

AN INFORMATION SECTOR PERSPECTIVE OF EMPLOYMENT EXPANSION IN THE REPUBLIC OF KOREA, 1975-80

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I. INTRODUCTION

EMPIRICAL studies of structural change of the economies of developed countries indicate a shift in the allocation of resources toward activities associated with the creation, storage, and dissemination of information [12] [2] [14]. This is explained by the fact that the more complex the economic system, the greater the "information overhead" or information handling task compared to the production task [6]. In recent years advances in telecommunication and computer technologies have accelerated this structural change to such an extent that many observers now speak of an "information revolution." To properly account for the changes in economic structure, changes in the national accounting system have been advocated [14]. In the changed national accounts system the information sector is accorded its well-deserved place alongside primary, secondary, and tertiary sectors. According to Porat [15] this quaternary or primary information sector (PRIS) is defined as including goods and services which (1) intrinsically convey information or which are directly useful in its production, processing, or distribution and which (2) are transacted on established markets. It includes not only the electronics industry, the communication sector, and education, but a wide variety of other goods and services. The complement of the PRIS is the secondary information sector (SIS) which accounts for the "in-house" component of information activities, i.e., those information activities used up by private firms and public bureaucracies which are not exchanged on established markets. The two sectors measure rather different aspects of information penetration of the economy and are different from a methodological point of view [14, p. 39]. In this study we are exclusively concerned with the PRIS.¹

To what extent similar structural changes as those experienced by developed economies have taken place in newly industrializing countries and other developing countries and how economic policy should respond to such changes is little known. Research into the PRIS in developing countries has mainly concentrated on the measurement of the size of that sector and on the analysis of its structure. Although substantial PRIS have been found in Singapore [7], Taiwan [4], the ASEAN

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¹ For a more detailed discussion of the information sector concept see, for example, [15] [10] [7].

countries and Fiji [8] [9], and Venezuela [11], little is known about their development over time.

In a recent study the author analyzed the PRIS of the Republic of Korea² in both 1975 and 1980 [5]. The existence of a large PRIS and its rapid growth between the two years was demonstrated. The study also confirmed the dominant position that the PRIS occupies in generating potential growth in the economy. This was found to be largely due to the sectors consumption induced effects.

In the present paper we utilize the new accounting system and analyze one particular aspect of the growth of the PRIS in Korea over the 1975 to 1980 period, i.e., the sectoral changes in employment and its sources. The methodology and data used for analyzing the employment changes are presented in Section II. In Section III the results obtained at a highly aggregated four-sector level are discussed. Results obtained at a disaggregated-sector level are given in Section IV. This is followed by concluding remarks in Section V.

II. METHODOLOGY AND DATA

The shift-share analysis used in this study to analyze sectoral changes in employment [1, p. 568] identifies several of the causes responsible for the rate of employment expansion: (1) changes in labor productivity, (2) capital accumulation, (3) changes in the composition of output, and (4) the combined effect of the aforementioned factors. The methodology has so far been only applied to the traditional manufacturing sector. However, if data permit, it can easily be applied to the whole economy. The shift-share analysis was executed at the macro level and at the more disaggregated thirty-one-sector level. The detailed sector classification is given in Appendix Table I.³ The aim is to detect any differences in the patterns and sources of employment absorption between the PRIS and other sectors in the economy during the period under review. The analysis can provide approximate answers to questions like "is a lower growth in productivity in the PRIS responsible for the observed employment growth?" or "does the predominance of the capital accumulation factors observed in earlier studies also apply to the PRIS?"

The shift-share identity is:

$$\begin{aligned}
 L^1 - L^0 &= \sum l_i^1 X_i^1 - \sum l_i^0 X_i^0, \\
 &= \underbrace{\sum X_i^0 (l_i^1 - l_i^0)}_A + \underbrace{\sum l_i^0 (\bar{X}_i^1 - X_i^0)}_B + \underbrace{\sum l_i^0 (X_i^1 - \bar{X}_i^1)}_C \\
 &\quad + \underbrace{\sum (l_i^1 - l_i^0) (X_i^1 - X_i^0)}_D,
 \end{aligned}$$

² In the following "Korea" is used to denote the Republic of Korea.

