Estimating labor income shares at the sectoral level in Korea during 1975-2018 using input-output tables

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Abstract

The goal and contribution of this paper is to estimate the sectoral labor income shares in Korea with the same methods over a long period. For this purpose, I harmonized the input-output (IO) tables of Korea for the period 1975-2018 according to a common 26-sector classification, and applied various methods for computing labor income shares to the variables available in IO tables and the accompanying employment tables. It is expected that the results of this paper can be utilized in a variety of studies.

In this paper, three methods were applied. First method is to use compensation of employees (CE), the narrowest definition of labor income, as the labor income. Second method is to assume that the average labor income of non-wage workers equals the average wage level of employees. Third method is to estimate the average labor income of non-wage workers using micro survey data. All three methods use domestic income (DI), the sum of CE and operating surplus (OS), as the total factor income. In this paper, I used the estimates by Im (2020) for the third method.

The economy-wide labor income share by the first method is highly close to the official income share published by the Bank of Korea, and is believed to underestimate the true labor income share. On the other hand, the share by the third method is expected to highly overestimate the true value. The accuracy and the reliability of the estimated shares can be greatly improved by estimating the relative average labor income share of non-wage workers more thoroughly based on more accurate survey data.

Keywords: Labor income share, Sectoral level, Input-output tables, Korea

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1 Introduction

Factor income refers to the income accruing to primary production factors such as labor and capital. It is the compensation for the service of primary production factors. Factor income shares are the fractions of individual factor income as percentages of total factor income. Factor income shares are utilized in many situations, not to mention the enormous interest in the shares themselves. For example, factor income shares are essential in accounting for the sources of economic growth. Most empirical studies dichotomize the total factor income into labor and capital income while some studies further decompose capital income into those of machinery, building and land.

While the concept of factor income share is simple and clear, computing them involves many complications, most of which are derived from the issues regarding how to classify or decompose self-employed workers' income. Employees' income is classified as 'compensation of employees (CE)' in most countries' national account system, and CE as the share of total factor income is the simplest method to compute the labor income share. Self-employed workers' income also contains the compensation of the service of their 'labor,' but their entire income is classified as 'operating surplus (OS),' which is a cost item for capital income in the national account system of the countries which follow the United Nations' System of National Accounts (UN, 2009). Obviously, labor income share would be underestimated if the entire OS is regarded as capital income. Many alternative methods have been suggested to decompose self-employed workers' income into labor and capital income, but none of them seems to have acquired general agreement.

The goal of this paper is to measure factor income share at the sectoral level in Korea for the period 1975-2018. There are two sources of data for the purpose, national income statistics and input-output (IO) tables. First, you can find the data of domestic value-added and its components – net production tax, consumption of capital, compensation of employees, and operating surplus – at the sectoral level since 1970 from Korea's national

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income accounts. We can simply use these data if we do not want to decompose OS. Otherwise, we need employment data, that is, the numbers of employees and self-employed workers, to estimate the portion of operating surplus to be classified as labor income. Sector classification of Korea's employment data, however, is considerably different from that of the national income data, and we need to harmonize one dataset to the other, which can result in some distortion.

Second option is to use input-output (IO) tables. The biggest advantage of using IO tables is that they are accompanied by their own employment tables which are compiled according to the same sector classification as the IO tables. The second option comes with two disadvantages. First, the list of income components included in IO tables is limited, so sophisticated measures of factor income shares cannot be estimated. For example, factor income from abroad is not included in IO tables. Second, sector classification of IO tables is revised frequently, so we need to harmonize the IO tables according to a common sector classification when our analysis crosses the revisions in sector classification. This can cause another type of distortion, but I determined that this is more acceptable than the distortion from the first option, and the second option is chosen in this paper.

The contribution of this paper is to provide factor income shares at the sectoral level for the period 1975-2018. Similar estimates of factor income shares at the sectoral level this long could not be found to my knowledge.

The paper is organized as follows. In Section 2, we will review various definitions of factor income and factor income shares, and will review the literature in the field. In Sections 3 and 4, we will explain the IO tables of Korea, and then will compute factor income shares at the sectoral level in Korea for 1975-2018. Section 5 concludes the paper.

2 Various Labor Income Shares and Literature review

Various components and definitions of income are given in Figure 1. The first four income components are generated inside the country while the last two can be regarded as income generated outside the country.

Figure 1. Various definitions of income

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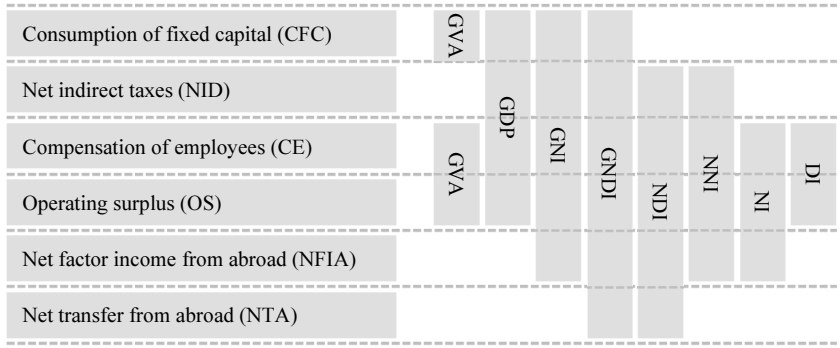

Note: GVA = Gross value-added (= GDP at factor cost)
GDP = Gross domestic product (=GDP at market price)
GNI = Gross national income (= Gross national product; GNP)
GNDI = Gross national disposable income
NDI = National disposable income (= Net national disposable income; NNDI)
NNI = Net national income (= National income at market price)
NI = National income (= National income at factor cost)
DI = Domestic income (= Domestic factor income)

Note: The premodifier 'gross' is used when the consumption of fixed capital (CFC) is included in an income concept. The premodifier 'net' is used, otherwise. This distinction is based on the fact that CFC is the compensation for the decrease in the value of capital due to its use in the production process. The postmodifier 'at market price' is used when net indirect taxes (NID) is included in an income concept. The postmodifier 'at factor cost' is used, otherwise. This is because the market price of goods and services includes net indirect taxes.

