Macroeconomic Consequence of Deindustrialization

- The Case of Korea in the 1990's -

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Abstract

Deindustrialization affects economic growth and fluctuation because both productivity growth and volatility are different between the industrial sector and the service sector. This paper investigates the effect of deindustrialization in the Korean economy on its growth and fluctuation. The estimation shows that the one year labor shift effect is a 0.2%p (narrow manufacturing)~0.45%p(broad manufacturing) decrease in annual average economic growth, and the cumulative labor shift effect is a 0.4%p~0.6%p decrease. Meanwhile, comparing the year 2000 with the year before the start of deindustrialization, it is estimated that deindustrialization reduced the volatility of employment by about 10%.

Key Words : deindustrialization, Korean economy, economic growth, productivity, volatility

I

Introduction

Ⅰ. Introduction

The portion of manufacturing in total employment rises at the early stage of economic development, but later it turns into a decreasing trend with the portion of service sector increasing. This phenomenon is called deindustrialization and is observed in most advanced economies. The portion of manufacturing employment has been falling in the U.S. economy since the mid 1960′s, and in Western Europe countries and Japan, it has been falling since the early 1970′s.[1]

Meanwhile, deindustrialization manifested itself in Korea during the 1990′s. As we will see later, the portion of manu-

1) There are many explanations about the background of deindustrialization, but it seems that productivity gap and the difference in income elasticity of demand between manufacturing and service are the two most important factors. The latter is often undervalued since income elasticity of demand for service is estimated to be close to one(Summers[1985] and Falvey and Gemmel[1996]). However, in economies with a high service sector portion like most advanced countries, elasticity slightly higher than one can make a significant rising trend of service portion in the long run. Therefore, those estimations cannot deny the importance of a demand factor.
There are abundant references on deindustrialization and its background. See, for instance, Baumol(1967), Fuchs(1968), Rowthorn & Wells(1987), Baumol, Blackman and Wolff(1989), Sachs & Schatz (1994), Wood(1994, 1995), and Rowthorn & Ramaswamy(1997, 1999).

facturing employment reached a peak in 1989, and from this year on kept falling. In case of the portion of industry employment(manufacturing + electricity · gas · water + construction), the peak was in 1991, and thereafter kept falling, too. Deindustrialization in Korea started later but proceeded faster than those of advanced countries.

In deindustrialization, as the portion of manufacturing falls, that of the service sector rises. It is generally believed that productivity grows slower in the service sector than in manufacturing. Thus we can expect that deindustrialization will slow productivity growth and consequently economic growth. It is also believed that volatility is smaller in the service sector than in manufacturing. Then deindustrialization can possibly lessen the volatility of the entire economy, too.

It is important to figure out these effects of deindustrialization in forecasting the future of an economy or in building an economic policy. However, while there is much research on the cause and the determinants of deindustrialization, the effect of deindustrialization has been rarely addressed. In this paper, I am going to investigate how much deindustrialization affected the Korean economy since the 1990′s in terms of economic growth and fluctuation.

The construction of this paper is as follows. Following the introduction, chapter 2 investigates the deindustrialization in the Korean economy. Next, in chapter 3 and chapter 4, the effects of deindustrialization on economic growth and fluctuation are estimated respectively. Finally, the paper concludes in chapter 5.

Ⅱ

Deindustrialization in the Korean Economy

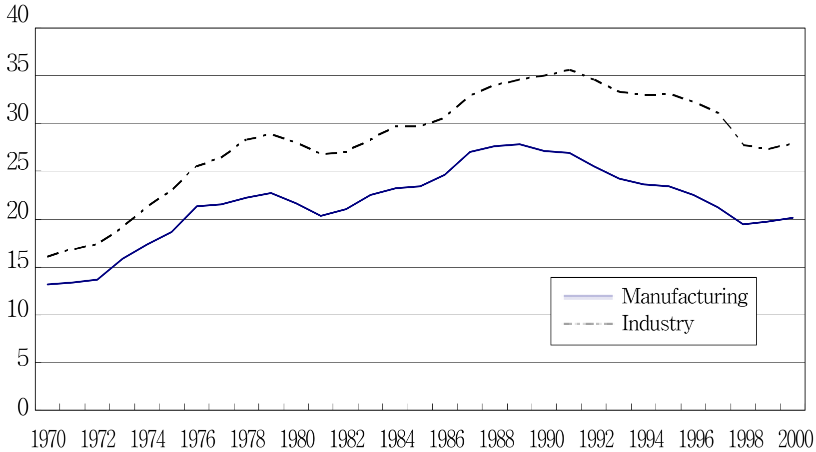
Ⅱ. Deindustrialization in the Korean Economy

During the period of rapid economic growth in Korea, the portion of manufacturing employment kept rising. But this rising trend reached its peak in the late 1980′s and thereafter it turned into a falling trend.

Figure 1 shows this change. The portion of manufacturing employment reached the peak 27.8% in the year 1989, and since then kept falling to 20.1% in the year 2000. There were slight rises in 1999 and 2000, but they were temporary phenomena due to structural adjustments following the economic crisis in 1998. The portion of industry covering manufacturing, electricity · gas · water, and construction also reached its peak of 35.6% in 1991 and has kept falling since then.

