries. By 5 year intervals, wage rise was the greatest in 1985 to 1990 period, followed by the ensuing 1990-95 period. Even among different worker groups the magnitudes of wage rise was similar.

Do simple regression analysis
Log w = ind_i + worker characteristics. How significant are the coefficients for industry dummies?

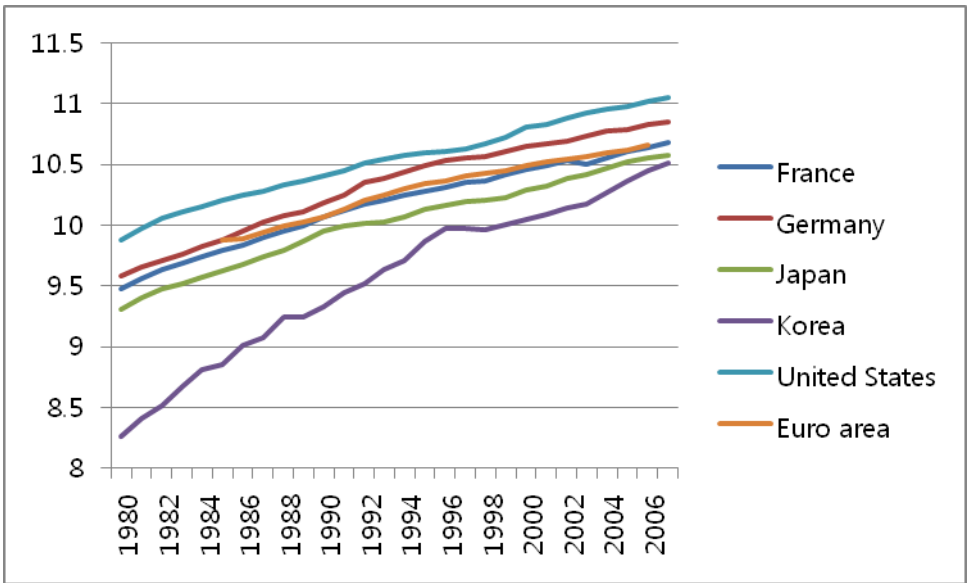
Trend of Average Log Real Wage
Source: OWS data sets, file:



Average Real Wage Trend, low-tech (1nd 17-19), production workers (occc1=7/8/9)

	M & F	Male Workers				Female workers			
	all	15-24	25-34	35-44	45-55	15-24	25-34	35-44	45-55
1981	5.81	5.83	6.36	6.55	6.48	5.64	5.80	5.67	5.63
1985	6.07	6.04	6.49	6.68	6.60	5.91	6.06	5.94	5.90
1990	6.58	6.52	6.90	7.03	6.97	6.41	6.51	6.45	6.41
1995	7.03	7.00	7.35	7.46	7.38	6.74	6.83	6.81	6.77

2000	7.08	6.91	7.30	7.43	7.38	6.88	6.93	6.88	6.85
2005	7.31	7.09	7.48	7.61	7.63	7.15	7.16	7.04	7.07
	all	15-24	25-34	35-44	45-55	15-24	25-34	35-44	45-55
1981-85	0.26	0.21	0.13	0.13	0.12	0.27	0.26	0.28	0.27
1985-90	0.51	0.48	0.41	0.35	0.37	0.50	0.45	0.51	0.52
1990-95	0.45	0.48	0.45	0.43	0.41	0.33	0.32	0.35	0.36
1995-2000	0.05	-0.09	-0.04	-0.03	0.00	0.14	0.10	0.08	0.07
2000-05	0.23	0.17	0.18	0.19	0.25	0.27	0.22	0.16	0.22



Log of Labor compensation per employee (PPPs),
Manufacturing, US $PPP adjusted, OECD,

2) Exchange Rate Movements

During the second half of the 1980s, the value of Korean Won against USD has rapidly appreciated. One USD was worth 881 KRW in 1986, but by 1989, it was worth only 671 Won. Such a rapid appreciation of the Korean currency was then ascribed to mis-management of the exchange rate, and pointed to have resulted the rapid waning of low-tech manufacturing industries such as textiles, shoes, toy, etc. Korean Won has been maintained weak deliberately in order to guarantee price competitiveness a way of export promotion strategy, however the large trade surplus created by the great appreciation of Japanese Yen in the second half of the 1980 following Plaza agreement made the Korean won to appreciate rapidly. It was claimed that combined with the sharp wage rise the appreciation pushed the cost of Korean labor intensive industries sharply without allowing sufficient time for the industries to adapt to the changed environment and forces those industries to disappear.

However, the hindsight shows that effects of the appreciation could not have been that persistent as to drive the light industries out of the world market. In terms of U.S. dollar values the appreciation ended in a few years and the exchange rate returned to its previous level quickly. From the peak value of 671 Won in 1989, it dropped to 733 Won by 1991, and by 1993 it stood at 803 Won, which is close to 1987 value.

Also the appreciation was driven by weak US dollar as much as strong Won. The trend of REER (real effective exchange rate) which considers the values of other currencies and price levels, the Korean Won had significantly depreciated before its appreciation during 1987 to 1989. During the period the value of Won just went back to the previous level. After returning to the level the value of Won stayed at the level for a decade.

Trend of KRW and JPY against USD (2005=100)
Source: OECD, STAT, FILE: oecd_x_adjusted.xlsx, sheet1

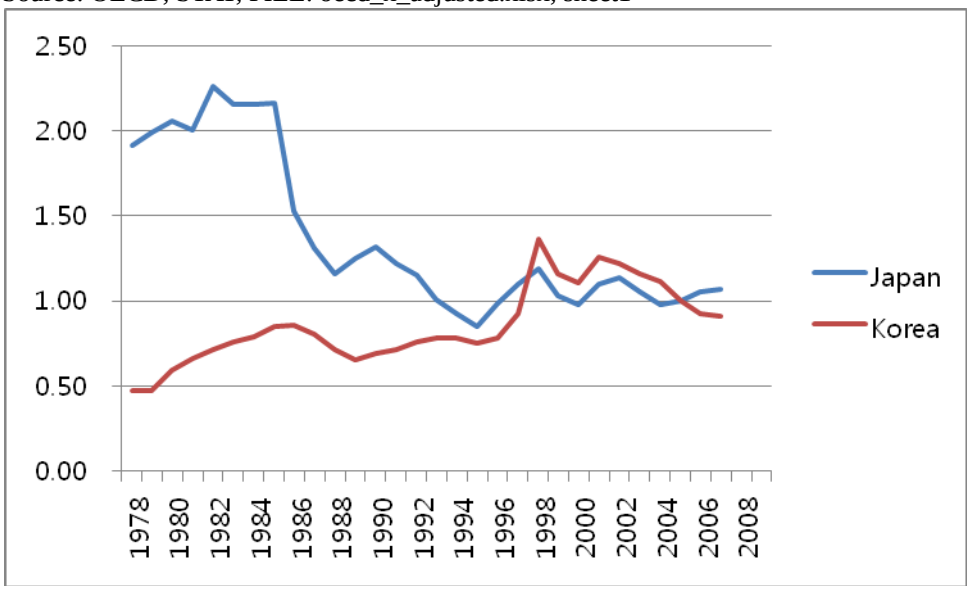
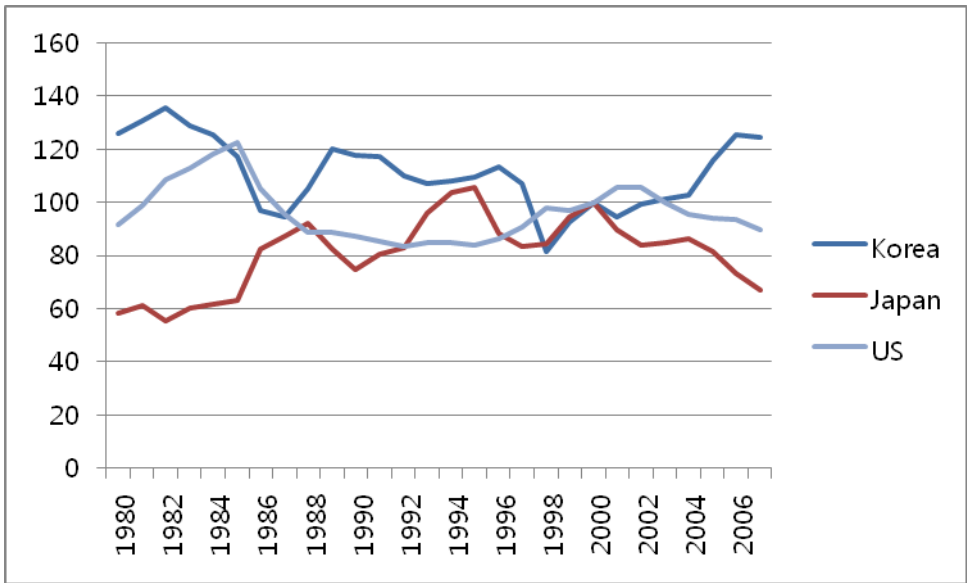
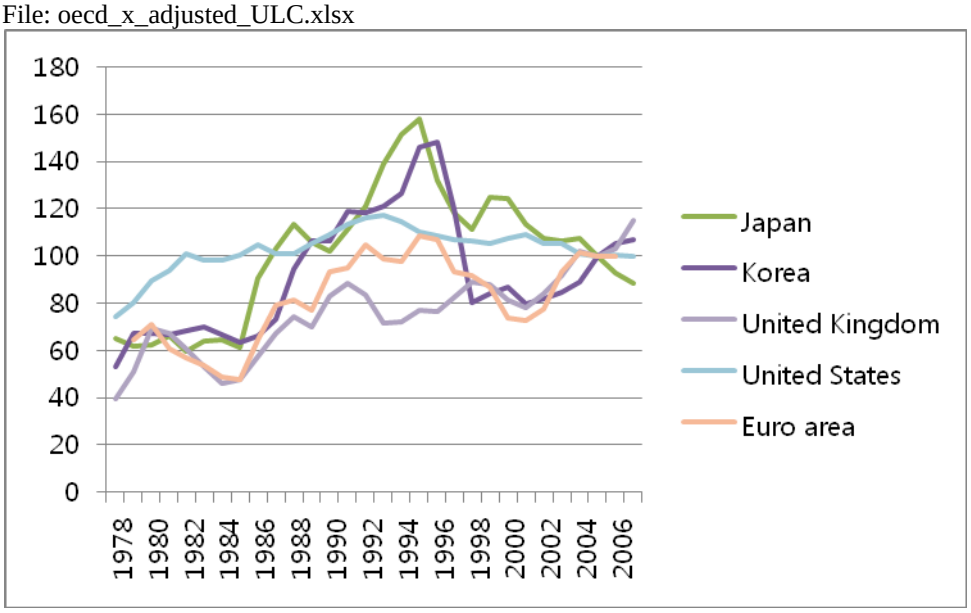


Figure: REER(Real Effective Exchange Rate) Trend (source: Bank of Korea, 2000=100)
File REER.xlsx, sheet2



Exchange Rate Adjusted ULC (unit labor cost), Manufacturing (2005=100)
Data: OECD stat
File: oecd_x_adjusted_ULC.xlsx



3) Foreign competition

The waning of Korea's light industries can be reviewed by their exports trend. We look into the five typical light industry goods-textile fibers, leather, textile yarn, clothing, and footwear from the UN COMTRADE data sets of world trade of commodities. Korea's share in world export market of the five goods were 12.9% in 1988, but it dropped to 5.7% by 1995, and as of 2005 it is only 2.7%. The decline is particularly conspicuous in clothing. Korea ranked at top 2 following Italy in world export market of clothing but by 2005 Korea is ranked at 25th with its export share 0.9%. Of course the most notable change is the growth of China as an exporting country. With the rise of china in the world export market of light industry goods, Korea's ranking precipitates.