The following are a brief explanation of the above six income components. (i) Consumption of fixed capital (CFC) is paid to the provider of capital, and is capital income when it is counted as income. (ii) Net indirect taxes (NID) is indirect taxes less subsidy. It is difficult to determine the incidence of NID, i.e., it is difficult to decompose NID into the contributions of labor and capital. (iii) CE is the main component of labor income, with the full amount being labor income. (iv) OS is computed as the residual, that is, the amount left after paying CFC, CE and NID from GDP. OS includes the compensation for the service of both labor and capital of self-employed workers and for the service of labor by unpaid family workers. Note that CE and OS are included in all of the above eight income concepts in Figure 1. (v) Net factor income from abroad (NFIA) is the factor income from abroad earned by residents less factor income earned by non-residents in the country. NFIA can be decomposed into net labor income from abroad (NLIA) and net capital income from abroad (NKIA), which are obviously labor income and capital income, respectively.

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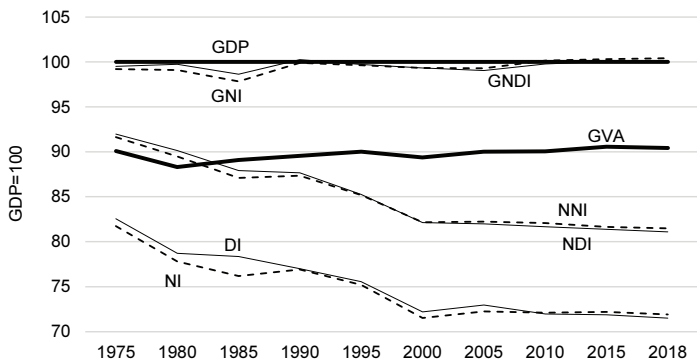
(vi) Net transfer from abroad (NTA) is the transfer from abroad less the transfer out of the country. NTA is neither labor nor capital income.

The data of the above six components are available in the national income and product accounts (NIPA), while only the first four components are available in IO tables. Even though both NIPA and IO tables are components of the national account system, they are compiled according to their own sector classification systems in Korea, which are considerably different from each other while they have been gradually converging. In fact, the values of the first four components in Figure 1 in NIPA and IO tables are different from each other.

Figure 2 depicts the relative sizes of various income concepts compared to GDP. Note that (i) NFIA and NTA are relatively small compared to GDP, so GNI and GNDI, NNI and NDI, and NI and DI are highly similar to each other. (ii) For the same reason, the magnitudes of GNI and GNDI are similar to GDP. (iii) Relative size of GVA has been stable at around 90% of GDP, which implies that NID as share of GDP has been stable at around 10%. (iv) CFC as share of GDP has increased consistently, from 7.5% of GDP in 1975 to 18.9% in 2018, which is why the gap between GNI and NNI has been widening. This is documented in Lee (2014). (iv) Finally, the differences among the values of various income concepts are considerably big, which might be one of the causes of big differences among various factor income shares.

Figure 2. Relative sizes of various income compared to GDP in Korea



Source: National income accounts, Bank of Korea.

Labor income share is defined as the fraction of labor income as a percentage of total factor income, but both the numerator, labor income,

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and the denominator, factor income, are defined in various ways depending on the purpose of the analysis and on the availability of data. The most frequently used definition of income is NI. In this case, the sum of CE and NLIA is frequently used as the numerator as in (1) below. The labor share in (1) is the formula for the official labor income share published by the Bank of Korea, which is in charge of producing national account statistics.

$$LS_{NA} = \frac{CE + NLIA}{NI} = \frac{CE + NLIA}{(CE+NLIA) + (OS+NKIA)} . \quad (1)$$

Labor income share in (1) regards the entire OS as capital income, so it underestimates the true labor income share. Many methods have been suggested to correct the problem, and Gollin (2002) seems to have been cited most frequently. He paid attention to the operating surplus of private unincorporated enterprises (OSPUE), a component of OS. He conjectured that most of self-employed workers' income would belong to OSPUE, and suggested three options to extract labor income from OSPUE.

The first option is to classify the entire OSPUE as labor income. This option is most likely to overestimate labor income share since self-employed workers also own capital. He claimed, however, that the distortion would be small in poor countries since self-employed workers might not have much capital.

The second option is to decompose OSPUE into labor and capital income under the assumption that the shares are identical with those in incorporated enterprises and the government. The labor income share in the second option is computed by subtracting OSPUE from both the numerator and the denominator. The second option might underestimate the labor income share since the share of labor income in OSPUE might be bigger than that in the OS of incorporated enterprises and the government.

The third option is to 'impute' the labor income of self-employed workers under the assumption that their average labor income equals the average wage level of employees. The accuracy of the third option depends on the relative income level of employees and self-employed workers, which might reveal big variation among sectors. The big disadvantage of the third option is that the computed income shares exceed 100% in some sectors in some years.