As figure 1 shows, deindustrialization became evident in Korea in the 1990′s. Compared with deindustrialization in most advanced countries, that of Korea started later, but proceeded with a faster pace. In the U.S., the portion of manufacturing employment fell from 28% in 1965 to 14.7% in 2000. In the U.K. it fell from 34.7% to 17.1% during 1970∼2000, and similar trends were shown in other western European countries and Japan : France from 27.8% to 17.4%, Germany from 37.4% to 24.1%, and Japan from 27% to 20.5% during the same period. These advanced countries took 30∼35 years for the portion

Figure 1. The Portion of Manufacturing(Industry) in Total Employment(%)



of manufacturing employment to fall by 10~17%p. But, in Korea, the portion fell by 8%p during the last 11 years.

The pace of deindustrialization can be measured by the size of intersectoral shifts of labor between manufacturing and service sector.

Table 1 and figure 2 show the portion of intersectoral labor shifts between manufacturing(or industry) and service in total employment. The size of intersectoral labor shifts between manufacturing(or industry) and service was obtained as follows. First, the whole private sector was classified into three sectors : the primary sector, manufacturing(or industry), and service sector. Supposing that there are no intersectoral shifts of labor, the employment in each sector will increase by the same rate as the growth rate of total employment. In this way, the number of persons that would be employed in

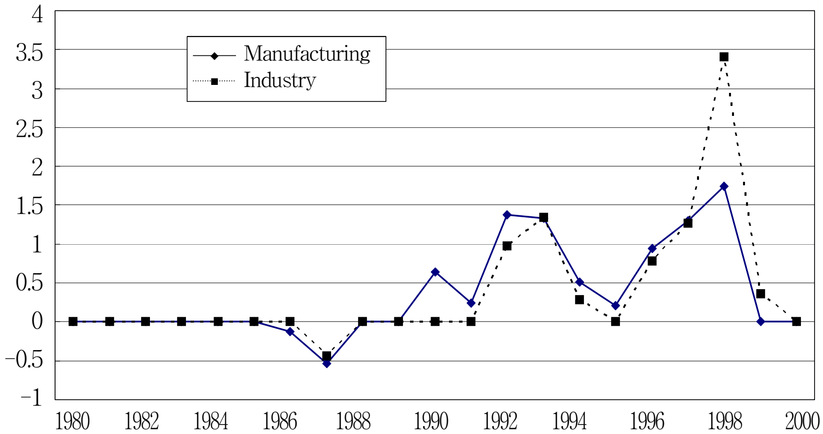
Table 1. The Shifts of Labor due to Deindustrialization(%)

	manufacturing	industry
1980	0	0
1981	0	0
1982	0	0
1983	0	0
1984	0	0
1985	0	0
1986	-0.121	0
1987	-0.530	-0.433
1988	0	0
1989	0	0
1990	0.647	0
1991	0.245	0
1992	1.376	0.976
1993	1.337	1.346
1994	0.516	0.286
1995	0.205	0.000
1996	0.939	0.781
1997	1.304	1.268
1998	1.740	3.402
1999	0	0.362
2000	0	0
average	0.9229 a	1.0526 b

Note : 1) the ratio of [the shifts of labor due to deindustrialization] / [total employment]
2) a : average of 1990~98, b : average of 1992~99

each sector if there were no intersectoral shifts of labor can be obtained. And comparing this figure with the actual employment in each sector, the net size of the labor inflows or outflows in each sector can be calculated. This net inflow (outflow) of labor was regarded as the size of intersectoral shifts of labor. For example, if the share of the net labor outflow from the primary sector is 3 percent of total employ

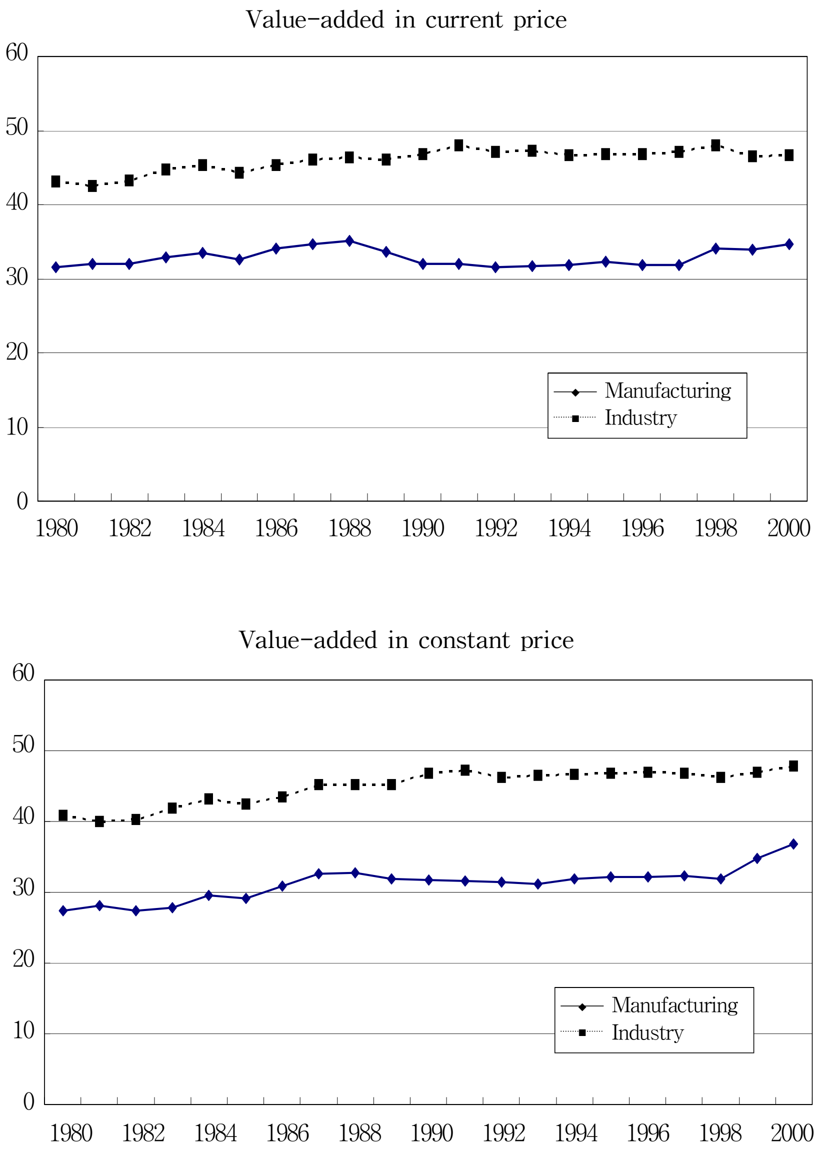
Figure 2. The Shifts of Labor due to Deindustrialization(%)