Trend of exports of light industry goods. Data from UN COMTRADE.

Top 10 countries in world … exports, and their shares in world exports.
Data: UN COMTRADE

S3-26 TEXTILE FIBRES
S3-61 LEATHER, LEATHER GOODS
S3-65 TEXTILE YARN,FABRIC,ETC.
S3-84 CLOTHING AND ACCESSORIES
S3-85 FOOTWEAR

S3-26 TEXTILE FIBRES	1988	1990	1995	2000	2005
World exports (US billion $)	53.7	65.8	91.8	70.9	90.1
Korea's share (%)	1.6	2.1	4.6	5.5	4.8
S3-61 LEATHER, LEATHER GOODS	1988	1990	1995	2000	2005
World exports (US billion $)	24.4	36.0	65.3	69.9	94.1
Korea's share (%)	2.3	3.5	9.4	7.8	3.7
S3-65 TEXTILE YARN,FABRIC,ETC.	1988	1990	1995	2000	2005
World exports (US billion $)	222.5	330.0	579.6	605.8	799.4
Korea's share (%)	8.7	7.3	8.4	8.3	5.1
S3-84 CLOTHING AND ACCESSORIES	1988	1990	1995	2000	2005
World exports (US billion $)	157.9	260.8	540.8	677.2	976.4
Korea's share (%)	19.8	11.0	3.3	2.7	1.0
S3-85 FOOTWEAR	1988	1990	1995	2000	2005
World exports (US billion $)	60.7	91.8	172.0	177.5	253.4
Korea's share (%)	24.4	18.5	3.3	1.6	0.6
Total of five commodities	1988	1990	1995	2000	2005
World exports (US billion $)	519	784	1,494	1,601	2,213
Korea's share (%)	12.86	9.25	5.69	5.03	2.70

Source: UN COMTRADE database.

A. Sum of the above 5 goods

	1988	share	1990	share	1995	share	2000		2005	
1	Italy	17.7	Italy	15.0	China	11.8	China	14.9	China	23.4
2	W. Germany	13.9	W.Germany	11.5	Hong Kong	11.7	Hong Kong	10.7	Hong Kong	8.4
3	**Korea**	12.9	**Korea**	9.2	Italy	10.1	Italy	8.6	Italy	8.0
4	France	7.6	France	6.4	Germany	6.8	USA	5.7	Germany	5.3
5	UK	5.6	USA	6.0	**Korea**	5.7	**Korea**	5.0	USA	4.1
6	Japan	5.5	UK	4.5	USA	5.3	Germany	5.0	India	3.4

7	Belgium	5.3	Belgium	4.5	France	4.1	France	3.3	Turkey	3.1
8	Australia	3.9	Japan	3.8	Belgium	3.0	India	3.1	France	3.1
9	Netherlands	3.8	Portugal	2.9	UK	2.9	Belgium	2.9	Belgium	2.9
10	Portugal	3.1	India	2.9	Thailand	2.5	Mexico	2.7	**Korea**	2.7

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1988		1990		1995		2000		2005	
1. Italy	20.4	Italy	16.1	China	15.7	China	18.6	China	26.4
2**. Korea**	19.6	**Korea**	10.7	Hong Kong	13.9	Hong Kong	12.5	Hong Kong	9.7
3. West Germany	12.1	West Germany	9.6	Italy	9.2	Italy	6.9	Italy	6.6
4. France	7.4	France	6.4	Germany	4.9	Mexico	4.5	Germany	4.4
5. U K	5.7	Portugal	4.8	USA	4.3	USA	4.5	Turkey	4.2
6. Portugal	5.2	Turkey	4.5	Turkey	4.0	Germany	3.5	India	3.3
7. India	3.5	UK	4.1	France	3.7	Turkey	3.4	France	3.0
8. Netherlands	3.4	Thailand	3.8	Thailand	3.3	India	3.2	Mexico	2.6
9. Belgium	3.1	USA	3.5	**Korea**	3.2	France	2.7	Bangladesh	2.5
10. Greece	2.8	India	3.4	UK	2.9	**Korea**	2.6	Belgium	2.4

4) Productivity calculation from I/O analysis

Input–output analysis provides a useful tool for decomposition of employment reduction in manufacturing by factors. Input-Output analysis is usually used to analyze structural change of industries. In analyzing the causes for manufacturing employment, input-output analysis enables one to see how much of the employment reduction is due to production change and how much is due to technology change—productivity growth. As the input / output table distinguishes the demand for output due to final demand and intermediate demands, the analysis allows one to decompose the changes in output into those due to final demand and intermediate demands which reflects the degree of circumvention of production. The final demand is comprised of domestic and export demands. As the exports share is large in Korea, this enables one to distinguish final demand change due to domestic and exports demands.

Input output analysis is usefully adopted for analysis of structural changes. And OECD's 1992 analysis is one such example. OECD(1992) performed an input-output analysis for seven leading economies to determine the causes for structural change. And a similar methodology can be adopted to analysis the causes for manufacturing employment reduction in Korea since 1990s. In the analysis OECD categorized manufacturing industries into three groups according to the R&D intensity of industries.
< Explanations on the classification. >

The employment trend shown up in the Input/Output table by the Bank of Korea is as follows. Bank of Korea measures employment according to man-year, which corresponds to the average number of workers at workplaces each year.[7] The unit roughly matches the 'full-time equivalent unit[8]' used by OECD STAN data base. The size of employment in manufacturing by technology levels confirms the earlier results that manufacturing employment contraction in Korea has been concentrated in low tech industries. Throughout the 1990s and until 2005, overall employment growth rate in total manufacturing was roughly -2% annually. But in low tech industries, the growth rate was -3.59%.

[7] Year average number of worker, according to BOK.

[8] Find the definition of it. Ratio of total number of paid hours during a period (part time, full time, contracted) by the number of working hours in that period Mondays through Fridays. (BusinessDictionay.com)

Table x. summarizes the employment trend. As we have seen about 1 million jobs disappeared during 1990 to 2005, and most of them were from low-tech manufacturing industries. The trend was consistent, although the downward trend had accelerated during 1995-2000 because there was an economic crisis, which hit the manufacturing sector particularly strongly. In 1990, about 60% of manufacturing employment was in low tech, but due to rapid employment reduction and sluggish employment growth in other industries the share became 50%.

Table. Employment Size in thousands

	1990	1995	2000	2005
MFG	4,359	4,123	3,195	3,236
HT	731	814	677	753
MT	1,148	1,179	938	1,050
LT	2,481	2,130	1,580	1,433

changes,	1990-95	1995-2000	2000-2005	1990-2000	1995-2005	1990-2005
MFG	-236	-928	41	-1,164	-887	-1,123
HT	83	-137	76	-54	-61	22
MT	32	-241	112	-209	-129	-97
LT	-351	-551	-147	-901	-697	-1,048

growth rates,	1990-95	1995-2000	2000-2005	1990-2000	1995-2005	1990-2005
MFG	-1.11	-4.97	0.26	-3.06	-2.39	-1.97
HT	2.18	-3.61	2.14	-0.76	-0.77	0.20
MT	0.55	-4.47	2.28	-1.99	-1.15	-0.59
LT	-3.00	-5.81	-1.93	-4.41	-3.89	-3.59

a
source: Bank of Korea, Input-Output Tables, various years.

A simple decomposition formula allows one to decompose the employment change into the part due to output change and productivity change. In input-output tables the relationship between employment and output is simply denoted by the employment coefficient l, which is the simple ratio between the two. And the change can be decomposed between the two.

A simple decomposition result shows that in all categories of industries, output change has worked towards increasing the manufacturing employment. From 1990 to 2005, although 1.1 million jobs have disappeared, and most of them were in low-tech industries, output changes, holding employment coefficient constant, would have increase the total manufacturing employment by 6 million, and 1.6 million jobs in low-tech industries alone. That is, if
cefficient eofficient(l) reduction

$L = L \; I \; X$,

Changes		1990-95	1995-2000	2000-2005	1990-2000	1995-2005	1990-2005
(thousands)	MFG	-236	-928	41	-1,164	-887	-1,123
	HT	83	-137	76	-54	-61	22
	MT	32	-241	112	-209	-129	-97
	LT	-351	-551	-147	-901	-697	-1,048
Changes due to							
Outputs	MFG	2,824	1,515	1,153	5,463	3,334	8,817
	HT	812	969	609	2,649	2,240	5,355
	MT	1,056	393	286	1,791	916	2,727
	LT	919	237	317	1,297	799	2,124
Productivity	MFG	-3,060	-2,443	-1,111	-6,628	-4,221	-9,940
	HT	-729	-1,105	-533	-2,702	-2,301	-5,333
	MT	-1,024	-634	-174	-2,001	-1,045	-2,825
	LT	-1,270	-787	-463	-2,199	-1,496	-3,172

Note: 1995-2000 result is from 90-95-00 connected I/O table. In computing 1990-2005 changes 1990 output values (in 2000 constant prices) were converted to 2005 constant prices, using price index derived from comparison of 1995 and 2000 output values in two .
difference between 2000 and 2005 price indices
. Price index used was derived as the average of 1995 and 2000

growth rates, (%) actual employment changes, annualized

growth r, %	1990-95	1995-2000	2000-2005	1990-2000	1995-2005	1990-2005
MFG	-1.1	-5.0	0.3	-3.1	-2.4	-2.0
HT	2.2	-3.6	2.1	-0.8	-0.8	0.2
MT	0.5	-4.5	2.3	-2.0	-1.2	-0.6
LT	-3.0	-5.8	-1.9	-4.4	-3.9	-3.6

growth rates, changes due to outputs, annualized

1990-1995	1995-2000	2000-2005	1990-2000	1995-2005	1990-2005
10.5	6.5	6.4	8.5	6.1	7.7
16.1	17.0	13.7	16.5	14.1	15.2
13.9	5.9	5.5	9.9	5.9	8.5
6.5	2.1	3.7	4.3	3.2	4.2

growth rates, changes due to productivity growth, computed as residuals,

1990-1995	1995-2000	2000-2005	1990-2000	1995-2005	1990-2005
-11.6	-11.4	-6.1	-11.5	-8.5	-9.6
-13.9	-20.6	-11.5	-17.3	-14.9	-15.0
-13.4	-10.4	-3.2	-11.9	-7.1	-9.0

-9.5 -7.9 -5.7 -8.7 -7.1 -7.8

Note: growth rate due to productivity growth is derived as residuals of actual and changes due to outputs. As the productivity changes produces negative employment, no meaningful growth rate numbers can be produced.