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The labor income shares according to the above three options are given in (2).

$$LS_{G1} = \frac{CE + NLIA + OSPUE}{NI}, \quad (2)$$

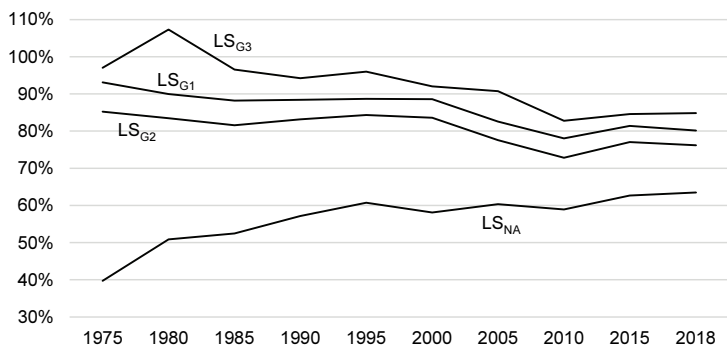
$$LS_{G2} = \frac{CE + NLIA}{NI - OSPUE},$$

$$LS_{G3} = \frac{\frac{CE}{L_E} \times L_T + NLIA}{NI},$$

L_E = number of employees and L_T = total number of workers.

Labor income shares computed by the formulas in (1) and (2) in Korea for 1975-2018 are given in Figure 3. These have been computed by many authors such as Kim (2013), Joo and Jeon (2014), Lee (2014), Im (2020), etc.

Figure 3. Labor income shares in Korea, 1975-2018



Source: National income accounts, Bank of Korea.

We learn the following from Figure 3; (i) The official labor income share by the Bank of Korea is the lowest during the entire period, which is because it classifies entire OS as capital income. (ii) The labor share by the Bank of Korea has steadily risen during the entire period with some fluctuations; one around the economic crisis in late 1990s and the other around the international financial crisis in late 2000s. The decreasing trend of the three adjusted labor income shares is due to the steady increase in

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the relative share of CE compared to OS, or, equivalently, due to the increase in the share of employees in total employment. This trend is also based on the decrease in the shares of the sectors with high shares of self-employed workers, e.g., agricultural sector. Kim (2013), Lee (2014) and Lim (2020) provide detailed analysis on this factor. (iii) The labor share by the third option is the highest, which might be due to the big share of self-employed workers in Korea. (iv) Three adjusted labor shares in (2) have steadily declined with some fluctuations. This might be due to the same cause in (iii).

Some variations of the above shares have been proposed. OECD employs the third option by Gollin (2002), but uses GVA, rather than NI, as the income, as below. This implies that CFC is regarded as factor income while NFIA is excluded. (See Figure 1.) This also implies that OECD's labor share is smaller than the labor share by the third option since CFC is much bigger than NFIA. (See Figure 2.)

$$LS_{OECD} = \frac{\frac{CE}{L_E} \times L_T + NLIA}{GVA}. \tag{3}$$

Krueger (1999) considered the following four labor shares as follows. The first two formulas imply that two-thirds of OSPUE is regarded as labor income, which is rooted on the suggestion by Johnson (1954). Krueger (1999) realized that (i) labor income shares in the US increased until 1970 and then decreased, (ii) the increase in labor income share is steeper when OSPUE is excluded, and (iii) the moves of labor share is countercyclical.

$$\begin{aligned} LS_{K1} &= \frac{CE + NLIA + \frac{2}{3} \times OSPUE}{DI}, \\ LS_{K2} &= \frac{CE + NLIA + \frac{2}{3} \times OSPUE}{NI}, \\ LS_{K3} &= \frac{CE + NLIA}{NI}, \\ LS_{K4} &= \frac{CE}{NI}. \end{aligned} \tag{4}$$

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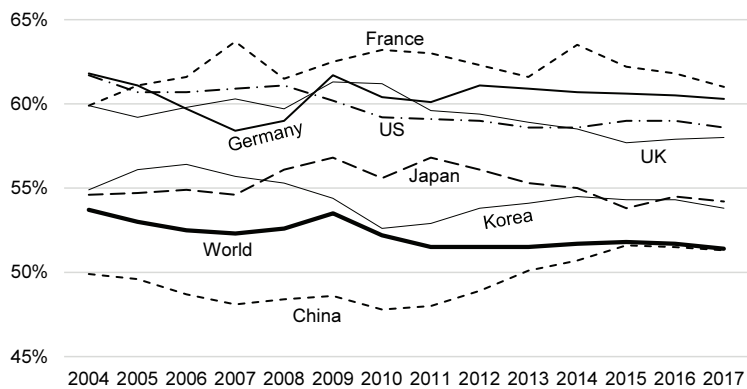
International Labor Organization (ILO, 2019) reviewed various definitions of labor income shares, and proposed the following formula. ILO classified all workers into four groups – employees (EES), own-account workers (OAW), contributing family workers (CFW), and employers (ERS) – and estimated the relative wage levels compared to that of employees, and applied the third option of Gollin (2002).

$$\mathrm{LS}_{\mathrm{ILO}} = \frac{\mathrm{CE}}{\mathrm{GDP}} \cdot \frac{\sigma_{\mathrm{EES}} + \sigma_{\mathrm{OAW}} w_{\mathrm{OAW}} + \sigma_{\mathrm{CFW}} w_{\mathrm{CFW}} + \sigma_{\mathrm{ERS}} w_{\mathrm{ERS}}}{\sigma_{\mathrm{EES}}}, \tag{5}$$

where σ represents the share and w represents the relative wage level of each worker group compared to those of employees computed using microdata. Labor income shares by ILO are used as the Indicator 10.4.1 - Labor Share of GDP Comprising of Wages and Social Protection Transfers in the UN's Sustainable Development Goals. Labor income shares of selected countries are given in Figure 4.