ment, and the share of the net inflow to the secondary sector is 2 percent of total employment, and the share of net inflow to tertiary sector is 1 percent of total employment, then it is assumed that 2 percent of total labor moved from the primary to the secondary sector, and 1 percent from the primary sector to the tertiary sector.[2] In the intersectoral shifts of labor obtained in this way, the shifts of labor from

2) The size of the intersectoral shifts of labor calculated in this way is not necessarily equivalent to the number of people who actually moved between the sectors. Thus, strictly speaking, it would be correct to say that this figure represents the size of the change in the industrial structure of labor input. But, since there are no other data that show the number of people who actually moved between the sectors(the size of intersectoral shifts of labor in a literal sense) and since intersectoral shifts of labor account for the largest portion of the change in industrial structure of labor input, it will be denoted in this paper as intersectoral shifts of labor.

Figure 3. Changes in the Portion of Manufacturing(industry) in Total Private GDP



manufacturing(industry) to service was regarded as representing deindustrialization.

This estimation shows that the shifts of labor due to deindustrialization started in 1990(in case of manufacturing) or in 1992(in case of industry) in Korea. And at an annual average base, the size of the shifts of labor due to deindustrialization in the 1990's was 0.9%(manufacturing) to 1.0%(industry) of the total employment.[3)]

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3) Deindustrialization can be defined in terms of production or value added as well as in terms of employment. Unlike the latter, deindustrialization in the former sense is not yet found in Korea. Neither in current price nor in constant price does the portion of manufacturing in the total GDP of Korea show any decreasing trend yet. (See figure 3.)

Ⅲ

The Effect of Deindustrialization on Economic Growth

Ⅲ. The Effect of Deindustrialization on Economic Growth

1. Deindustrialization and Economic Growth

It is known that productivity growth is slower in service sectors than in manufacturing. At first glance, it is obvious that the automation of production process or the substitution of capital for labor is more difficult in service sectors.[4] Although recent development in information technology offers opportunities for faster productivity growth in some service sectors such as the banking or retail sector, it is still true that, on average, technical advances or productivity growth of the service sector is slower than in manufacturing.

One can easily guess that if productivity growth of the service sector is slower than that of manufacturing, deindustrialization will slow down the productivity growth and consequently economic growth of the entire economy. In this section, I will estimate the effect of deindustrialization on economic growth in Korea during the 1990′s.

There are two ways for deindustrialization to affect economic

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4) In this context, W. Baumol(1967, p.416) once wrote, “A half hour horn quintet calls for the expenditure of 2 and 1/2 man-hours in its performance, and any attempts to increase productivity here is likely to be viewed with concern by critics and audiences alike.”

growth. First, as explained above, because of the difference in productivity(growth), deindustrialization affects economic growth. When labor moves from manufacturing with high productivity to the service sector, it brings about efficiency loss from the reallocation of labor.

Another way is through changes in factor input. Since the capital / labor ratio is generally lower in the service sector and demand for capital is positively correlated with labor input, it can be expected that labor shifts from manufacturing to the service sector have the effect of decreasing the total demand for capital and finally capital input in the economy. As a result, deindustrialization reduces capital input growth and economic growth. The effect of deindustrialization on economic growth is the sum of these two effects.[5)]

2. Method of Estimation

The effect of deindustrialization can be estimated in two perspectives. First, we can estimate the effect of the shifts of labor from manufacturing to service in each year on economic growth. Second, the effect can be estimated by comparing the actual growth and the hypothetical growth that would have been realized if there had been no deindustrializa-

5) If there are differences in average working hours or the quality of labor between manufacturing and service sectors, this can also affect economic growth in deindustrialization. However since those differences are negligible in reality, these effects can be ignored.

tion since the base year. For instance, assuming that the portion of manufacturing employment is maintained as that of 1989(the peak of the portion), we can estimate the hypothetical growth rate of that economy in a certain year and compare it with the actual growth rate in that year. The estimated result in this case is equivalent to the cumulative effect of deindustrialization since the base year.

Let us call the first method 'each year effect estimation', and the second one 'cumulative effect estimation'. The result of the two estimations will be the same in the first year of deindustrialization, but later, the latter will be greater than the former.