A simple decomposition shows that the productivity growth has been large and consistent in all technology levels of industries. Productivity growth was the fastest among the high tech industries, as could be expected, but even in low tech industries, the productivity growth has been consistent throughout in tandem with the rise of real wages. As the expansion of output slows down, employment shrank fast in low tech industries.

Productivity growth did not slow down. And they are persistent.

Output changes that caused employment change can be further decomposed into factors due to final demand changes and technology changes. The effects of final demand changes can be divided into those due to domestic final demand changes and export changes, and the reduction due to import substitution of final goods. Changes in the production process is reflected in the changes in input-output coefficients.

FE	effects of	domestic final demand expansion
EE		export expansion
ISF		import substitution of final goods
IWS		import substitution of intermediate goods
IOA		changes in input-output coefficients

From i/o analysis, factors for

	change in number of engaged	breakdown of change due to output expansion						changes due to labor productivity changes
		gross output expansion	domestic final demand expansion	export expansion	import substitution of final goods	import substitution of intermediate goods	changes in input-output coefficients	
France (1977-85)								
B. Absolute change in thousands								
All mfg	-884	274	281	506	-234	-270	-10	-1156
High-tech	-63	282	143	190	-46	-46	39	-345
medium-tech	-269	2	15	135	-80	-82	14	-271
low-tech	-552	-10	123	181	-109	-142	-63	-542
B. Growth rate indicators (percent)								
All mfg	-2.14	0.66	0.68	1.22	-0.57	-0.65	-0.02	-2.80
High-tech	-0.95	4.24	2.15	2.86	-0.68	-0.68	0.59	-5.18
medium-tech	-2.20	0.03	0.12	1.11	-0.65	-0.67	0.12	-2.22
low-tech	-2.45	-0.04	0.55	0.80	-0.48	-0.63	-0.28	-2.41

Japan (1975-1985)								
A. Absolute change in thousands								
All mfg	700	9895	5364	3275	36	-58	1277	-9195

High-tech	626	5063	2585	1949	154	67	308	-4437
medium-tech	309	3522	1699	1225	-65	-41	704	-3213
low-tech	-235	1310	1080	102	-53	-84	265	-1543
B. Growth rate indicators (percent)								
All mfg	0.48	6.80	3.69	2.25	0.02	-0.04	0.88	-6.32
High-tech	2.33	18.81	9.60	7.24	0.57	0.25	1.15	-16.48
medium-tech	0.51	5.80	2.80	2.02	-0.11	-0.07	1.16	-5.30
low-tech	-0.41	2.27	1.87	0.18	-0.09	-0.15	0.46	-2.68

Japan (1975-1985)

A. absolute change in thousands								
mfg	700	9895	5364	3275	36	-58	1277	-9195
High-tech mfg	626	5063	2585	1949	154	67	308	-4437
medium-tech mfg	309	3522	1699	1225	-65	-41	704	-3213
low-tech mfg	-235	1310	1080	102	-53	-84	265	-1543
B. Growth rate indicators (percent)								
mfg	0.48	6.80	3.69	2.25	0.02	-0.04	0.88	-6.32
High-tech mfg	2.33	18.81	9.60	7.24	0.57	0.25	1.15	-16.48
medium-tech mfg	0.51	5.80	2.80	2.02	-0.11	-0.07	1.16	-5.30
low-tech mfg	-0.41	2.27	1.87	0.18	-0.09	-0.15	0.46	-2.68

US (1977-1985)

A. absolute change in thousands								
mfg	-390	2636	4359	717	-906	-756	-779	-3026
High-tech mfg	815	2831	2341	621	-213	-133	215	-2016
medium-tech mfg	-293	-175	590	33	-322	-231	-245	-118
low-tech mfg	-912	-20	1428	64	-371	-392	-749	-892
B. Growth rate indicators (percent)								
mfg	-0.25	1.69	2.80	0.46	-0.58	-0.49	-0.50	-1.94
High-tech mfg	2.64	9.15	7.57	2.01	-0.69	-0.43	0.69	-6.52
medium-tech mfg	-0.69	-0.41	1.38	0.08	-0.75	-0.54	-0.58	-0.28
low-tech mfg	-1.11	-0.02	1.74	0.08	-0.45	-0.48	-0.91	-1.09

Korea(1990-2000)

DX	FE	EE	ISF	IWS	IOA
5,463	2,248	3,905	-13	-146	-531
2,649	772	1,749	43	-141	225
1,791	595	1,191	86	43	-123
1,297	972	1,160	-165	-105	-566
8.5	4.2	6.6	0.0	-0.3	-1.3
16.5	7.5	13.0	0.6	-2.1	2.7
9.9	4.3	7.4	0.7	0.4	-1.1
4.3	3.4	3.9	-0.7	-0.4	-2.6

France (1977-85)								
A. Absolute change in thousands								
All mfg	-884	274	281	506	-234	-270	-10	-1156
High-tech	-63	282	143	190	-46	-46	39	-345

medium-tech	-269	2	15	135	-80	-82	14	-271
low-tech	-552	-10	123	181	-109	-142	-63	-542
B. Growth rate indicators (percent)								
All mfg	-2.14	0.66	0.68	1.22	-0.57	-0.65	-0.02	-2.80
High-tech	-0.95	4.24	2.15	2.86	-0.68	-0.68	0.59	-5.18
medium-tech	-2.20	0.03	0.12	1.11	-0.65	-0.67	0.12	-2.22
low-tech	-2.45	-0.04	0.55	0.80	-0.48	-0.63	-0.28	-2.41

Other explanation

Also, another explanation is raised by the global trade structure. The early 1990s was the period when other late comers began their process of industrialization, and Korea had been faced with rising competition with other Asian countries such as Malaysia, Indonesia, in textile exports. As the competition for the world market elevated by the incoming of those late comer countries with low cost labor, Korea may have lost its competitiveness, and some light industries such as textiles, shoes and toys have retarded and employment dwindled as a result. A similar but more theoretical explanation is that in a developing country as Korea, the productivity growth may be something exogenous after all. The technology growth may be conditioned by exogenous conditions, as a catching-up country

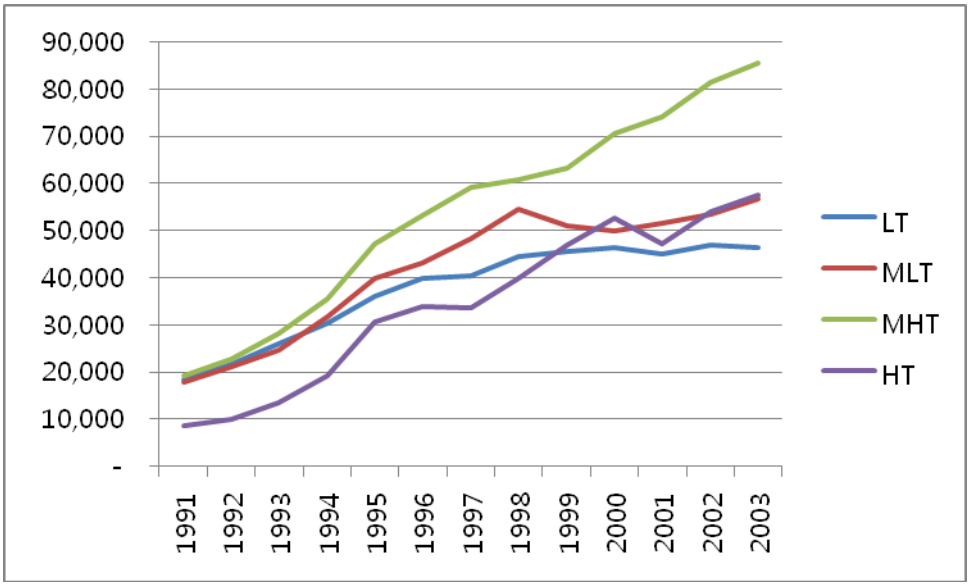
5) Evidences from firm panel data

In the previous section, we have seen that at all levels of industries productivity improved rapidly, leading to employment contraction in manufacturing. Then a natural question that can be raised is 'by whom and how the productivity rose?' To answer the question, we look into micro data sets of manufacturing firms. The data set used here is the manufacturing survey (MS) data sets surveyed by KNSO. The data set covers establishment with 5 and more average workers. As the survey is a census which covers the whole establishments registered, the data set can be reconstructed as a panel data set in principle, and from the penalized data set we can find out a dynamic structure of productivity enhancement. In this version I use data sets for 1991-2003, which can be made penalized. But a complete data set of 1981-2007 is newly available, hence all the results contained in this section can be reproduced using the new data sets.

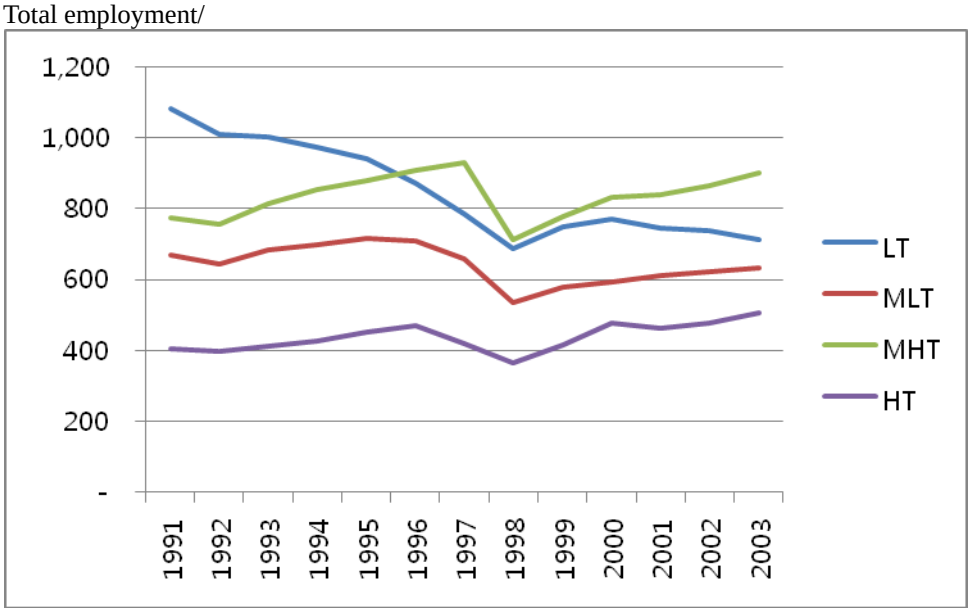
The data set covers manufacturing and mining. Among manufacturing it comprises 17 industries and we categorize them into 4 sectors according to the tech level—high tech, medium high tech, medium low tech, and low tech industries. The classification corresponds to OECD STAN's classification criteria, but does not match exactly. The trend of output (value added), employment, and productivity is as follows:

Figure total value added, unit: billion 2005 constant won

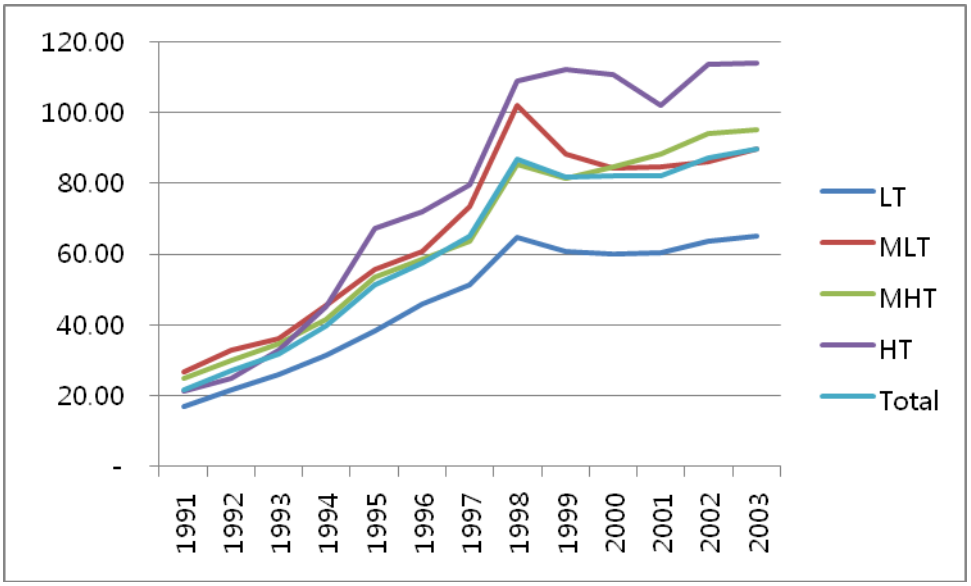
File: 090704_ms_data_summary.xlsx/생산고용추이전체!



Total employment/



Productivity trend.



Source: MS data.

Previously we have seen that the rise of wages in manufacturing sector among production workers were very even across industries. There was a lot of worker mobility across companies, industries and sectors of economy. Along with the wage rise, worker productivity (average product of labor) rise also proceeded rather evenly, as shown by figure x. What has made such a general rise possible? How it proceeded? We address this question here.

Size distribution of workers.

1) Trends

Data from Census of Establishments which covers establishment with 5 and more workers since 1993 shows the following trend of worker distribution by establishment sizes in manufacturing. By establishment sizes, most conspicuous trend in the decrease of workers in large establishments. In 1993, 900 thousand workers were employed at establishments with 1,000 and more workers. By 2005 the number more than halved. The number of workers at 300-499 establishments also diminished, while at smaller sized the size of employment of total manufacturing at least did not decrease.

The decrease of workers at large establishments has to do with declining low-tech industries, especially the textile industries. According to manufacturing survey, for which a two-digit industry classification code can be identified and categorization by tech level is possible, employment of establishments with 300 and more workers reduced by 0.43 between 1991 to 2003, from 1 million in 1991 to 0.6 million in 2003. Among them, a reduction of 0.25 million was in low-tech industries, thus the decline of large employers in manufacturing sector can be explained by the decline of low-tech industries, but the decline of large employers in other tech level manufacturing was also significant.

Low-tech industries were not particularly large employer industry either. As of 1991, only 31.1% of them were establishments with 300+ workers. It was the large firms with low average productivity that disappeared first.

1991	Frequency	Percent
1	160330	25.81
2	128544	20.70
3	183544	29.55
4	148685	23.94

2003	Frequency	Percent
1	15352	4.27
2	97783	27.19
3	120108	33.39
4	126435	35.15

1991k	Frequency	Percent
1	20222596	22.57
2	29124532	32.51
3	29558921	32.99
4	10689459	11.93

1	32290036	15.73
2	61208971	29.82
3	68523529	33.38
4	43268133	21.08

THE QUESTION IS HOW DID REDUCE THEIR WORKFORCE.
DID THEY SUCCESSFULLY SHED LABOR TO RAISE PRODUCTIVITY?
WAS THE MARKET FLEXIBLE ENOUGH FOR THEM TO DO THAT OR DID THEY DISAPPEAR, I.E, HAD TO EXIT FROM THE MARKET? THAT'S AN IMPORTANT QUESTION. AND HOW IS THE TREND. DID THE TREND CHANGE… THESE ARE IMPORTANT QUESTIONS.

Productivity compassion with other countries:

Standard methodology: Griffith, Redding, Reenen(2004)

Country i, industry j, time t, value added Y, labor L, physical capital K

=

$$\ln Y_{ijt} = \ln A_{ijt} + \ln F_{jt}(L_{itj}, K_{ijt})$$

Griffith, et al. p.887 (10)
The measure of the level of an industry's TFP relative to the geometric mean of the TFPs of all other countries.

$$MTFP_{ijt} - \ln\left(\frac{Y_{ijt}}{Y_{jt}}\right) - \bar{s}_{ijt}\ln\left(\frac{L_{ijt}}{L_{jt}}\right) \quad (1 \quad \bar{s}_{ijt})\ln\left(\frac{K_{ijt}}{K_{jt}}\right)$$, where $\bar{s}_{ijt} = \frac{1}{2}(s_{ijt} + \bar{s}_{jt})$ the average of the labor share in country i and the geometric mean of labor share. The gap with the TFP leader country:

$$TFPGAP_{ijt} = MTFP_{ijt} \qquad MTFP_{jt}$$

But OECD capital database (OECD ISDB) does not include Korea data. Estimates for

Hence, for international comparison, we use labor input only. Assume fixed coefficient production function for each industry. Then,

Measurement of labor inputs for international comparison – from OECD, "OECD Productivity Database: Calculation of Multi-factor productivity growth," 15-April-2004

$$w_t = \frac{COMP_t}{EE_t}$$

COMP=compensation of employees in period t
EE: number of employees
L=E_t total number of employed.

This survey compared GDP per capita of various countries, national economy productivity (GDP per worker= GDP labor productivity,) industry-specific actual value added labor productivity of 7 major industrialized countries, labor productivity of manufacturing sector, etc. based on the data of the OECD and the World Bank. In calculating the GDP labor productivity, the value added of each country is converted into U.S. Dollar using nominal purchasing power parity. The purchasing power parity in 2004 was 133.72 Japanese Yen to the U.S. Dollar in the OECD data and 132.54 Japanese Yen to the U.S. Dollar in the World Bank data.

Purchasing power parity is the rates of currencies required to purchase predetermined combination of goods in set amount taking into account the different prices of goods in different countries. If, for example, a hamburger of McDonald's of the same quality and size cost US$1 in the U.S. and 100 Japanese Yen in Japan, then the purchasing power parity of that hamburger is US$1=100 JYN. Purchasing power parity is defined by applying this concept to combination of goods that is perceived as representative of GDP.

Korea's labor productivity growth
International comparison of Korea's labor productivity
For international labor productivity comparison, I pick up six manufacturing industries which accounts for 62.9% of total value added (as of 2007 in terms of constant value) and compare the trend with Japan, Germany, and the productivity leader country US. The six industries with their share within manufacturing are as follows.

1) Total manufacturing 15-37

….FOOD PRODUCTS AND BEVERAGES	15	5.2

……..TEXTILES	17	2.4
….CHEMICALS AND CHEMICAL PRODUCTS	24	8.1
….BASIC METALS	27	7.6
……..RADIO, TELEVISION AND COMMUNICATION EQUIPMENT	32	28.9
….MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS	34	10.7
Total		62.9

An international productivity comparison requires a very detailed and tedious data work. There exist some evaluation of Korea's labor productivity for the whole manufacturing sector or for the whole economy, but more detailed analysis on two-digit industry level does not exist.

Existing researches show the following results.

1) Korea's KPC (Korea Productivity Center)[9] measures Korea's manufacturing labor productivity as 68.5% of the US, whereas that of Japan as 72.7%, and that of Germany as 64.4% as of 2005 using OECD data and PPP evaluation. The growth rate of labor productivity during the ten year period ending in 2006 is 8.85% in Korea, 4.51% in the US, 3.41% in Japan, and 3.44% in Germany. KPC's labor productivity measure is constant national currency price value added divided by employment, and for international comparison the currency values are converted using OECD year 2000 PPP.
2) Groningen Growth and Development Center (May 2003) estimates:
   A. 1997 bench mark year, labor productivity

EU KLEMS industries	*EUK*	FRA	GER	JAP	KOR
Total Manufacturing, excluding electrical machinery	MexElec	0.90	1.00	0.72	0.55
Food products, beverages and tobacco	15t16	0.72	0.72	0.46	0.29
Textiles, textile products, leather and footwear	17t19	0.75	0.85	0.55	0.33
Wood and products of wood and cork	20	1.10	1.04	0.58	0.52
Pulp, paper, paper products, printing and publishing	21t22	0.84	1.00	0.74	0.37
Coke, refined petroleum products and nuclear fuel	23	1.22	0.97	3.81	1.41
Chemicals and chemical products	24	1.32	0.87	1.12	1.13
Rubber and plastics products	25	1.54	1.48	0.62	0.73
Other non-metallic mineral products	26	1.02	1.18	0.67	0.66
Basic metals and fabricated metal products	27t28	0.91	1.01	0.94	0.74
Machinery, nec	29	0.95	1.21	1.05	0.41
Electrical and optical equipment	30t33	0.74	0.76	0.84	0.50
Transport equipment	34t35	0.84	0.97	1.00	0.49
Manufacturing nec; recycling	36t37	0.84	1.05	0.55	0.59

3)

4) RIETE (Research Institute of Economy, Trade, and Industry, Japan)[10] conducted an international productivity comparison study among the Asian economies-Japan, China, Korea, Taiwan and the US using year 2000 data, and some major TFP comparison results in 2-digit industries are as follows:

year 2000	Korea	Japan	China
food and kindred products	64.1	73.6	64.8

[9] International Comparison of Korea's Total Factor Productivity, Korea Productivity Center, 2008.

[10] RIETI, International Comparison of Productivity among Asian Countries (ICPA) Project,

Productivity in Asia: Economic Growth and Competitiveness, eds. by Dale Jorgenson, Kuroda Masahiro, Motohashi Kazuyuki, Edward Elgar Publishing, 2007.

textile mill	77.3	106.9	53.9
Apparel	52.2	94.1	60.8
lumber/wood	81.8	78.9	43.5
Chemicals	72.8	92.7	47.6
petroleum and coal products	101.8	81.5	74.1
primary metal	80.8	115.7	73.1
fabricated metal	87.1	78.2	49.2
machinery, non-electrical	88.6	92.6	46.9
electrical machinery	85.3	118.1	70.1
motor vehicle	80.0	114.3	58.6
transportation equipment and ordinance	77.6	101.5	48.3
Instruments	68.2	124.6	45.8

/

2)

3) data series begins in 1993, up to recent data is available. Not much information.