³ The thirty-one sectors are aggregated into macro-sectors as follows: Primary sector or agriculture (sectors 28 and 29), secondary or manufacturing sector (sectors 14 to 25, 31), tertiary sector or services (sectors 26, 27, and 30), quaternary sector or PRIS (sectors 1 to 13). The primary, secondary, and tertiary sectors referred to in this study are net of PRIS components and, therefore, not identical to conventional primary, secondary, and tertiary sectors.

where

- L^j = total employment in year j , $j=1, 0$; in our case: $j=1980, 1975$,
- X_i^j = output of the i th sector in year j , valued in constant prices,
- $l_i^j = L_i^j/X_i^j$ = labor output ratio in the i th sector in year j ,
- $\bar{X}_i^1 = \sum X_i^1 \cdot X_i^0 / \sum X_i^0$ = output of the i th sector in year 1, assuming the structure of production remains the same as in year 0.

- A: effect of productivity change on employment expansion (growth and structure of output held constant); it expresses the combined effects of (a) capital deepening and (b) technological change.
- B: the capital accumulation or "pure growth" effect (sectoral labor productivities and output structure held constant); it shows the effect of capital widening, i.e., the change in employment due to a change in output volume.
- C: effect of a change in the structure of production on employment (sectoral productivities and overall growth held constant).⁴
- D: combined or cross-effect of factors A to C working simultaneously, it is expected to be large in economies undergoing rapid structural change.

The limitations inherent in an analysis based on accounting identities allow in most cases only to isolate the *likely* cause of employment change. This is due to the fact that the components are assumed to be independent of one another. In reality there will be significant causal relations between productivity change, growth, and structural change in an economy. Martin and Evans [12, p. 159] criticize the use of accounting identities as a tool of economic analysis and point out that in order to account for the important interactions of factors, behavioral relations have to be incorporated in the analysis. The ideal approach would be the construction of a complete general equilibrium model. In the accounting identity applied in this study the interactions of the first three factors are captured in the combined or cross effect. If this effect is large, it will be difficult to assess the importance of any of the factors and the analysis becomes an exercise in counter-factual hypothesizing.

The data for output and employment by sector are taken from the rearranged input-output tables of the Republic of Korea for 1975 and 1980 derived in [5]. Sectoral outputs are valued in constant 1980 wholesale prices. Output values for 1975 have been inflated to 1980 values by applying industry specific price inflators taken from the *Korea Statistical Yearbook* [16]. In cases where price indices were only available for subsectors, the average for the entire sector was arrived at by aggregation, using subsector outputs as weights. For nine out of

⁴ As pointed out by Banerji and Riedel [1, p. 573], the structural change component of the accounting identity lends itself to an interpretation as to the nature of the structural change which has taken place:

$$\sum l_i^0 (X_i^1 - \bar{X}_i^1) \begin{matrix} > \\ = 0 \longleftrightarrow \\ < \end{matrix} \begin{matrix} \text{Labor-intensive structural change,} \\ \text{Neutral structural change,} \\ \text{Capital-intensive structural change.} \end{matrix}$$

TABLE I
NUMBER OF PEOPLE EMPLOYED BY MACRO-SECTOR IN 1975 AND 1980

Sector	1975		1980		Increase over 1975 Level (%)
	Employment	%	Employment	%	
Primary	4.66	44.1	4.026	33.0	-13.6
Secondary	2.30	21.9	2.912	23.9	+26.3
Tertiary	2.64	25.0	3.445	28.3	+30.5
Quaternary	0.956	9.0	1.800	14.8	+88.3
Total	10.556	100.0	12.184	100.0	

Source: [5, Table 2].