A. Each year effect estimation

As explained above, deindustrialization affects economic growth in terms of productivity change and capital input change. The effect through the latter channel results from the fact that the intersectoral shifts of labor brings about the change in capital input. The question in this case is how much change is brought about by the intersectoral shifts of labor. From a theoretical perspective, it depends on the slope of the demand and supply curves for capital.

In a Cobb-Douglas production function like equation (1),

$$Y = AK^{(1-b)}L^{b} \quad \cdots\cdots \quad (1)$$

(Y, A, K, L represent output, technology, capital, and labor input respectively.)

the marginal productivity of capital is obtained from equation

(2). If r is the price of capital, from equation (2) and r = $\frac{\partial Y}{\partial K}$, equation (3) is obtained.

$$\frac{\partial Y}{\partial K} = (1-b)A\,(K/L)^{-b} \quad \cdots\cdots (2)$$

$$G_r = G_A - b(G_K - G_L)$$

$$\left(G_K \equiv \frac{\dot{K}}{K},\ \text{notations are in similar ways for other variables} \right) \quad \cdots\cdots (3)$$

Rearranging equation (3), the following equation (4) is derived.

$$G_K = \frac{1}{b}(G_A - G_r) + G_L \quad \cdots\cdots (4)$$

Equation (4) represents the demand function of capital. Namely, the increase rate of capital demand is determined by the increase rate of labor input, the rate of change in the price of capital, and the rate of technological advance. If G_A is independent of the increase rate of K or L by assumption, since r is determined by the demand and supply of capital, G_r will be affected by the changes in the increase rate of capital demand. In this case, how much r changes depends upon the slope of the capital supply curve (price elasticity). If all other conditions are the same, the more elastic the capital supply curve is, the less r is affected by changes in K, and accordingly the more capital input is affected by changes in labor input. That is, the more elastic the capital supply curve is, the more the intersectoral shifts of labor influence capital input.

Since it is difficult to estimate the slope of the capital supply curve or the relationship between intersectoral shifts of labor and capital input, I will estimate here only the theoretical maximum and the minimum effects of intersectoral shifts of labor on capital input. Theoretical maximum corresponds to the case that the capital supply curve is flat (price elasticity is infinite). In this case, G_r has a constant value in equation (4), and accordingly G_K changes proportionately with G_L. In other words, the change in labor input resulting from deindustrialization brings about the same rate change in capital input.

Meanwhile, the minimum is the case that the capital supply curve is vertical (price elasticity is 0). In this case, changes in the labor input is independent of changes in the capital input. Therefore, deindustrialization does not affect capital input. Also, the effect of deindustrialization is restricted to the productivity effect only.

The theoretical maximum effect is equivalent to the gross allocation effect(GAE) in Syrquin(1986). GAE estimates the effect of intersectoral shifts of labor on economic growth under the assumption that labor productivity in each sector are the same before and after the shifts of labor. See the following equations.

$$y \equiv Y/L = \sum_i \frac{Y_i}{L_i}\frac{L_i}{L} = \sum_i y_i \gamma_i \quad \cdots\cdots (5)$$

where γ_i is the portion of sector i in total employment ($\equiv \frac{L_i}{L}$).

$$G_Y = \sum_i \theta_i G_{Yi} \text{ (where } \theta_i \equiv \frac{Y_i}{Y},\ G_Y \equiv \frac{\dot{Y}}{Y}) \cdots\cdots\cdots\cdots (6)$$

From the relationships expressed in equation (5) and (6), equation (7) is obtained.

$$G_y = \sum_i \theta_i G_{yi} + \sum_i \theta_i G_{\gamma i} \cdots\cdots\cdots\cdots (7)$$

(For convenience, all the time subscripts have been omitted.)

Equation (7) shows that productivity growth of the whole economy comprises two parts, the weighted sum of sectoral productivity growth and the productivity gain from intersectoral shifts of labor. The latter results from the shifts of labor from low productivity sector to high productivity sector. Syrquin called this 'Gross allocation effect' of inter-sectoral shifts of labor(Syrquin(1986), p. 237).

$$\text{GAE} = \sum_i \theta_i (G_{Li} - G_L) \cdots\cdots\cdots\cdots (8)$$

Since we are interested only in the shifts of labor from manufacturing to service, GAE in this paper can be rewritten as equation (9).

$$\text{GAE} = \sum_{i=m,s} \theta_i (G_{Li} - G_{Li*}) \cdots\cdots\cdots\cdots (9)$$

(where G_{Li*} represents the growth of labor input of sector i when there was no deindustrialization, and m and s denote the manufacturing and service sector respectively)

When there is no deindustrialization, labor input growth rates in manufacturing and service are equivalent to equation (10) and (11) reapectively.

$$G_{Lm*}(t) = G_L(t) \quad \cdots\cdots (10)$$

$$G_{Ls*}(t) = \frac{L_s(t) + L_m(t) - L_m(t-1)(1 + G_L(t))}{L_s(t-1)} - 1$$
$$= G_{Ls}(t) + (G_{Lm}(t) - G_L(t)) \frac{L_m(t-1)}{L_s(t-1)} \quad \cdots\cdots (11)$$

(where $L_m(t), L_s(t), L(t)$ represent labor inputs in manufacturing, service, and the whole economy in period i respectively.)

From equation (9), (10), and (11), GAE of deindustrialization can be estimated.