4) What does this mean that large companies

5)

6) Trend size distribution of establishments

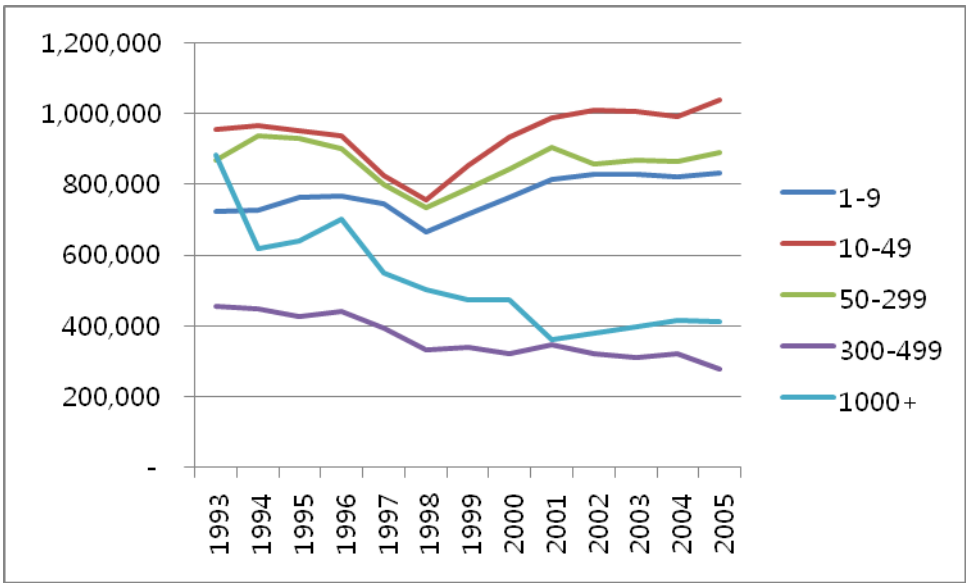
Figure. Distribution of manufacturing workers by establishment sizes. (1993-2009)

Keller, Wolfgang, ¡°International Technology Diffusion,¡± Journal of Economic Literature, v.42, September 2004, pp.752-782.

Griffith, Rachel, Stephen Redding, and John Van Reenen, ¡°Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Countries,¡± RES, November 2004, 86(4), 883-895

How to measure the gap with the tech leader country.

R&D expenditure and productivity growth.



7)

8) 사업체기초통계조사 (establishment census), 1993-2005.
9) Establishment census does not give information on 2 digit level in mfg sector.
10) MS data summeary from KNSO web: lists info since 1999- but since the major changes occurred in the 1990s not 2000s not much of use.

11)

across firmindustries movements

Before, we claimed that low tech

At all levels of technology grew fast. How.

Question 1: many large firms disappeared since the early 1990s.
Are they low-tech? are they low productivity firms?

Industry classification in the data set is in 17.
Figures 1 to 3 shows
The general trend is as f

made as a

and who
Aside from the overall changes on a macro scale,

a. Who contributed to productivity growth? – are they large firms or small firms? New firms or existing firms? Who makes the productivity growth to procrastinate?
b. Who creates jobs? Is it large firms? Small firms? Existing firms?
c.
d.

Dynamics
We can
which

the retreat of
The retreat of low-tech manufacturing sector
the share of manufacturing employment has steadily declined since the 1960, and in some countries since the 1970s.
all de
advanced countries. In
Korea's manufacturing employment reduction was
A major characteristic of Korea's manufacturing employment reduction transition is that it occurred with an unprecedented pace. Most industrialized countries experienced manufacturing employment share decline since the 1970s.

Question nu

3. apid reduction of manufacturing employment

A. The trend

During the 1980s, manufacturing was the major sector of employment growth, but the trend turned around by the end of the decade and manufacturing employment started to decrease. The downward trend continued until it stabilized in the 2000s. The pace of employment reduction in manufacturing was very rapid in comparison with other countries. Table 1 summarizes the trend. During the 1980s, manufacturing employment grew by two thirds from roughly 3 million in 1980 to 5 million in 1990. Manufacturing accounted for almost half (44.4%) of the total job growth in the 1980s. But after the manufacturing employment marked 5 million in 1991, it decreased at a very rapid pace, and it stood at 4.3 million in 2000, and 4.2 million in 2005.

Two explanations are commonly suggested for the turnaround and rapid reduction of manufacturing employment: One is the rapid rise of real wage as a consequence of invigorated activated union activity that followed political democratization in the late 1980s; and the other is the rapid exchange rate appreciation as a result of the huge trade surplus at the time aided by worldwide economic boom and the strong yen. Real wages rose at a double digit rate during 1990-93 and the Korea Won appreciated by xx % during …

(see data_work/x_trends)

Manufacturing employment by industries

The trends of manufacturing employment by industries

During the 1970s major employment growth sector in the Korean manufacturing was the low tech, light industries. Textiles industry alone created 36.7% of total job growth in manufacturing.[11] The manufacturing job growth pattern in the 1980s were more evenly distributed among sectors, and there was significant job growth in heavy and chemical industries. Machinery and electrical equipments, textile, chemical, metals, and transport equipments registered roughly the same amount of job growth in the 1980s. Among the 1.9 million job increase in the decade, machinery and equipments industry job growth was the largest, registering 0.7 million jobs, among which 0.4 million was in electrical equipments. Textiles, chemical, metals, and transport equipment industries registered similar amount of job increase, of about 0.2 million, respectively. Low wage light industry was not a major job growth sector any more but it increased steadily. Textile industry accounted for 11% of total manufacturing job growth in the 1980s, while it accounted for 37% in the 1970s,.

Manufacturing job decrease started around the end of the 1980s and it proceeded at a rapid pace during the 1990s. During the 1990s, manufacturing employment reduced by 0.6 million, which corresponds to 12.6% of total manufacturing employment in 1990. During the same period total employment increased by 3.1 million, 17.0% of the 1990 employment. Manufacturing employment reduction in the 1990s were concentrated in low-tech mfg, such as textiles, non-metallic and manufacturing n.e.c.[12] In other mfg industries, employment did not decrease appreciably. Employment reduction was especially large in the textile industry. The size of its job decrease during 1990 to 2005 was 0.9 million, while the total manufacturing job reduction was 0.8 million in the same period. (The statistic is from manufacturing survey (MS), which covers establishments with 5 or more workers. EAPS does not provide employment by 2 digit industries.) Textile employment reduced by 70% compared to its 1990s level, while non-metallic and manufacturing n.e.c. also decreased by 50%, respectively.

Very rapid contraction of manufacturing employment

Korea's manufacturing employment reduction has been very rapid, but it is not very exceptional. Korea's manufacturing employment decrease by 17.3% during a decade following 1981. Japan's manufacturing employment decrease during the 1990s were 16.6% and France also registered a manufacturing job decrease of

[11] Topel and Dae-il Kim summarize the major characteristics of labor mobility during the period. Low wage jobs in the manufacturing served as inlets for the excess labor flow from the rural area. A typical pattern of young rural labor was from rural area to urban manufacturing, and then to urban services.
[12] Not else classified.

17.1% during the 1980s and by 13.9% during the 1990s according to OECD STAN dataset. But Korea's manufacturing job decrease in the 1990s were very concentrated in low-tech mfg. Low-tech manufacturing, which are food, textile, woods, and paper industries, are in downwards trends in most countries. But in no other OECD country the employment reduced as quickly as in Korea. In Korea, low-tech manufacturing employment reduced by 37.4% during 1991-2001 and by 51.8% during 1991-2006, whereas in Japan, it reduced by 20.5% and 33.9% during 1990-2000 and 1990-2005, respectively. And during the 1990s manufacturing employment reduction was concentrated in the low-tech sector. In other sectors, high-tech, medium high and medium low tech manufacturing, employment reduced only slightly. As the low-tech manufacturing was the industries that provided jobs to low educated worker in Korea, its fast reduction produced social impacts as well as the employment structure shift.

Table 2 compares the manufacturing employment trends in Korea with other major economies. Korea's manufacturing employment share, standing at 18.0% as of 2006, is relatively high compared to other OECD countries, being a manufacturing country. The level is at a par with those in other manufacturing countries such as Germany and Japan: it is lower than Germany's 19.3% (2005) but slightly higher than Japan's 17.2% (2005). And it is higher than France's 13.4% and much higher than US's 10.3%. On the other hand, Korea's deindustrialization is yet to happen, if we define deindustrialization as drop of manufacturing's share of value added. The Korean manufacturing's share in total output (value added) did not drop since the 1990s. As of 2006, the share is still as high as 28.0%, whereas those in Japan and Germany dropped to 20.6% and 22.7%, recently. Compared with Germany and Japan, Korea's mfg employment share is low, considering its high output share. Unlike in those countries, in the Korean case, manufacturing's share in output did not drop because the share of high-tech mfg in output increased during the 1990s, due to the leap of electronics such as semi-conductor industry. If its effect is subtracted, the gaps in employment to output ratio are much narrowed.[13]

In advanced economies, low tech mfg employment reduction was a steady trend that begun long time age. Low-tech mfg employment consistently decreased in advanced countries since the 1970s and the downward trend only accelerated with globalization since the 1990s. On the contrary, low-tech mfg significantly expanded in Korea in the 1980s. Quick reduction in the 1990s may be a consequence of the expansion in the 1980s.

Most advanced countries experienced a quick reduction of manufacturing employment in medium tech mfg since the 1990s, as the globalization trend advances. But such trend did not happen in Korea and the employment levels are generally higher in 2006 compare to 1991 level. It could be that competition with less development countries took medium industry jobs in advanced countries, whereas it took away low tech jobs in Korea. Or, the trend may be one yet to come in Korea, in which case Korea should expect a further job decrease in mfg.

<u>Wage rise since the late 1980s</u>

[13] The share of radio, television and communication equipment (ISIS rev3. 32) in total nominal value added is 5.4% as of 2006.

The year 1987 marks the year of union activity liberalization in Korea. Political democratization and lifting up of oppressive regulations on strikes prompted a burst of labor disputes. Strikes were prevalent and wages quickly rose in every factory. Manufacturing wages rose by 16% and 15% in 1988 and 1989, respectively, in real terms.[14] Sharp rise of mfg wages continued until the early 1990s. The average mfg wage rose by 45% in 4 years, and by 1995 it more than doubled from its level in 1987. As such a rapid rise accompanied the rapid reduction of manufacturing employment in the 1990s, which were mostly concentrated in the low-tech sector, the rise of wages is often associated with the rapid retardation of low-tech industries. In this subsection, we review the pattern of wage rise and see if such claim can be validated.

Table 2 compares the log real wage trend in low-tech mfg with that in other sectors. As the figure shows the trend is parallel, and the wage gap between low-tech mfg and other mfg remained about the same, although the low-tech industries are low-wage industries and wages are lower in the industries. Even in the early 1990s, when low-tech mfg employment quickly reduced, the wage gap between low-tech and other mfg industries did not widen.[15] Wages in low-tech industries rose as quickly as the medium and high tech mfg industries. Such facts imply that the wage rise, although they may be initiated by labor unions, affected all manufacturing industries, and raise wage levels in all sector. (To be confirmed) Being a non-segregated labor market with active labor mobility between sectors, union activities raise the wage level of all industries. And with the wage rise, some of the low-tech industry lost international competitiveness and disappeared.