Figure 4. Labor income shares in selected countries



Source: ILO.

Lee (2014) reviewed the important issues related with labor income share in Korea, computed various labor income shares and their trends, and proposed an adjustment method considering Korea's specific situations. He also used the shift-share analysis and showed that the decline in labor income share in Korea was mainly due to the decreases

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inside industries.

Joo and Jeon (2014) reviewed the labor income shares such as those by the Bank of Korea, Krueger, Gollin, OECD, etc., and suggested a formula for labor income share considering the situations in Korea. He first showed that the share of self-employed workers as a percentage of total employment is bigger than those in other developed countries, that the average income of self-employed workers is lower than that of employed workers, and that the gap has widened. For this reason, he concluded that OECD's method overestimates Korea's labor income share. He proposed a procedure for a labor income share by computing labor income from OSPUE considering the above characteristics of Korea's self-employed workers, and showed that OECD's labor income shares are higher than the proposed.

There are not many studies which compute labor income shares at the sectoral level. It is most likely due to the lack of statistics. As studied earlier, the most important topic in the field is about how to decompose the income of non-wage workers, and the data of most related variables are available only at aggregate level. Some variables are not even defined at the sectoral level. OSPUE and NFIA are typical examples. Several studies are introduced here. Valentiny and Herrendorf (2008) estimated the labor income shares of the five industries, agriculture, manufactured consumption, services, equipment, and construction, and computed the labor income shares in the US at the sectoral level. They decomposed the capital income share into those of land, structures and equipment. Zuleta and Young (2007) and Young (2010) studied the shares of labor income in value-added in 35 sectors in US during 1958-1996. They used annual industry data to compute the sectoral labor income shares. However, their main interest was in the stability of factor income share in the context of economic growth. Bentolila and Saint-Paul (2003) studied the determinants of the labor income shares using country-industry panel data of 13 industries and 12 countries during 1972-1993.

Im (2020) used Korea's IO tables to estimate labor income shares at the sectoral level for 2015-2018. He computed Korea's sectoral labor income shares in three ways; (i) include only CE as labor income, (ii) use Gollin's third option, i.e., compute self-employed and family workers' labor income under the assumption that their average income is identical with that of employed workers, (iii) use outside survey data to obtain the average

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relative income levels of non-wage and wage workers and use the ratio of these two to estimate the relative labor income of non-wage workers. For the third method, he used the Household Financial and Welfare Survey data in 2018 and 2019, and computed the sectoral labor income share using the following formula;

$$LS'_{i\,G3} = \frac{CE_i\left(1+\pi_i \frac{L_{Si}}{L_{Ei}}\right)}{NI_i} \tag{6}$$

where π is the relative income level of non-wage workers compared to wage workers, L_E and L_S are the numbers of wage and non-wage workers, respectively, and i represents the sector. We do not have sectoral NLIA. Im (2020) estimated the labor income shares using the above methods only for 2015-2018 because the IO tables in 2015-2018 are published according to the same sector classification, and the IO tables in the previous years are published according to different sector classification.

3 Input-output Tables of Korea

IO tables for 1960 were the first in Korea, and Korea has produced IO tables 36 times since then. The tables evaluated at producer's price were produced in the early years. Tables evaluated at purchaser's price have been produced since 1995, tables evaluated at basic price since 2003, and make and use tables since 2010. Employment tables have been published since 1975. This implies that the longest time-series of IO tables and employment tables with sufficient level of time-series continuity is for 1975-2018, using IO tables evaluated at producer's price. This is the period of analysis in this paper.

As mentioned in Section 1, sector classification of Korea's IO tables has been revised many times; in the years whose last digit is 0 or 5 and in 2003. In order to obtain the tables with the time-series continuity in sector classification, I set up a sector classification whose number of sectors is big enough for rich and flexible analysis, and into which all IO tables can be rearranged, or, harmonized with minimum amount of distortion.

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Table 1 is the 26-sector classification adopted in this paper. After the classification has been determined, all IO tables and employment tables were rearranged according to this classification and to a common layout. In Korea's IO tables, value-added is classified into four terms; CE, OS, CFC and NID. In Korea's employment tables, total number of workers is decomposed into the number of employees and the number of self-employed and family workers.

Table 1. 26-Sector classification

Number	Name
1	Agricultural, forest, and fishery goods
2	Mined and quarried goods
3	Food, beverages and tobacco products
4	Textile and leather products
5	Wood and paper products
6	Coal and petroleum products
7	Chemical products
8	Non-metallic mineral products
9	Basic metal products
10	Fabricated metal products
11	Machinery and equipment
12	Electrical and electronic equipment and components
13	Precision instruments
14	Motor vehicles
15	Other transport equipment
16	Other manufactured products
17	Electricity, gas, and water supply
18	Construction
19	Wholesale and retail
20	Food services and accommodation
21	Transportation and warehousing
22	Communications and broadcasting
23	Finance, insurance, real estate services and business services
24	Public administration and defense
25	Education, research and healthcare services
26	Other services

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Compositions of GDP and DI from IO tables are given in Figures 5 and 6, respectively. We observe that the shares of CE and CFC as a percentage of GDP have increased consistently, from 32.0% and 7.3% in 1975 to 46.3% and 19.2% in 2018, respectively. The share of OS has rapidly decreased, from 53.6% to 26.1%. The share of NID has been stable between 7% and 10%. The share of CE as a percentage of DI (= CE + OS) increased from 37.3% to 64.0% during the same period, or, roughly, from one third to two thirds.