TABLE II
DECOMPOSITION OF EMPLOYMENT CHANGE, 1975-80

Sector		Change in Employment	Productivity Change	Pure Growth	Structural Change	Cross Effect
Primary	A	-634,660	-442,801	+3,877,296	-4,089,390	+20,149
	B	-126,932	-88,560	+775,459	-817,878	+4,029.8
	C	-2.9	-2.0	+17.9	-18.8	+0.1
Secondary	A	+598,728	-771,101	+1,924,329	+130,648	-684,992
	B	+119,746	-154,220	+384,866	+26,130	-136,998
	C	+4.6	-5.9	+14.7	+1.0	-5.2
Tertiary	A	+801,942	-847,129	+2,198,728	+228,210	-777,828
	B	+160,388	-169,426	+439,746	+45,642	-155,565.6
	C	+5.3	-5.6	+14.4	+1.5	-5.1
Quaternary	A	+844,111	-361,435	+795,608	+1,142,939	-732,579
	B	+168,822	-72,287	+159,122	+228,588	-146,516
	C	+12.2	-5.2	+11.5	+16.6	-10.6

Note: 1. A=total employment change; B=average annual employment change; C=B as percentage of average annual employment.

2. Any differences between the change in employment and the sum of the four effects are due to rounding.

the thirty-one sectors, industry specific price indices were not available to the author and the general wholesale price index was used to inflate 1975 output values. These are: sectors 6, 31 (construction); 7, 27 (distribution); 26 (services); and the information service sectors, 9 (finance and insurance), 10 (real estate services), 11 (business services), and 12 (other information services).

III. ANALYSIS OF THE FOUR-SECTOR ECONOMY

The employment statistics in Table I document the large increase in the number of people employed in the PRIS between 1975 and 1980. During that period, employment in that sector increased by 88.3 per cent over the 1975 level, by far the largest increase of any macro-sector. As a proportion of the total number

of people employed, the percentage accounted for by the PRIS rose from 9 per cent in 1975 to 14.8 per cent in 1980.⁵ Conventional statistics obscure this important structural change.

Table II summarizes the results of the decomposition analysis for the aggregated four-sector economy. The quaternary or PRIS had by far the highest rate of growth in annual employment (12.2 per cent). The effect of labor productivity growth on employment does not vary widely between the secondary, tertiary, and PRIS sector. The primary sector, however, experienced a lower growth in labor productivity. Except for the PRIS, the pure growth or capital accumulation effect is by far the dominant positive effect influencing the level of employment. The pure growth effect would have resulted in a much higher rate of employment expansion in the primary, secondary, and tertiary sector if labor productivities and the structure of production had not changed.

The results obtained for the structural change effect are instructive. The Korean government pursued a policy of developing heavy and chemical industries between the mid and late 1970s. The heavy and chemical industrialization program was launched in 1976. However, due to adverse international economic conditions and overzealous government plans, the Korean economy entered a severe recession in early 1979 which necessitated a major downward revision of the program in 1980. Despite of this, it seems to have been successful in the long run, resulting in substantial import-substitution due to backward linkage effects [17]. The low structural change effect obtained for the secondary sector is therefore somewhat surprising. It seems to indicate relative capital-intensive structural change. However, it will become obvious during the discussion of the results obtained for the disaggregated economy that this impression is due to the high level of aggregation which masks important differences between individual manufacturing sectors.

The PRIS experienced by far the largest positive structural change effect (16.6 per cent), indicating the highly labor-intensive structural change in that sector.⁶ The PRIS is the only sector for which the structural change effect

⁵ This percentage does not denote the percentage of people employed in informational occupations in the economy. The PRIS contains people employed in informational and non-informational occupations. On the other hand, a substantial number of information workers are employed in the non-PRIS, i.e., they are part of the SIS.

⁶ The calculation of the structural change effect $\sum l_i^0(X_i^1 - \bar{X}_i^1)$ also provides us with insights into the effect structural change had on output by comparing the output in 1980 calculated under the assumption that no change in the production structure had taken place (\bar{X}_i^1) with the actual output of 1980 (X_i^1). It has already been noted that the PRIS experienced high growth in terms of output between 1975 and 1980 [5, Table 2]. The table below supplements this finding and indicates that one of the main factors responsible for this was indeed structural change in the economy (output in billion won):

Sector	X_i^1	\bar{X}_i^1	$X_i^1 - \bar{X}_i^1$
Primary	8,535.0	16,380.2	-7,845.2
Secondary	50,488.7	48,978.6	+1,510.1
Tertiary	19,234.8	18,369.0	+865.8
Quaternary	13,853.5	8,384.2	+5,469.3