Demise of Low-tech Manufacturing Employment

1) In which industry?

Most of the low-tech mfg employment reduction occurred in textiles (ISIC 17), apparel (18), and leather (19) industries. Among the decrease of 686 thousand jobs in low-tech industry during 1990 to 2000, 654 job reductions were in the three industries.(OECD STAN statistics) Textiles is the largest among them and also registered the largest reduction: one-third (220/686) of low tech mfg job reduction occurred in textiles alone. Leather industry virtually vanished during the 1990: its employment size was 364 thousand but only 86 thousand jobs left by 2000. The downward trend of low-tech mfg employment continued in the 21st century, and it further decreased until 2005. Out of total employment reduction of low-tech mfg of 946 thousand, 601 thousand are in textiles, 233 thousand are in apparel, and 318 thousands are in leather industry.

(This result is according to OECD STAN data sets. Can us MS (mfg survey) data set which covers 5+ establishment, and can get more reliable results)

2) Who and where workers lost jobs?

[14] According to OWS data sets. Average wages in establishments with 10 or more
[15] See 0613_mfg_lowwage.xls

Answers to questions of how the jobs decreased in those low-tech industries and who lost jobs in manufacturing can provide implications for the tasks ahead. A panel of manufacturing survey (MS) data sets are available, and an establishment panel can be constructed for the period 1991 to 2003. An extended panel of the same data sets is now available and the panel can be constructed from 1980 to 2005. The results contained in this section will be updated when the new panel data becomes available. The survey data include number of workers at the establishment in three categories—production workers, white collar workers and self-employed. From the data, what kind of workers decreased and job creation/destruction pattern can be found out. The survey covers establishment with 5 and more workers.

If we review the data sets for industries 17, 18, 19 (textiles, apparel, and leather) among which most of job decrease in low-tech mfg happened, job decrease was predominantly among the production workers. During 1991-95 in which period job decrease was most rapid, 173 thousand production jobs disappeared, where as white collar job losses were only 7 thousands. During 1995 to 2003, white collar job losses increased and 33 thousand white collar jobs disappeared but in the same period production job decrease was 170 thousands.[16]

By size of establishments, employment reduction occurred predominantly in large establishments. During 1991-95, 113 thousand job losses among the total of 174 jobs losses were in large establishments with 500+ workers. (MS data set), At small establishments (5-9 and 10-29 workers) employment increased slightly, by thousand and 15 thousand, respectively. At medium sized establishments, employment also reduced, but the magnitudes are not as large as in large establishments.

Entry, exit, and expansion and contraction

Size distribution of exiting firms?

ind 17-19	total change	exit	entrance	expansion contraction
1983	13,487	-105,240	103,757	14,970
1984	-1,155	-96,709	95,461	93
1985	9,097	-79,325	91,152	-2,730
1986	61,456	-75,734	118,748	18,442
1987	38,132	-78,371	111,078	5,425
1988	-6,233	-84,904	109,522	-30,851
1989	-36,924	-96,328	116,784	-57,380
1990	72,284	-103,125	233,661	-58,252
1991	-82,007	-134,261	99,151	-46,897
1992	-66,756	-117,638	87,723	-36,841
1993	-25,585	-129,617	136,064	-32,032
1994	-34,487	-103,484	84,958	-15,961
1995	-41,975	-114,836	93,090	-20,229
1996	-53,705	-102,029	70,993	-22,669

[16] L_decrease in low tech.xlsx!sheet1;rows122-

1997	-55,150	-79,644	52,822	-28,328
1998	-61,966	-97,532	54,452	-18,886
1999	33,954	-59,725	80,539	13,140
2000	12,600	-59,511	75,597	-3,486
2001	-30,123	-65,516	58,367	-22,974
2002	-16,126	-56,666	50,883	-10,343
2003	-34,973	-61,043	41,707	-15,637
2004	-36,533	-50,393	31,626	-17,766
2005	-20,711	-44,014	33,884	-10,581
2006	-15,938	-35,336	29,127	-9,729
2007	-8,144	-64,673	22,102	34,427

data: panelized Mfg Survey, Korea National Statistical Office
source: DRC_섬유산업.xlsx

Jobs are created and destroyed by firms' entrance and exits and existing firms' expansion and contraction, and destruction of low-tech mfg jobs can also be decomposed as such by using the constructed panel of the MS data sets. At the early phase of demise of labor intensive, low tech industries, exits were the major cause for jobs destruction. During 1991-92, exits of existing firms destroyed 103 thousand jobs in textiles, apparel, and leather industries.[17] The amount was even greater than the total job reduction of 73 thousand. At the early phase of the demise of labor intensive industries, exit of firms were widespread. It was not limited to small to medium companies. Large companies with 500+ workers also accounted for a job loss of 22 thousand in 1992.

But after 1992, contraction of survival firms was the major source of job destruction. Job creation and destruction due to entries and exits were active and about the same amount in the midst of overall employment decrease, but existing firms quickly cut down their production workers and it soon became the major reason for production worker reduction in the industries. For example, large firms' (500+) employment in the industries reduced by 41 thousands and 45 thousand in 1991-92 and 1992-93, respectively. Among them, 22 thousand has been due to exiting firms in 1991-92 but in 1992-93, only 3 thousands were accounted for by exiting firms.

After 1992, exits of large companies were not common. Most were small to medium companies and large companies reduced their employment scale and became medium sized companies instead of going out of business. (This part to be confirmed with a longer panel.)

How many were released?

Who were they?

3) how they released—what is the cause? Wage hike? Exchange rate movement?

[17] L_decrease_in_low_tech.xlsx!sheet1:rows158-170.

A natural question that can be raised on the rapid demise of labor intensive low-tech manufacturing industries is what the causes of it are. If the rapid employment decrease was because of the institutional wage hike that made the companies in the sector lose international competitiveness and ultimately disappear, one can ask why did the workers raise their wages risking their jobs? Or, was it the exchange rate change that appreciated quickly in the period as a result of trade surplus in the period. Or was it shortage of labor supply from the rural sector which has been source of low-wage abundant labor during the industrialization period?

To find out answers to these questions, we look into the change in worker composition in the industries.

Why the firms chose to exit during 1988-1992 but rather chose to reduce employment. Employment reduction of existing firms after 1992 suggests that employment adjustment was not impossible at the time. Was it the 'pull' factor? Wages in other sectors of the economy rose so fast that workers moved out of those low wage, low tech mfg industries and as a consequence those industries disappeared? To answer these questions, we look into wage movements.

The characteristics of production workers in those industries that diminished

Figure xx summarized the trend.[18] The employment decrease in industries 17-19 during the 1990s were predominantly among the low-educated young female workers. At the end of 1980s, the majority of production workers in low-tech labor intensive industries were women with age under 25. But by the mid 1990s, they all but disappeared in the industries. The young female workers were typically less educated from the rural area, and low wage workers. Also the next figure shows then real wage trend.[19] The wages among the young female workers rose rapidly, but they were not the group for which wages rose most. Young males' wages rose much quicker and young female production workers wage rise was among the modest in worker characteristics groups.

Different explanations are possible for this phenomena. One explanation is provided by simple demand / supply curve and institutional wage increase. As Gordon(1997) explains,[20] if wage increases by an institutional factor, under homogeneity of labor assumption, this will push up labor supply curve, resulting higher wages and lower employment. With higher wage, business profits drop, and in the longer run, both employment and wages fall as capital stocks adjusts downwards. If union activities since the late 1980s raised wages among the low education young female workers in the low tech mfg industries, this would have squeezed business profits in the sectors and employment in the sector ultimately.

[18] Workers_characteristics_in_low-tech.xls

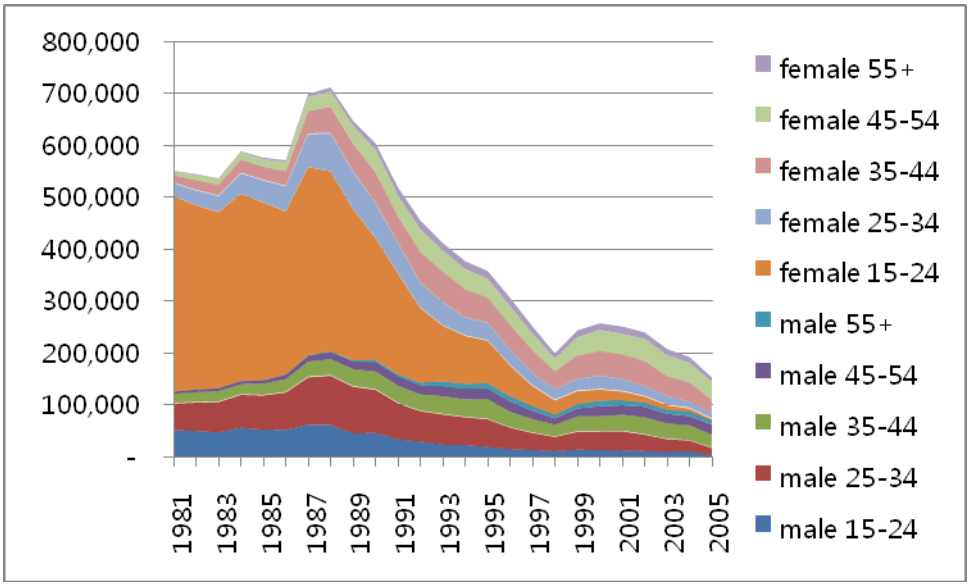
[19] Defined as regular and overtime wages plus 1/12 of the previous year's bonus (special pay) in real terms. (deflated with CPI)

[20] Gordon, R.J. (1997), "Is There a Tradeoff between Unemployment and Productivity Growth," in D.Snower and G. de la Dehasa, (eds.) *Unemployment Policy: Government Options for the Labour Market*, Cambridge University Press. And Boulhol, Herve and Laure Turnet, "Employment-Productivity Trade-off and Labour Composition," OECD Economics Department Working Paper, n.698, OECD, Paris, ECO/WKP(2009)39, 2009.