Figure 5. Composition of GDP in input-output tables

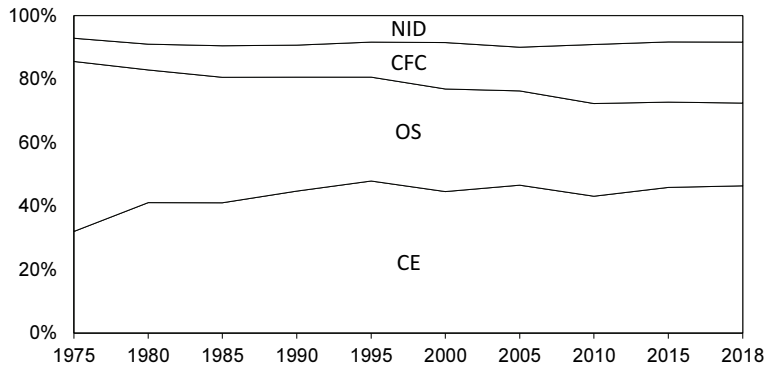
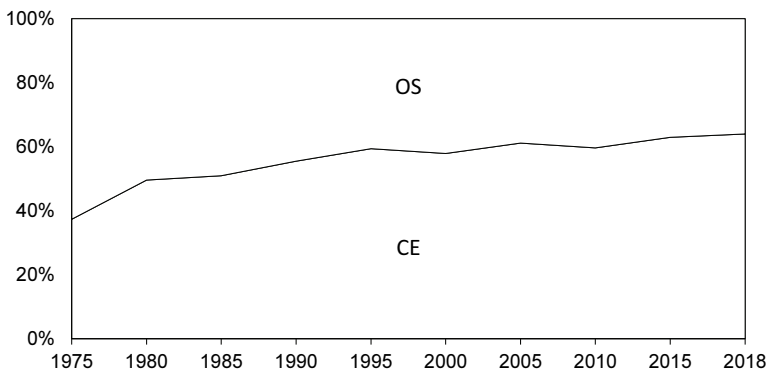


Figure 6. Composition of domestic income in input-output tables



The comparison of IO tables and national income data is necessary. In Korea, IO tables and national income data have been produced with weak link, so the values of major aggregates show considerable differences. Figure 7 depicts the ratios of the components of GDP from IO tables to

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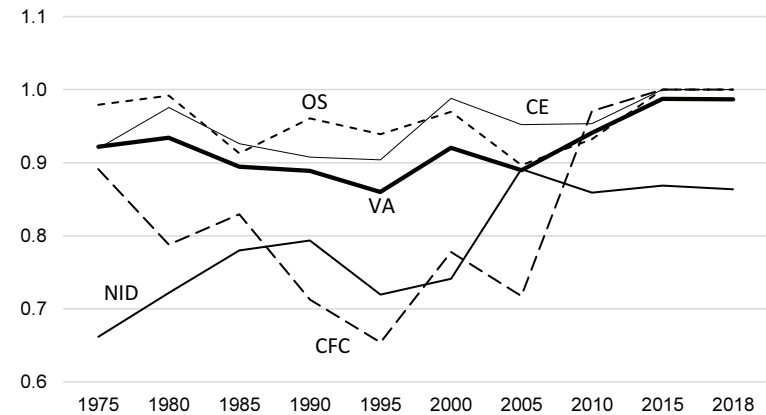
those from national income accounts. Note that the values from IO tables have always been smaller than those from national income accounts. Also note that the gaps were big for NID and CFC until recently, while most variables, except NID, have been harmonized since 2015.

Figure 7. Comparison of national accounts and input-output tables



Compositions of employment in the employment tables is given in Figures 8. We observe that the share of employees in the total employment has consistently increased, from 47.0% in 1975 to 73.5% in 2018, with some decreases around the economic crises in 1997 and 2008-2009.

Figure 8. Composition of employment in employment tables

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In Korea, employment data from the Economically Active Population Survey (EAPS) are the official data while those in the employment tables annexed to IO tables are separately produced. While the numbers of workers in the EAPS are 'head counts,' those in the employment tables are 'full-time equivalents.' Figure 9 depicts the ratios of the numbers of workers from employment tables to those from EAPS. Note that the gap has reduced significantly since 2010.

Figure 9. Comparison of economically active population survey and input-output tables

4 Estimation of Labor Income Share at the Sectoral Level

The official labor income share in (1) cannot be applied to IO tables since net factor incomes from abroad, NLIA and NKIA, are not available in IO tables. However, their magnitudes are relatively small compared to those of CE and OS, so it is expected that the labor income shares using DI are close to those using NI. Labor income shares using NI and DI from national income accounts are depicted in Figure 10. Labor income shares using DI from IO tables is also depicted in Figure 10, and we observe that these three measures are close to one another.

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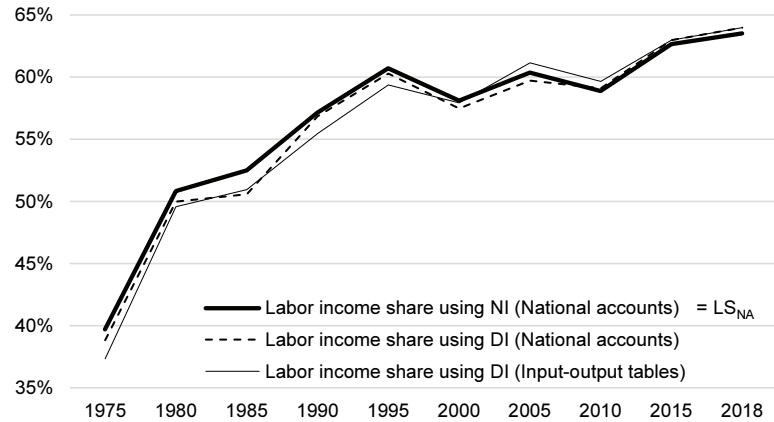
Figure 10. Labor income shares using NI and DI



Source: National income accounts and IO tables, Bank of Korea.