TABLE III
DECOMPOSITION OF MANUFACTURING EMPLOYMENT EXPANSION

		Employment Expansion	Productivity Change	Pure Growth	Structural Change	Cross Effect
1963-70	A	+677.0	-217.0	+1,411.0	+88.0	-6.5
	B	+97.0	-31.0	+2.2	+13.0	-86.0
	C	+10.3	-3.3	+21.5	+1.3	-9.2
1970-73	A	+198.0	-496.0	+1,141.0	+51.0	-498.0
	B	+66.0	-165.0	+380.0	+17.0	-166.0
	C	+4.8	-12.1	+27.7	+1.3	-12.1

Source: [3, Table 6].

Note: In this case A denotes total employment change in 1,000 men years.

exceeds the capital accumulation (pure growth) effect! This is remarkable considering the fact that the PRIS consists to a large extent of sectors which were not at the top of the government's list of development priorities during that period (finance and insurance, information services, real estate services, education, etc.).

The structural change effect for the primary sector is strongly negative, indicating the rapid relative decline of the agricultural sector in the Korean economy. The structural change effect of the tertiary sector is positive but small.

The cross effect obtained for the PRIS is distinctly higher than that obtained for the secondary and tertiary sector (the primary sector's cross effect is practically nil), indicating a high degree of interaction between productivity change, capital accumulation, and structural change effects. However, it is not particularly large compared to cross effects reported in other studies⁷ and seems to allow at least the qualitative statement that the high labor absorption in the PRIS is due to a combination of capital accumulation and structural change effects, whereby the latter effect is stronger than the former.

It is interesting to compare our findings with those obtained for earlier periods. De Melo [3] uses the same accounting identity as in the present study to decompose employment expansion in the manufacturing sectors of Korea and Taiwan. His results for Korea are shown in Table III. It should be noted that the manufacturing sector in de Melo's study includes industries like electronics, precision instruments, etc., which in our classification are part of the PRIS. Therefore his findings are not directly comparable to ours. However, some general conclusions are possible from a comparison of Table III and Appendix Table I. First, the rate of employment expansion in manufacturing fell sharply

Structural change had a strongly negative effect on the output of the primary sector, the PRIS, however, benefitted by far the most from it. This provides further support for the hypothesis that already during its heavy industrialization phase of the mid to late 1970s the Korean economy was developing into an information-based economy.

⁷ De Melo [3] reports cross effects for the manufacturing sector of Taiwan of -17.5 (1961-65) and -13.1 (1966-71).

from 1963–70 to 1970–73. Our result for 1975–80 shows that the manufacturing sector did not regain its earlier rate of employment expansion. Second, the increase in labor productivity over the period 1975–80 seems to have been approximately half of that experienced in the early 1970s. Third, the pure growth (capital accumulation) effect appears to have declined considerably compared to earlier periods. Fourth, the structural change effect for the manufacturing sector in Korea seems to have been persistently low in the 1960s and 1970s.⁸

IV. DISCUSSION OF RESULTS OBTAINED FOR THE DISAGGREGATED ECONOMY

The highly aggregated analysis presented so far is instructive in providing insights into the changes in employment absorption associated with broad structural changes which have taken place in the economy. However, results obtained for the macro-sectors tend to obscure important differences at a finer sector level. For instance, the high labor intensity of structural change observed for the PRIS might only be due to a few sectors. Only an analysis conducted at a sufficiently disaggregated sector level can provide answers to such questions. The results obtained for such a disaggregated analysis are presented in Appendix Table I. That table reveals wide variations in employment absorption and its causes between sectors within the secondary and PRIS macro-sectors.