GAE is growth effect of intersectoral shifts of labor under the assumption that intersectoral shifts of labor is independent of labor productivity. From the perspective of growth accounting, however, GAE contains growth effects of capital input change as well as productivity effects.

Since sectoral productivity growth(G_{yi}) is expressed as in equation (12),

$$G_{yi} = G_{Ai} + (1 - b_i)\, G_{ki} \quad \cdots\cdots (12)$$

the assumption that sectoral productivity growth(G_{yi}) is independent of intersectoral shifts of labor is equivalent to the assumption that sectoral capital/labor ratio is independent of intersectoral shifts of labor (because G_A is independent of intersectoral shifts of labor). Thus GAE is, in fact, implicitly assuming that changes in sectoral labor input growth bring about a proportionate change in sectoral capital input growth.

In that sense, GAE corresponds to the theoretical maximum of the growth effect of deindustrialization.

Next, consider the theoretical minimum of the growth effect, the case that capital input is independent of intersectoral shifts of labor. In this case, there is no capital input change from deindustrialization, and the growth effect appears only through the productivity effect. Let us call it NEE(net efficiency effect) to distinguish it from GAE. While GAE is the growth effect under the assumption that labor productivity is independent of intersectoral shifts of labor, NEE is the growth effect under the assumption that total factor productivity is independent of intersectoral shifts of labor.[6)]

Under the CRTS(constant returns to scale) Cobb-Douglas production function, total factor productivity growth of sector i is obtained from equation (13).

$$G_{Ai} = G_{Yi} - b_i G_{Li} - (1 - b_i) G_{Ki} \quad \cdots\cdots (13)$$

(where b_i is labor's share in sector i. $G_{Yi}, G_{Ai}, G_{Ki}, G_{Li}$ denote actual growth rates of output, total factor productivity,

6) This is not the same as Syrquin's net reallocation effect(Syrquin (1986), pp. 255-256). Both of Syrquin's net reallocation effects and NEE in this paper represent GAE minus the capital input change effect. But, while Syrquin's net reallocation effect is deducting the effect of total capital input change of the whole economy(total capital input change under GAE - actual total capital input change), NEE is obtained by deducting the effect of sectoral capital input change(sectoral capital input change under GAE - actual sectoral capital input change). As an estimator representing net productivity effects excluding the effect of capital input change, I think NEE in this paper is a more accurate concept than Syrquin's net reallocation effect.

capital, and labor input respectively, and notations with * represent hypothetical growth rates when there is no deindustrialization.)

If total factor productivity growth(G_{Ai}) and capital growth (G_{Ki}) are independent of intersectoral shifts of labor, G_{Ai} and G_{Ki} remain the same with or without intersectoral shifts of labor, and thus the hypothetical growth rate without deindustrialization (G_{Yi*}) can be expressed as equation (14).

$$G_{Yi*} = G_{Ai} + (1 - b_i)G_{Ki} + b_i G_{Li*} \quad \cdots\cdots (14)$$

Therefore, we can obtain equation (15),

$$G_{Yi} - G_{Yi*} = b_i(G_{Li} - G_{Li*}) \quad \cdots\cdots (15)$$

and, the whole economy's NEE of deindustrialization is expressed as in equation (16).

$$G_Y - G_{Y*} = \sum_i \theta_i b_i (G_{Li} - G_{Li*}) \quad \cdots\cdots (16)$$

From equations (10), (11), and (16), NEE of deindustrialization in terms of 'each year effect estimation' can be estimated.

B. Cumulative effect estimation

Cumulative effect estimation is obtained by comparing the growth rate of the actual economy and that of a hypothetical economy where it is assumed there has been no deindustrialization since the base year. Cumulative effect estimation literally estimates the cumulative effect of deindustrialization since the base year.

In cumulative effect estimation, to begin with, sectoral labor input growth of the hypothetical economy without deindu-strialization is different from that in 'each year effect' estimation. Without deindustrialization, labor input growth of manufacturing would be the same as that of the whole economy, which is the case in 'each year effect' estimation, too(the same as in equation (10)). However, labor input growth of the service sector without deindustrialization in cumulative effect estimation becomes different from that in 'each year effect' estimation. In 'each year effect' estimation, labor input growth is obtained by comparing this year's hypothetical labor input of the service sector without deindustrialization with last year's actual labor input of the service sector. But, in cumulative effect estimation, it is obtained not by comparing it with last year's actual labor input of the service sector, but by comparing it with last year's hypothetical labor input of the service sector without deindustrialization, because it is assumed that there has been no deindustrialization since the base year, and accordingly the two are different from each other. Therefore, labor input growth of the service sector without deindustrialization is obtained as in equation (17).

$$G_{Ls*} = \frac{L_s(t) + L_M(t) - L_M(0) \cdot \Pi_{t=0}^{t-1}(1 + G_L(t))}{L_s(t-1) + L_M(t-1) - L_M(0) \cdot \Pi_{t=0}^{t-2}(1 + G_L(t))} - 1 \cdots (17)$$

In addition, the economic growth rate without deindu-strialization is obtained from the weighted average of the sectoral growth rate without deindustrialization(G_{Yi*}) weighted by $\theta_i^*(t-1)$, hypothetical sectoral weight without deindustrialization, not weighted by $\theta_i(t-1)$, actual sectoral weight. This is because the sectoral growth rate without deindustrialization becomes different from the actual growth rate and $\theta_i^*(t-1) \neq \theta_i(t-1)$ since the second year after the base year.[7)]

$$G_{Y*}(t) = \sum_i \theta_i^*(t-1)\, G_{Yi*}(t) \quad \cdots\cdots (18)$$

(θ_i^* is the portion of sector i in the whole economy without deindustrialization)

Thus, the whole economy's growth effect of deindustrialization can be obtained from the following equation.