For this reason, we will compute the sectoral labor income shares using CE and OS from IO tables as follows where CE_i and OS_i denote CE and OS in i th sector, respectively.

$$LS_i^{IO1} = \frac{CE_i}{CE_i + OS_i}. \tag{7}$$

Sectoral labor income shares computed by (7) are given in Table 2. Labor income shares in the manufacturing industry (sectors 2~16) and the shares in the service industry (sectors 17~26) have been similar to each other until 2000s, but began diverging in 2010s. This is due to the considerable increase in the share of employees in the service sector in 2010s and the decrease in the manufacturing sector. Labor income share in the agricultural sector has been the lowest during the entire period.

Table 2. Labor income shares using input-output tables: First method

Number	1975	1980	1985	1990	1995	2000	2005	2010	2015	2018
1	12.1%	14.6%	14.3%	16.6%	15.7%	16.7%	12.2%	17.6%	18.8%	21.6%
2	72.7%	71.4%	81.1%	52.5%	43.0%	35.3%	40.3%	44.5%	37.7%	45.1%
3	35.5%	59.2%	59.7%	64.1%	63.2%	53.2%	60.1%	63.5%	66.1%	67.0%

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4	53.3%	67.1%	67.5%	74.3%	70.5%	67.1%	74.1%	55.0%	64.4%	64.1%
5	54.6%	81.8%	58.3%	59.9%	58.0%	53.9%	65.6%	58.8%	48.9%	48.2%
6	30.2%	24.4%	21.6%	97.8%	33.1%	35.6%	33.7%	25.3%	13.7%	16.6%
7	44.8%	53.8%	53.5%	52.9%	52.7%	53.1%	59.7%	45.1%	41.2%	44.1%
8	47.0%	60.1%	54.5%	58.5%	61.9%	61.6%	58.5%	53.0%	53.5%	60.8%
9	45.2%	54.2%	41.9%	47.5%	46.2%	45.8%	37.8%	39.9%	54.2%	55.1%
10	55.0%	74.4%	61.4%	65.5%	74.5%	68.6%	66.7%	56.4%	50.7%	52.5%
11	51.5%	60.9%	61.8%	66.9%	71.5%	65.0%	70.5%	61.1%	65.1%	64.0%
12	49.1%	63.1%	60.4%	65.5%	45.0%	42.4%	62.3%	54.1%	51.7%	38.1%
13	60.5%	59.1%	62.5%	68.7%	73.4%	71.3%	76.0%	56.4%	53.4%	60.8%
14	70.8%	93.3%	62.3%	63.8%	74.8%	74.2%	85.9%	67.8%	78.3%	92.5%
15	52.0%	61.1%	73.7%	86.8%	76.3%	67.7%	92.4%	55.5%	186.0%	98.5%
16	36.2%	61.0%	63.3%	64.6%	69.7%	67.5%	80.4%	63.5%	68.2%	71.0%
17	41.9%	37.4%	23.7%	30.1%	35.0%	30.6%	40.9%	62.1%	29.4%	62.0%
18	69.2%	69.6%	68.0%	67.1%	71.2%	72.9%	76.7%	86.0%	87.7%	86.9%
19	15.7%	26.1%	24.1%	25.5%	40.8%	46.5%	47.0%	40.5%	58.5%	59.8%
20	32.1%	48.4%	56.2%	57.6%	63.7%	71.1%	65.3%	57.6%	71.4%	74.7%
21	52.4%	67.0%	67.1%	69.4%	70.2%	76.1%	64.1%	74.8%	80.4%	89.7%
22	50.7%	52.8%	57.5%	60.3%	61.7%	60.3%	58.1%	68.0%	55.6%	69.9%
23	30.5%	33.0%	39.2%	41.6%	48.9%	42.5%	39.4%	43.3%	45.6%	45.3%
24	98.4%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
25	82.6%	96.1%	93.1%	95.6%	94.9%	93.3%	89.7%	87.4%	89.4%	88.8%
26	54.0%	58.2%	66.1%	71.5%	69.9%	66.0%	67.5%	68.9%	69.7%	73.8%
Total	37.3%	49.6%	50.9%	55.4%	59.4%	57.9%	61.1%	59.6%	63.0%	64.0%
1	12.1%	14.6%	14.3%	16.6%	15.7%	16.7%	12.2%	17.6%	18.8%	21.6%
2~16	48.1%	61.3%	58.8%	63.2%	59.1%	55.2%	63.8%	54.6%	56.2%	53.6%
17~26	45.0%	54.8%	56.5%	57.8%	63.9%	61.9%	62.6%	63.2%	66.9%	68.9%

Source: Input-output tables, Bank of Korea.
Note: The cells in which labor income share exceeds 100% are shaded in gray.

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Observe that in the manufacturing industry, labor income shares are relatively high in the labor-intensive sectors, such as food and beverage (sector 3) or textile and leather (sector 4), or in the sectors with small number of self-employed workers, such as transport equipment (sectors 14 and 15). Similarly, labor income share is very low in the capital-intensive sector such as petroleum product (sector 6). The rapid drop in the labor share in the electrical and electronic equipment and components sector (sector 12) in 2018 is due to the unprecedented surge in the operating surplus.