Reading Appendix Table I column-wise we notice that the top nine sectors ranked according to the average annual growth rate of employment, i.e., sectors 12, 10, 2, 5, 9, 6, 4, 7, and 3, are all PRIS. Also, except for sector 24, the heavy and chemical industries subsumed under the secondary sector did have higher than average increases in annual employment. The lower average obtained for the secondary macro-sector seems to be due to sector 14 food and, especially, sector 15 textiles.⁹

The first six sectors ranked in terms of increases in labor productivity are all secondary sectors (sectors 14, 17, and the heavy industry sectors 21 to 24). It is interesting to note that the information services producing sectors 9, 10, and 12 (but not sector 11 business services!) in contrast to the information goods producing sectors 2 to 5 exhibit only a very small growth or even a decline in labor productivity. This seems to support the thesis that the large overall increase in employment in the PRIS is at least partly due to the smaller growth rate of labor productivity in information services producing sectors.

The pure growth effect is strongest for sector 28 agriculture, followed by sectors 15 textiles and 24 transport equipment. The information sectors benefitting most from this effect are sectors 1, 13, 8, and 11. It is precisely these PRIS

⁸ Taiwan, in comparison, experienced much greater labor-intensive structural change in the 1960s. For a discussion of this difference between the two countries see de Melo [3, pp. 26–27].

⁹ Sector 15 textiles is by far the largest secondary sector, employing more than 0.9 million people in 1980. Therefore it has a strong influence on the results obtained for the aggregated secondary sector.

for which the pure growth effect substantially exceeds the actual annual increase in employment.

The top sectors experiencing labor-intensive structural change are the information goods producing sectors 2 to 5, the heavy industry sectors 21 to 23 and sectors 14 and 17. It is also exactly these sectors which show high cross-effects, i.e., a high degree of interaction between the factors responsible for the expansion in employment. The highly labor-intensive structural change of the heavy industry sectors was obscured at the macro-sector level. This is due to the important sector 15 textiles. Although that sector is often regarded as synonymous with labor-intensive manufacturing in newly industrializing countries, it actually experienced capital-intensive structural change between 1975 and 1980. This testifies to the "upgrading" (in terms of value added) of this industry.

V. CONCLUDING REMARKS

In this paper employment changes in Korea over the period 1975 to 1980 have been analyzed within an accounting framework initially developed for OECD economies. The results confirm the relevance of the information sector approach for the analysis of newly industrializing countries. The study revealed that the PRIS had by far the highest rate of employment expansion of any macro-sector during a period which is noted for its industrial, i.e., secondary sector, development. Moreover, the analysis of the sources of employment change shows a distinct pattern for the PRIS, different from that observed for the other macro-sectors. The findings also provide new insights into the growth of the (conventional) service sector. In many developing countries the latter is expanding faster than their manufacturing sector. Our data show a clear distinction within the conventionally measured tertiary sector. Employment in non-information services was found to increase at less than half the rate that experienced in information service sectors. Our results are an indication of the increasing information intensity of the Korean economy. It is hoped that future studies will be able to overcome the present data limitations and explore the labor market implications of the expanding PRIS further. Changes in the pattern of employment are, however, but one aspect of the growing PRIS. We need to know more about the growth dynamics of that sector and how it relates to the growth of other macro-sectors, for instance the expansion of the secondary sector. The findings might reveal costs and benefits associated with policies of export promotion and import substitution which so far have not been taken into account.

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APPENDIX TABLE I
 DECOMPOSITION ANALYSIS OF EMPLOYMENT CHANGE, 1975-80