GAE in period t ($\equiv g(t)$) = $G_Y(t) - G_{Y*}(t)$

$$= \sum_i \theta_i(t-1) \cdot G_{Yi}(t) - \sum_i \theta_i^*(t-1) \cdot G_{Yi*}(t)$$

$$= \sum_i \theta_i(t-1) \cdot (G_{Yi}(t) - G_{Yi*}(t))$$

$$+ \sum_i (\theta_i(t-1) - \theta_i^*(t-1)) \cdot G_{Yi*}(t)$$

($\because$ in GAE, $G_{Yi}(t) - G_{Yi*}(t) = G_{Li}(t) - G_{Li*}(t)$ from the assumption of $G_{yi}(t) = G_{yi*}(t)$)

$$= \sum_i \theta_i(t-1) \cdot (G_{Li}(t) - G_{Li*}(t))$$

$$+ \sum_i (\theta_i(t-1) - \theta_i^*(t-1)) \cdot (G_{Yi}(t) - (G_{Li}(t) - G_{Li*}(t)))$$

$$= \sum_i (\theta_i(t-1) - \theta_i^*(t-1)) \cdot G_{Yi}(t)$$

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7) Of course, in 'each year effect' estimation, $\theta_i^*(t-1) = \theta_i(t-1)$.

$$+\sum_i \theta_i^*(t-1)\cdot(G_{Li}(t)-G_{Li*}(t)) \quad \cdots\cdots (19)$$

where $\theta_i^*(t-1)$

$$=\theta_i(0)\cdot \Pi_{t=0}^{t-1}\frac{1+G_{Yi}(t-1)+g_i(t-1)}{1+G_Y(t-1)+g(t-1)} \quad \cdots\cdots (20)$$

$(g_i(t)=G_{Li}(t)-G_{Li*}(t),\ \ g_i(0)=g(0)=0)$

NEE in period t $(\equiv e(t)) = G_Y(t)-G_{Y*}(t)$

$$=\sum_i \theta_i(t-1)\cdot G_{Yi}(t)-\sum_i \theta_i^*(t-1)\cdot G_{Yi*}(t)$$

$$=\sum_i \theta_i(t-1)\cdot(G_{Yi}(t)-G_{Yi*}(t))$$

$$+\sum_i(\theta_i(t-1)-\theta_i^*(t-1))\cdot G_{Yi*}(t) = \text{(from equation (15))}$$

$$\sum_i \theta_i(t-1)\,b_i(t)\cdot(G_{Li}(t)-G_{Li*}(t))$$

$$+\sum_i(\theta_i(t-1)-\theta_i^*(t-1))\cdot(G_{Yi}(t)-b_i(t)(G_{Li}(t)-G_{Li*}(t)))$$

$$=\sum_i(\theta_i(t-1)-\theta_i^*(t-1))\cdot G_{Yi}(t)$$

$$+\sum_i \theta_i^*(t-1)\,b_i(t)\cdot(G_{Li}(t)-G_{Li*}(t)) \quad \cdots\cdots (21)$$

where $\theta_i^*(t-1)$

$$=\theta_i(0)\cdot \Pi_{t=0}^{t-1}\frac{1+G_{Yi}(t-1)+e_i(t-1)}{1+G_Y(t-1)+e(t-1)} \quad \cdots\cdots (22)$$

$(e_i(t)=b_i(G_{Li}(t)-G_{Li*}(t)),\ \ e_i(0)=e(0)=0)$

GAE of deindustrialization in terms of cumulative effect estimation is obtained from equations (10), (17), (19), and (20), and NEE is obtained from equations (10), (17), (21), and (22).

3. Data

In this paper, deindustrialization is analyzed in terms of two categories of industry : 'manufacturing' and 'industry'. The latter is defined as covering manufacturing, electricity/gas/water, and construction and represents broader manufacturing. Accordingly, the coverage of the service sector becomes different in each case. Industry meets service in the narrow sense, equal to [whole private sector-primary sector- industry], and manufacturing meets service in the broad sense, covering [service in the narrow sense], [electricity/gas/water], and [construction], equal to [whole private sector-primary sector-manufacturing].

As was seen above, deindustrialization started in 1990 in terms of manufacturing and started in 1992 in terms of industry in Korea. Thus, we need sectoral output, labor input, and factor income data during 1990~2000. For sectoral output, sectoral GDP data with constant prices in National Accounts were used. Labor input was based on Economically Active Population data from the NSO. The change in quality of labor was ignored. Labor income of self employed persons was estimated following Kim and Hong(1997)'s method, but in a slightly modified way.

4. Results of Estimation

The estimated results of the growth effect of deindustrialization are demonstrated in 〈table 2〉. To begin with, 'each year effect' estimation shows that deindustrialization (more precisely, the shifts of labor from manufacturing(industry) to service in each year) lowered average annual growth in the 1990′s Korea by −0.1∼−0.32%p in the manufacturing case, and −0.26∼−0.62%p in the industry case.[8] For the sake of convenience, using the median of estimated value, they are equivalent to about 6∼16% of the fall in growth rate during the 1990′s.