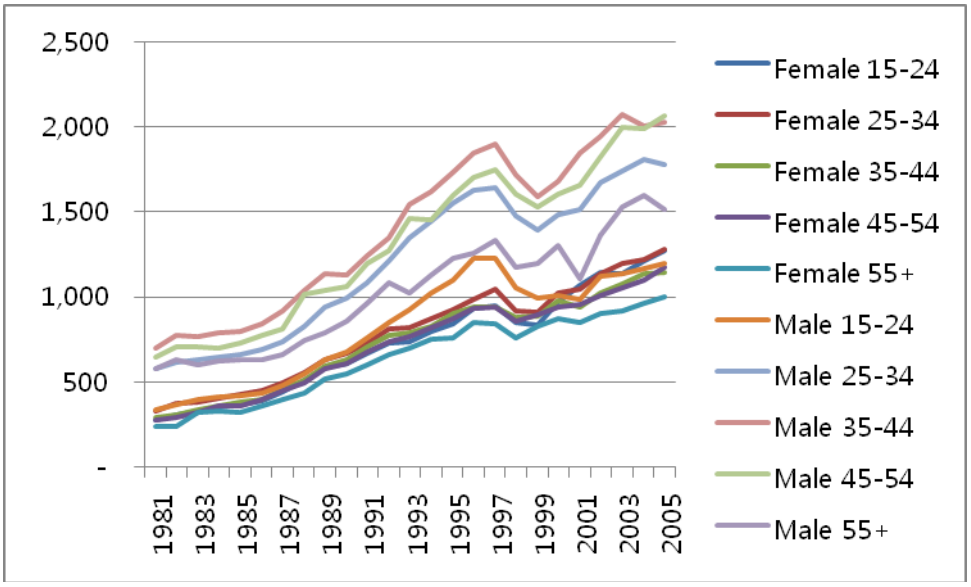
The wage rise since the late 1980s were rapid, but among the production workers in low tech manufacturing sector, the rise of wages among young female workers were not particularly high compared with other groups of workers. Since the output of low-tech mfg

< Output trend >

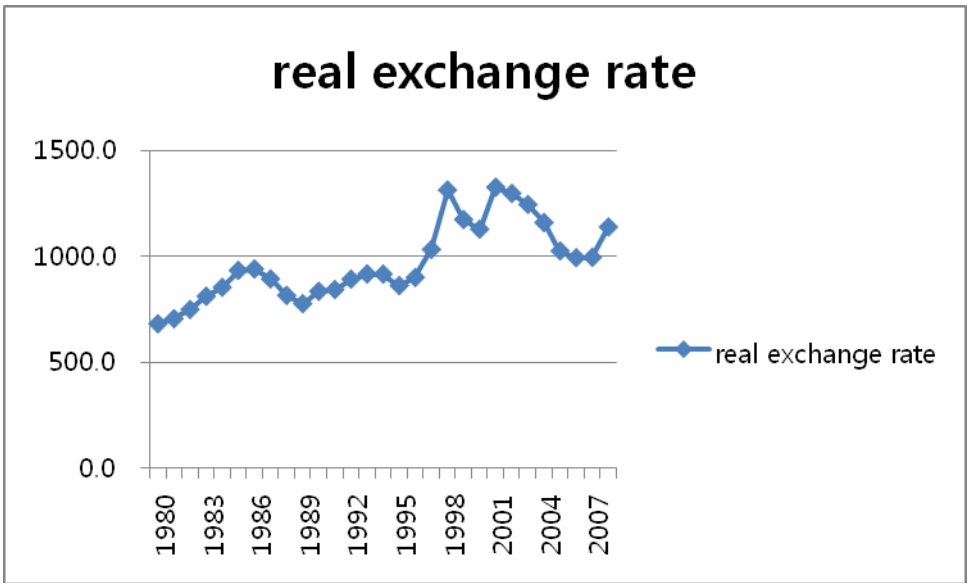
Employment by Worker Characteristics in Low-Tech mfg (ind 17-19)



Real Total Wage Trend among Production Workers by
Worker Characteristics in Low-Tech mfg (ind 17-19)



Real exchange rate trend



The above figure is the real exchange rate trend between Korean Won and US dollars, both deflated by producers price index of the countries. Real exchange rate of the Korean Won appreciated rapidly during the second half of the 1990s but the level was resumed by the mid-1990s, in which period the structural change, and the demise of labor intensive industries even accelerated. From this we can deduce that rapid appreciation of the Korean Won was a cause for rapid demise of the labor intensive industries in the short run, but they can not explain the long-term trend.

Low educated female workers stayed in mfg?

Moved to services?

Check ows and and eapsnew data and find out where they moved.

The trend of worker characteristic of mfg industries in the 1980s and 1990s

Young female workers just left the mfg industries?

According to the OWS data young female workers quickly moved out of manufacturing sector. The following table[21] is the distribution of production workers (occupation codes 7/8/9) in manufacturing. Female workers age under 25 among the production workers in mfg was 566 thousand in 1986 but ten years later, by 1996, the number reduced to 173 thousand. The trend continued and by 2001 it was less than 100 thousand.

		1981	1986	1991	1996	2001
male	15-24	198,968	191,372	169,779	168,533	109,586
	25-34	308,183	444,021	464,867	409,762	372,308
	35-44	137,529	186,906	232,614	294,587	336,159
	45-54	38,431	66,859	116,866	148,233	175,320
	55+	5,682	8,294	22,784	52,901	52,964
female	15-24	601,485	566,026	378,642	172,972	93,187
	25-34	51,822	104,258	118,850	80,449	74,500
	35-44	44,137	80,639	135,389	153,232	141,530
	45-54	19,345	44,653	93,437	110,168	130,660
	55+	2,154	6,402	26,598	37,858	33,456

The above table shows that young female workers moved out of manufacturing. Their economy wide employment change pattern can be ascertained from EAPS data set. (worker characteristics xls) EAPS data shows that despite the rapid mfg employment reduction young female employment did not reduce in the 1990s. Employment rate stayed roughly at the same level.

The real wage trend among production workers in low-tech industries reveals that some institutional wage increase did exist—wages in large companies rose faster than in small to medium companies. The wage level at large companies were lower than small and medium companies, reflecting the fact that large companies were the major hirers of simple labor, but since 1987 wages in large companies rose faster and the wage

[21] Worker_characteristics_lowtech.xls!sheet1, column 50

structure eventually reversed.

Large
There did is supports the view

What were the wage trends?

What were the exchange rate trends?

Then why large company employment reduced so quickly?

How productivity in mfg improved – due to exit/entry? Due to investment?

Characteristics of the workers in those industries:
The production workers in those low-tech industries

Characteristic of production workers in the those industries from OWS data sets.

By size of establishment, low-tech manufacturing employment reduction occurred mostly in large establishments. From OWS data sets, which can be better confirmed from MS data sets, low tech employment reduced in large-sized establishments. (see L_decrease_in_low_tech.xls / data are saved in bulk/lowtech&y)

From mspanel data, see the employment trend by
Effects of unionization on wages?
Effects of what kind of people?
Resulted in migration?

Review OWS data sets
How fast mfg wages rose in mfg / low-tech mfg?
Different patterns by unions/ size of firms?

Pattern of Manufacturing Employment Reduction

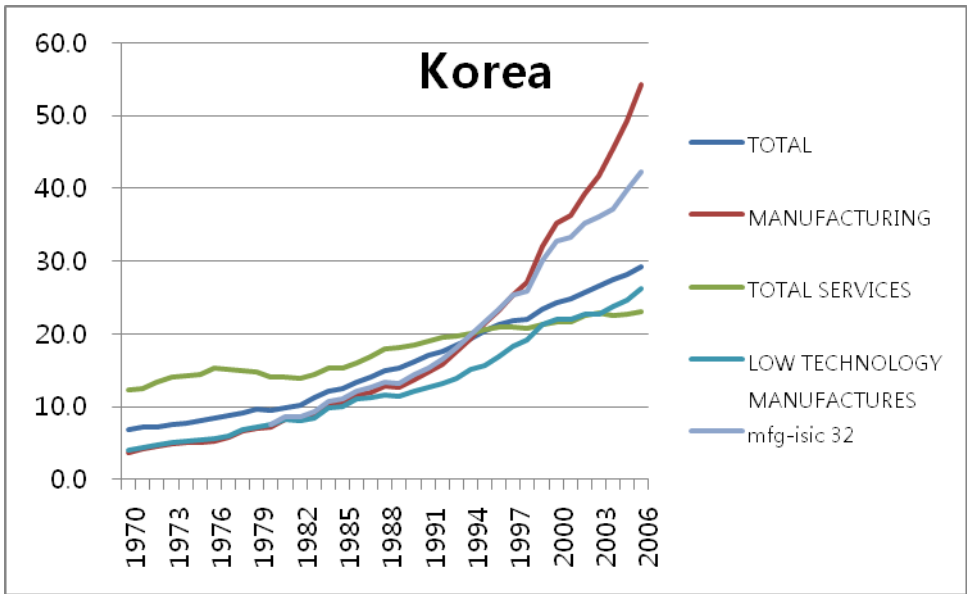
Mspanel.data analysis
How jobs created and destroyed? By entry/exit or by expansion/contraction

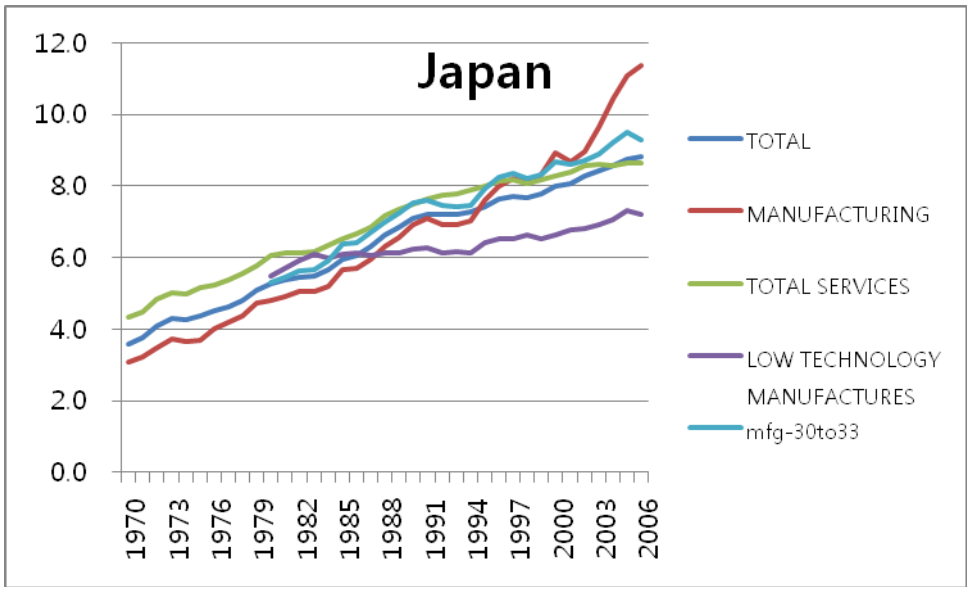
In which sector jobs creates/destroyed?