Note that the labor share of income exceeds 100% in some sectors. This happens when the operating surplus in the sector is negative. The shipbuilding sector (sector 15) around 2015 is a typical example. On the other hand, the labor share is 100% in the government (sector 24). This is because the operating surplus is set at zero in the government sector according to the national accounting system. Also, the labor share is very high in the education, research and health sector (sector 25) for the similar reason. Also, it is possible that labor income shares could reveal considerable time-series discontinuity in certain sectors due to a change in the national accounting system. This implies that direct comparison of labor income shares is not proper for some sectors, and that we need to be careful when comparing labor income shares both in time-series and cross-section manners.

The second method for computing labor income shares using IO tables is to utilize the information contained in the employment tables and to compute the sectoral labor income under the assumption that the average labor income of the self-employed workers equals average wage level of employees. The formula is given as follows where L_{Ei} and L_{Ti} denote the number of employees and total number of workers in the i th sector, respectively.

$$LS_i^{IO2} = \frac{\frac{CE_i}{L_{Ei}} \times L_{Ti}}{CE_i + OS_i}. \tag{8}$$

Sectoral labor income shares computed by the second method are given in Table 3. Note that labor income shares exceed 100% in the sectors where

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(i) the share of employees is very low such as agriculture (sector 1), wholesale and retail (sector 19), food services and accommodation (sector 20), etc. and (ii) share of operating surplus is highly small due to national accounting system such as education, research and healthcare services (sector 25) or due to poor performance temporarily such as shipbuilding (sector 15).

Table 3. Labor income shares using input-output tables: Second method

Number	1975	1980	1985	1990	1995	2000	2005	2010	2015	2018
1	87.1%	122.3%	110.8%	139.0%	146.3%	210.5%	128.0%	178.8%	206.4%	250.9%
2	74.1%	72.7%	82.8%	53.9%	43.5%	38.9%	43.8%	50.0%	41.4%	45.3%
3	38.8%	64.6%	68.0%	70.6%	68.0%	72.3%	83.1%	88.5%	85.8%	86.1%
4	55.1%	70.2%	70.4%	79.6%	81.9%	76.9%	88.6%	70.9%	81.9%	83.5%
5	58.4%	87.4%	60.7%	62.4%	61.1%	62.1%	74.2%	71.5%	56.3%	55.2%
6	31.2%	24.8%	22.0%	98.6%	33.3%	36.1%	34.1%	25.7%	13.9%	16.9%
7	45.2%	54.3%	54.2%	53.7%	53.8%	55.5%	62.5%	50.1%	44.8%	47.6%
8	48.9%	61.6%	56.1%	59.7%	63.4%	66.8%	63.4%	61.8%	61.0%	70.2%
9	45.4%	54.6%	42.4%	47.9%	46.7%	47.8%	39.0%	42.9%	56.7%	57.9%
10	56.4%	80.0%	64.1%	67.2%	78.2%	82.2%	80.1%	70.6%	59.4%	62.5%
11	52.9%	63.0%	63.4%	68.1%	73.4%	71.0%	76.4%	69.7%	73.6%	71.9%
12	49.3%	63.4%	61.0%	66.0%	45.6%	43.7%	64.3%	58.0%	55.2%	41.2%
13	61.0%	60.4%	64.0%	69.8%	75.5%	77.2%	81.0%	67.7%	60.6%	69.0%
14	73.3%	96.1%	63.2%	64.5%	90.1%	92.8%	103.7%	84.1%	94.8%	113.7%
15	52.5%	61.6%	74.1%	87.4%	76.9%	68.7%	93.3%	57.7%	189.8%	100.6%
16	39.9%	66.4%	65.9%	66.6%	73.3%	86.8%	102.5%	81.6%	80.8%	83.4%
17	41.9%	37.4%	23.7%	30.1%	35.0%	30.6%	40.9%	62.7%	30.0%	62.4%
18	70.9%	69.9%	71.1%	70.5%	74.6%	76.8%	77.4%	111.9%	115.5%	110.9%
19	69.8%	75.1%	61.6%	78.6%	115.0%	114.8%	102.6%	73.9%	100.4%	99.7%
20	48.2%	71.0%	101.1%	103.0%	149.9%	163.6%	139.4%	102.3%	121.8%	134.9%
21	57.7%	74.4%	76.2%	86.8%	91.1%	105.4%	92.9%	138.4%	149.4%	160.0%
22	52.3%	54.6%	62.7%	61.5%	62.1%	62.2%	59.6%	69.8%	57.5%	71.9%

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23	43.1%	42.2%	53.6%	54.0%	56.7%	48.0%	43.0%	50.5%	52.9%	53.4%
24	98.4%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
25	87.4%	99.3%	97.3%	105.1%	106.5%	104.0%	97.2%	102.1%	101.8%	100.0%
26	104.7%	113.4%	121.3%	125.3%	115.5%	125.4%	108.0%	115.9%	110.5%	118.5%
Total	79.4%	88.2%	84.6%	85.7%	90.1%	90.5%	86.9%	85.1%	86.3%	87.1%
1	87.1%	122.3%	110.8%	139.0%	146.3%	210.5%	128.0%	178.8%	206.4%	250.9%
2~16	50.0%	63.9%	61.1%	65.6%	63.2%	62.4%	71.7%	65.0%	64.8%	62.1%
17~26	77.5%	81.0%	84.1%	86.4%	94.0%	90.8%	84.2%	87.6%	90.2%	92.0%

Source: Input-output tables, Bank of Korea.
Note: The cells in which labor income share exceeds 100% are shaded in gray.