Meanwhile, according to cumulative effect estimation, deindustrialization (the cumulative sum of the shifts of labor from manufacturing(industry) to service since 1990(1992)) is estimated to lower annual economic growth by −0.26∼−0.67%p in manufacturing, and −0.31∼−0.77%p in industry. In other words, if there had been no change in manufacturing′s (industry′s) share in employment since the year 1989(1991), the average annual growth rate of the Korean economy during the 1990′s

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8) In another study, I investigated the relationship between growth slow down in the 1990′s in the Korean economy and the change in intersectoral shifts of labor, and estimated the effect of intersectoral shifts of labor during 1990∼97 on economic growth (Kang[2001]). The study showed that two important changes in intersectoral shifts of labor occurred during the 1990′s, the sharp decrease of shifts of labor between agricultural and nonagricultural sectors and the rise of deindustrialization, and it also showed that both changes slowed down economic growth. According to the estimation, the effect of the change in intersectoral shifts of labor on economic growth was −0.53%∼−1.25%p of the annual average and two thirds of the effect was the contribution of the decrease of shifts of labor between agricultural and nonagricultural sectors and the remaining one third was due to deindustrialization.

Table 2. The Effect of Deindustrialization on Economic Growth : Estimation Results(%)

	Size of deindustrialization		Each year effect estimation				Cumulative effect estimation			
			GAE		NEE		GAE		NEE	
	manufac-turing	industry	manufac-turing	industry	manufac-turing	industry	manufac-turing	industry	manufac-turing	industry
1990	0.647	0.000	-0.035		0.005		-0.035		0.005	
1991	0.245	0.000	-0.023		0.003		-0.042		-0.006	
1992	1.376	0.976	-0.168	-0.406	-0.019	-0.207	-0.245	-0.406	-0.044	-0.207
1993	1.337	1.346	-0.287	-0.589	-0.060	-0.271	-0.453	-0.668	-0.105	-0.298
1994	0.516	0.286	-0.155	-0.153	-0.035	-0.063	-0.433	-0.228	-0.159	-0.098
1995	0.205	0.000	-0.078	0.000	-0.027	0.000	-0.311	-0.066	-0.145	-0.039
1996	0.939	0.781	-0.409	-0.455	-0.199	-0.225	-0.698	-0.588	-0.299	-0.279
1997	1.304	1.268	-0.663	-0.805	-0.270	-0.370	-1.226	-1.019	-0.463	-0.437
1998	1.740	3.402	-1.029	-2.250	-0.329	-0.823	-1.547	-2.841	-0.391	-0.940
1999	0.000	0.362	0.000	-0.324	0.000	-0.119	-1.483	-0.877	-0.777	-0.379
2000	0.000	0.000	0.000	0.000	0.000	0.000	-0.850	-0.205	-0.437	-0.092
average	0.923 a	1.053 b	-0.316 a	-0.623 b	-0.104 a	-0.260 b	-0.666 c	-0.766 d	-0.256 c	-0.308 d

note : a: 1990~98 average, b: 1992~99 average, c: 1990~2000 average, d: 1992~2000 average

would have been about 0.3~0.8%p higher than the actual growth rate. This difference accounts for about 4.5~11% of the actual growth rate during the 1990's.

Ⅳ

The Effect of Deindustrialization on Business Cycles

Ⅳ. The Effect of Deindustrialization on Business Cycles

According to Filardo(1997) and Haimonwitz(1998), the service sector is believed to be less volatile than manufacturing because of the following characteristics of service. First, since the accumulation of inventory is impossible in service, the demand for service is more stable than that for manufacturing. Considering the relatively high volatility of inventory investment, the impossibility of inventory accumulation seems to lower the volatility of demand substantially. Second, since service is generally non-tradable, it is less likely to be affected by foreign shocks. Third, since capital intensity is lower in service than in manufacturing, service is less affected by the volatility from the change in equipment investment than manufacturing.

Since deindustrialization implies the rise of the portion of the service sector, if service is actually less volatile as they maintained, it can lower the volatility of the entire economy. Based upon the difference in volatility of employment between service and manufacturing, I will estimate the effect of deindustrialization in the 1990′s Korea on the volatility of total employment.

Table 3 shows the volatility of employment growth in each sector calculated from the quarterly employment data. The

Table 3. The Volatility of Sectoral Employment Growth

Year		1971~1979	1980~1989	1990~2000
whole private sector	variance	3.469	10.266	5.631
	coefficient of variation	0.468	1.205	1.269
manufacturing	variance	70.132	36.903	23.999
	coefficient of variation	0.774	1.259	-3.850
industry	variance	54.973	22.805	39.981
	coefficient of variation	0.661	1.045	-52.590
service(narrow)	variance	27.512	6.322	2.522
	coefficient of variation	1.089	0.462	0.321
service(broad)	variance	28.971	4.784	7.485
	coefficient of variation	0.941	0.421	0.575

Note : 1) Coefficient of variation = standard deviation/average.
2) The year 1998 was excluded.
3) Figures based upon growth rate from the same period of previous year.

volatility of manufacturing(industry) is quite higher than that of service in the table, supporting the argument of Filardo (1997) and Haimonwitz(1998). From this difference of volatility, the contribution of deindustrialization to the stabilization of employment fluctuation can be estimated.