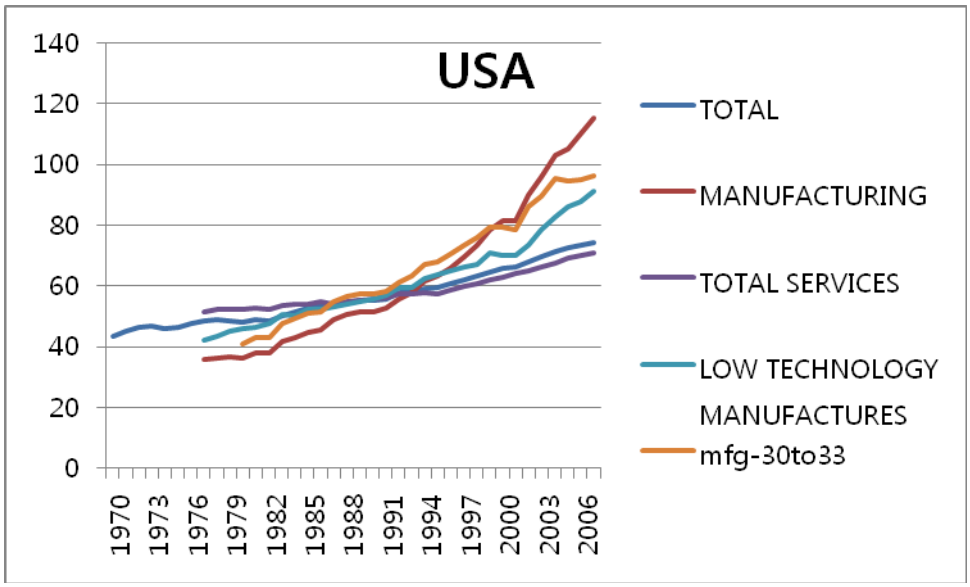
PRODUCTIVITY

1. Trends;
    1) Gap between mfg productivity and services productivity

    From OECD STAN data sets.

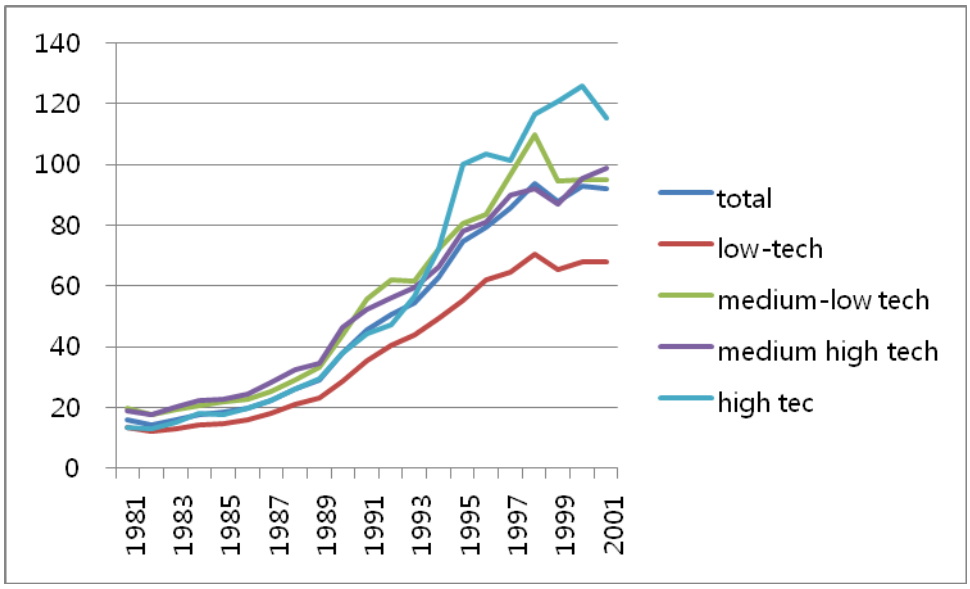






Average Productivity Trend by Industries

Data: Mfg Survey, Labor productivity = value added real / total employment



the 1990s and

For example, its employment share among manufacturing in Korea was

concentrated in low-tech manufacturing industries as defined by the OECD STAN manufacturing industry classification, but again, such is not unique to Korea. The employment share of low-tech manufacturing among total manufacturing was

is

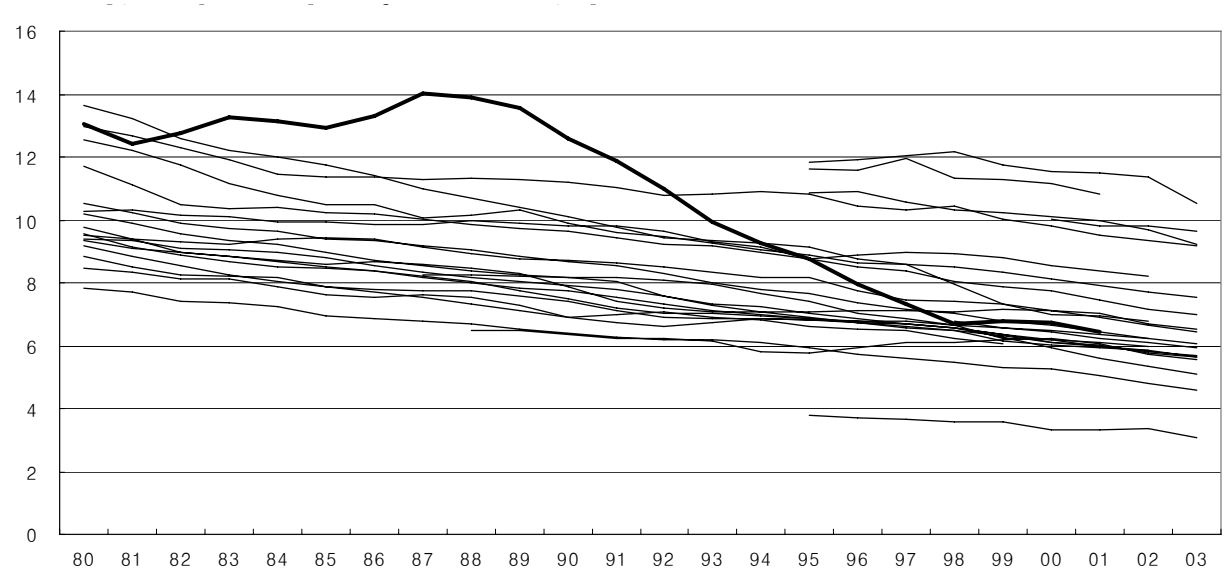
during the same time span.

by any standards. And since the reduction is concentrated in low-tech, low-wage industries a simplistic (industrial structure) view points to the rise of wage level and change in competitiveness as the cause for the rapid employment reduction. (Ahn, …) But the view misses several points. Firstly, currently Korea's manufacturing employment share is even lower than those in other manufacturing countries such as Germany or Japan which have even higher wage level. From a labor economist's point of view, what matters is the productivity, not the wage level. Secondly, industrial structure point of view misses what is really happening behind the advancement and retardation of international competitiveness. The wage level is just one factor and a very static factor in determining competitiveness, and the latter depends upon many other things, such as the industry leader, training, R&D development.. etc. AND OTHER EXPLANATIONS.

Before proceeding any further, let's review the facts.

Manufacturing employment reduction trend-international comparison
From OECD STAN data sets.

Trend in employment share of OECD countries by sector:
Low-tech manufacturing industry (from Ahn, Sang-hoon)



Industrial structure change view starts with industry statistics. During the 1990s the share of low-tech industries in total manufacturing value added production halved. It actually dropped from 20% in 1987? to 10% in 2003. Accordingly low-tech industry's employment share among total employment dropped from 13% to 7% and the share among manufacturing dropped from 42% to 30% in the 15 year period. (Ahn, …) Structural change in manufacturing was slow in 80-85 but accelerated since the late 1980s throughout the 1990s.

Confirm these numbers, which shouldn't be hard.

Among the two opposing views, determining which effect is more dominant is not so difficult, because they affected differently. Wage rise caused by union activity has been concentrated in large companies while exchange rates affected all companies in country regardless of size of firms or industry. Thus by looking into the pattern of employment reduction, one could be able to determine what the major cause was in the period's job reduction in manufacturing.

6/13/2009
Ows data 제조업 부문 임금 상승 추세 확인을 위하여
Make mfg subset of data sets
1980-2005
1999년 이후는 상용근로자 10인 이상으로 제한
99년 이후는 esize=1 제외

80-92: 75년산업분류(제4차개정이 적용) mfg: 31-39 – 31-34가 low tech

93-2001: 91년 산업분류—mfg: 15-37 – 15-22가 low tech

02- ; 2000년 산업분류—mfg: 15-37
신분류: 17: 섬유, 18: 의복 및 모피, 19: 신발 가죽
구분류: 32: 섬유,의복,가죽

Appendix to chapter 4: i/o table

Oecd, 1992, structural change and industrial performance, 7 country growth decomposition study p.115 decomposition

[1] oecd(1992)
[2] *2005 Input-Output Tables*, The bank of Korea, 2008, pp. 16-32

[1] p.114

$$X_i = \sum_j W_{ij} + F + E - M$$

(1) X=AX + F + E – M i.e.,

$$a_{ij} = W_{ij} / X_j$$

(2) define A as
(3) ratios of domestic demand of imports M into two uses:
intermediate demand as u_i^w and domestic final demand as u_i^f
where (3) $u_i^w = \frac{W_i^d}{W_i}$ and (4) $u_i^f = \frac{F_i^d}{F_i}$

(5) $X = \hat{u}^w AX + \hat{u}^f F + E$
(6) $M = \hat{m}^w AX + \hat{m}^f F$

On the other hand, in [1],

$$X = A^d X + Y^d$$

국산거래표 : from this, $A^d = \hat{w}^d A$, $Y^d = \hat{f}^d F + E$, $\hat{f}^d F = Y^d - E$

수입거래표 from this, $A^m = \hat{m}^w A$, $Y^m = \hat{m}^f F$

생산유발계수행렬 = 투입계수행렬은 A^d 행렬

p.115 decomposition
(12) where
Output change = effects of domestic final demand (FE)
+ effects of export expansion (EE)
+ effects of import substitution of final goods (ISF)
+ effects of import substitution of intermediate goods (ISW)
+ effects of changes in input-output coefficients (IOA)

F is final demand : F = $\hat{f}^d F + \hat{m}^f F$ =

$$\hat{f}^d = \frac{F^d}{F} = \frac{[(Y]^d - E)}{[\ ]} \quad (Y\,|_d \;|\; E + Y\,|_m)$$

$$\hat{w}^d = \frac{W^d}{W} = \frac{A^d X}{A^d X + A^m X}$$: 수입거래표 중간수요계/(국산거래표 중간수입계+수입거래표 중간수입계)

$$X = A^d X + Y^d = W + V$$

Denote 국산거래표

& 수입거래표 then, $\hat{w}^d = \frac{W^d}{W^d + W^m}$

$$AX = X\,|F\;|\,E + M$$

from (1)

(국산거래최종수요+수입거래최종수요) + 수입

BoK formula

And,

Hence, , and

Thus, $A = A^d + A^m$

Addendum:

where 생산유발계수, : 국산거래표 총수요

ISW=

IOA=

$$B_0\hat{W}_0^W(\hat{L}\Delta A)X_1 = B_0\hat{W}_0^W(A_1X_1 - A_0X_0) = B_0[\hat{W}_0^W W_1 - A_0^d X_1) = B_0[(\hat{W}_0^W W_1 - X_1) + X_1$$

I do not need A^m matrix or its inverse matrix!!!

<end 6-27-09 Boston>