Sector	Change in Employment	Productivity Change	Pure Growth	Structural Change	Cross Effect
Primary Information Sectors					
1. Printing, publishing, & paper	+7,519 +2.5	-25,554 -8.3	+47,632 +15.5	+11,876 +3.9	-26,436 -8.6
2. Office machinery	+4,752 +18.5	-1,216 -4.7	+2,294 +8.9	+8,345 +32.4	-4,670 -18.2
3. Electronic & communication equipment	+85,590 +11.7	-55,157 -7.6	+85,454 +11.7	+216,893 +29.7	-161,597 -22.1
4. Precision instruments & apparatus	+17,015 +14.3	-7,926 -6.7	+12,635 +10.6	+39,267 +33.0	-26,962 -22.7
5. Other informational manufactures	+17,150 +18.1	-5,181 -5.5	+8,629 +9.1	+35,776 +37.7	-22,078 -23.2
6. Construction	+36,675 +15.6	-12,298 -5.2	+23,663 +10.1	+62,316 +26.6	-37,003 -15.8
7. Distribution	+81,340 +12.0	-16,574 -2.4	+78,386 +11.6	+40,310 +6.0	-20,830 -3.1
8. Communication	+18,860 +6.9	-15,016 -5.5	+37,164 +13.7	+13,743 +5.1	-17,032 -6.3
9. Finance & insurance	+158,900 +17.7	-14,243 -1.6	+82,643 +9.2	+119,325 +13.3	-28,822 -3.2
10. Real estate services	+18,210 +20.7	+395 +0.4	+7,048 +8.0	+9,976 +11.3	+790 +0.9
11. Business services	+49,133 +8.0	-45,870 -7.5	+80,994 +13.2	+97,899 +16.0	-83,893 -13.7
12. Other information services	+271,254 +22.9	+20,262 +1.7	+84,122 +7.1	+125,129 +10.5	+41,734 +3.5
13. Education & research	+77,710 +4.7	-111,717 -6.8	+241,300 +14.6	+65,889 +4.0	-117,768 -7.1
Manufacturing					
14. Food, beverages, & tobacco	+64,430 +4.0	-175,405 -10.9	+239,964 +14.9	+367,701 +22.8	-367,804 -22.8
15. Textiles, clothing, & leather products	+38,850 +0.9	-273,203 -6.2	+716,640 +16.2	-260,639 -5.9	-143,949 -3.3
16. Wood, wood products, & furniture	+14,779 +4.1	-6,824 -1.9	+53,198 +14.9	-29,029 -8.1	-2,567 -0.7
17. Paper, paper products	+12,361 +6.8	-16,019 -8.9	+24,806 +13.7	+36,186 +20.0	-32,614 -18.1
18. Chemicals	+90,496 +7.1	-64,785 -5.1	+174,795 +13.6	+49,172 +3.8	-68,736 -5.4
19. Non-metallic mineral products	+29,368 +6.4	-28,563 -6.2	+64,217 +13.9	+27,461 +5.6	-33,766 -7.3
20. Basic metal products	+30,460 +8.5	+48,694 +13.6	+46,466 +13.0	-56,208 -15.8	-8,454 -2.4

APPENDIX TABLE I (Continued)

Sector	Change in Employment	Productivity Change	Pure Growth	Structural Change	Cross Effect
21. Fabricated metal products	+28,539 +8.7	-27,913 -8.5	+42,705 +13.0	+80,340 +24.4	-66,596 -20.2
22. General industrial machinery & parts	+39,991 +11.6	-30,777 -8.9	+40,721 +11.8	+148,438 +42.9	-118,386 -34.2
23. Electrical machinery	+17,780 +7.6	-22,481 -9.6	+31,572 +13.4	+66,527 +28.3	-57,840 -24.6
24. Transport equipment	+6,670 +1.4	-59,050 -12.1	+78,167 +16.0	+97,354 +19.9	-109,796 -22.5
25. Miscellaneous manufacturing	+52,819 +10.6	-29,755 -6.0	+60,533 +12.2	+78,727 +15.8	-56,684 -11.4

Others					
26. Services	+428,774 +7.8	-311,677 -5.7	+735,542 +13.3	+405,131 +7.3	-400,235 -7.3
27. Trade & transport	+354,338 +3.7	-532,055 -5.6	1,433,932 +15.0	-154,430 -1.6	-393,121 -4.1
28. Agriculture, fishery, & forestry	-647,700 -3.1	-408,892 -1.9	+3,760,327 +17.8	-4,022,780 -19.1	+23,632 +0.1
29. Mining & quarrying	+13,040 +2.1	+1,223 +0.2	+99,198 +15.7	-87,498 -13.9	+120 0.0
30. Utilities	+18,830 +11.5	-554 -0.3	+19,221 +11.8	+629 +0.4	-474 -0.3
31. Construction	+172,195 +6.9	-152,192 -6.1	+341,749 +13.7	+172,110 +6.9	-89,490 -7.6

Note: For each sector the first row denotes total employment changes (A in Table II), the second row shows the average annual employment change as a percentage of average annual employment (C in Table II).