For stochastic variables X and Y, and an arbitrary constant a with a relationship shown in equation (23), their variances and covariance have the relationship as in equation (24).

$$Y=\sum_i a_i X_i \quad \cdots\cdots (23)$$

$$\mathrm{Var(Y)}=\sum_i a_i^2\, Var(X_i)\, +2\sum_{i,j} a_i a_j\, Cov(X_i X_j) \quad \cdots\cdots (24)$$

Similarly, the relationship between the variances and co-variance of sectoral employment growth and total employment growth is expressed as in equation (25).

$$\text{Var(G)} = \sum_i \gamma_i^2 \, Var(G_i) + 2 \sum_{i,j} \gamma_i \gamma_j \, Cov(G_i G_j) \quad \cdots\cdots\cdots\cdots \ (25)$$

(where G, $G_{i,}$ γ_i are total employment growth, sector i's employment growth, and sector i's share in total employment respectively.)

Since deindustrialization means the fall of manufacturing's share in employment(γ_m) and the rise of service's share in employment(γ_s), the contribution of deindustrialization to the volatility of employment(Var(G)) can be estimated from equation (25).

If x denotes the size of deindustrialization, the fall of γ_m between base year(0) and current year(T),

$$x \equiv \gamma_m(0) - \gamma_m(\text{T})$$

then each sector's share in total employment without deindustrialization is represented as follows,

$$\gamma_p^* \equiv \gamma_p(0), \ \gamma_m^* \equiv \gamma_m(0) - x, \ \gamma_s^* \equiv \gamma_s(0) + x,$$

(where γ_p is the primary sector's share)

and the contribution of deindustrialization to the stabilization of employment fluctuation is obtained from equation (26).

$$\frac{V*(T)}{V(0)} = \frac{\sum_{i=p,m,s} \gamma_i *^2 \, Var(G_i) + 2 \sum_{i,j} \gamma_i * \gamma_j * \, Cov(G_i G_j)}{\sum_{i=p,m,s} \gamma_i(0)^2 \, Var(G_i) + 2 \sum_{i,j} \gamma_i(0) \, \gamma_j(0) \, Cov(G_i G_j)} \cdots (26)$$

where V*(T) and V(0) are variances of employment fluctuation with $\gamma_m = \gamma_m(T)$ and with $\gamma_m = \gamma_m(0)$ respectively.

In estimation, base year(year 0) and the compared year (year T) were regarded as the year before the start of deindustrialization(1989 for manufacturing and 1991 for industry) and year 2000, respectively. For $Var(G_i)$, variances of fluctuation in sectoral employment growth were used.

The estimation result is demonstrated in table 4. The size of deindustrialization during the period from the start of deindustrialization in the early 1990's to year 2000 is about 7.6% of total employment. And this deindustrialization is estimated to reduce the volatility of employment growth by about 10% in year 2000, compared to the volatility in the year before the start of deindustrialization.

Table 4. The Contribution of Deindustrialization to the Stabilization of Employment Fluctuation during the 1990's

	x (%p)	V(0)	V(T)*	V(T)*/V(0)
manufacturing	7.656	6.141	5.523	0.899
industry	7.642	7.353	6.553	0.891

Note : 1) x : the size of deindustrialization during the analysis period (the fall of industry's share in employment)
2) V(0) : estimated volatility with $\gamma_m = \gamma_m(0)$
3) V(T)* : estimated volatility with $\gamma_m = \gamma_m(T)$

V

Policy Implication and Conclusion

V. Policy Implication and Conclusion

Judging by the median of the above estimated results, the contribution of deindustrialization is summarized as follows : the effect to the slow down of economic growth is 0.2%p (manufacturing)~0.45%p(industry) in 'each year effect' estimation and 0.5~0.6%p in cumulative effect estimation, and the effect to the business cycle is about a 10% decrease in the volatility of employment fluctuation in the year 2000 compared with that of the year before the start of deindustrialization.

Considering the nature of deindustrialization, these changes in economic growth and fluctuation are regarded as irreversible and structural. Since deindustrialization will proceed in Korea as it does in most advanced countries, these changes are expected to be continued in the future of the Korean economy. Of course, the size of the effect on economic growth or volatility is changeable depending upon the speed of deindustrialization and the productivity growth of manufacturing and service sectors. These are important factors to be considered in building and implementing macroeconomic policies.

Deindustrialization is a natural change following economic development and the rise of income. From the perspective of economic welfare, deindustrialization is regarded as having both positive and negative effects on national economy, since it is generally considered that growth slow down decreases welfare while less volatility improves it. To be short, deindustrialization is not a pathological phenomenon to be solved.

However, although deindustrialization itself is inevitable as income rises, its effect to slow down economic growth can be controlled in some degree. Therefore, policies focusing on that aspect may be necessary. For instance, growth slow down effects of deindustrialization can be reduced by policies to promote productivity growth in service sectors and consequently to narrow the gap of productivity growth between manufacturing and service. Specifically, such policies which seem to be useful in that sense include deregulation, support for IT related investment in the service sector, and structural adjustment focusing on the reinforcement of business service which is relatively more productive in the service sector.[9)]

9) The level and growth of productivity of the business service sector such as communication, banking, professional service etc. are almost as high as those of manufacturing in Korea(Min [1998]). This is a common fact to be observed in other countries, too. For example, Klodt(1999) divided service into embodied service and disembodied service(the latter is a concept borrowed from Bagwati(1984) having almost the same coverage as business service in this paper), and showed a relatively high portion of the latter in the German service sector accounts for a relatively high productivity growth and low labor absorption of the German service sector compared with that of the U.S.

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