The economy-wide labor income share computed by the second method was roughly 85~90%, which is higher than the shares by the first method by more than 20%p. As already mentioned in the previous sections, this is because the first method underestimates and the second method overestimates the true labor income share. We can use the sectoral GVA as the denominator in (8), which is parallel with the OECD method given in (3), but I did not report the results here.

The third method for computing labor income shares using IO tables is to estimate the non-wage workers' labor income by using the information from survey data, i.e., follow the method of Im (2020).

$$LS_i^{IO3}=LS'_{iG3}=\frac{CE_i\left(1+\pi_i\frac{L_{Si}}{L_{Ei}}\right)}{CE_i+OS_i}. \quad (9)$$

In this paper, I used the estimates of sectoral average labor income levels by Im (2020). Specifically, I used the simple average of π_i in 2018 and 2019 from Im (2020) and applied it to all years. This could cause distortion since the relative average labor income of non-wage workers might have time-series trend in various sectors, but this was the best way to take full advantage of the information in Im (2020).

Sectoral labor income shares computed by the third method are given in Table 4. Note that the labor income shares by the third method show similar patterns with those by the second method while the shares by the

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third method are smaller. The difference between the shares by the third and the second methods are given in Table 5, which shows the decreases, or, adjustments, in the shares by adjusting the average labor income of non-wage workers using survey data obtained by Im (2020).

Table 4. Labor income shares using input-output tables: Third method

Number	1975	1980	1985	1990	1995	2000	2005	2010	2015	2018
1	68.8%	95.9%	87.1%	109.0%	114.3%	163.0%	99.6%	139.3%	160.5%	194.8%
2	73.6%	72.3%	82.2%	53.4%	43.3%	37.7%	42.6%	48.1%	40.2%	45.2%
3	37.7%	62.7%	65.2%	68.4%	66.4%	65.7%	75.2%	79.9%	79.1%	79.6%
4	54.5%	69.1%	69.5%	77.8%	78.0%	73.6%	83.6%	65.5%	76.0%	76.9%
5	57.1%	85.5%	59.9%	61.6%	60.1%	59.3%	71.3%	67.2%	53.8%	52.8%
6	30.9%	24.6%	21.8%	98.3%	33.3%	35.9%	34.0%	25.5%	13.8%	16.8%
7	45.1%	54.1%	54.0%	53.4%	53.4%	54.7%	61.6%	48.4%	43.5%	46.4%
8	48.3%	61.1%	55.6%	59.3%	62.9%	65.0%	61.7%	58.8%	58.4%	67.0%
9	45.4%	54.4%	42.2%	47.7%	46.5%	47.1%	38.6%	41.9%	55.8%	57.0%
10	55.9%	78.1%	63.2%	66.6%	76.9%	77.6%	75.5%	65.7%	56.5%	59.1%
11	52.4%	62.3%	62.8%	67.7%	72.8%	68.9%	74.4%	66.7%	70.7%	69.2%
12	49.2%	63.3%	60.8%	65.8%	45.4%	43.2%	63.6%	56.6%	54.0%	40.2%
13	60.8%	60.0%	63.5%	69.4%	74.8%	75.2%	79.3%	63.8%	58.1%	66.2%
14	72.4%	95.1%	62.9%	64.3%	84.9%	86.5%	97.6%	78.5%	89.2%	106.4%
15	52.4%	61.5%	74.0%	87.2%	76.7%	68.4%	93.0%	56.9%	188.5%	99.8%
16	38.7%	64.5%	65.0%	65.9%	72.0%	80.2%	95.0%	75.4%	76.5%	79.2%
17	41.9%	37.4%	23.7%	30.1%	35.0%	30.6%	40.9%	62.5%	29.7%	62.2%
18	71.4%	70.0%	72.0%	71.5%	75.6%	77.9%	77.6%	119.5%	123.7%	118.0%
19	58.3%	64.7%	53.7%	67.3%	99.3%	100.3%	90.8%	66.8%	91.5%	91.2%
20	49.3%	72.5%	104.2%	106.2%	155.9%	170.1%	144.6%	105.4%	125.3%	139.1%
21	57.5%	74.1%	75.8%	86.1%	90.3%	104.3%	91.8%	135.9%	146.6%	157.2%
22	52.1%	54.5%	62.2%	61.4%	62.1%	62.0%	59.5%	69.6%	57.3%	71.7%
23	40.8%	40.5%	51.0%	51.7%	55.3%	47.0%	42.4%	49.2%	51.5%	51.9%
24	98.4%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

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25	86.9%	99.0%	96.9%	104.0%	105.2%	102.9%	96.4%	100.4%	100.4%	98.8%
26	97.9%	106.0%	113.9%	118.1%	109.4%	117.4%	102.5%	109.6%	105.0%	112.5%
Total	62.7%	72.6%	70.4%	74.9%	78.5%	78.8%	75.3%	77.0%	80.8%	82.1%
1	68.8%	95.9%	87.1%	109.0%	114.3%	163.0%	99.6%	139.3%	160.5%	194.8%
2~16	49.3%	62.8%	60.2%	64.5%	61.6%	59.6%	68.5%	60.7%	61.4%	58.7%
17~26	65.8%	70.0%	70.7%	74.4%	82.5%	80.3%	76.5%	81.7%	85.3%	87.3%

Source: Input-output tables, Bank of Korea.
Note: The cells in which labor income share exceeds 100% are shaded in gray.

Table 5. Labor income shares: Difference between Third and Second method (Third – Second)

Number	1975	1980	1985	1990	1995	2000	2005	2010	2015	2018
1	-18.4%	-26.4%	-23.6%	-30.0%	-32.0%	-47.5%	-28.4%	-39.5%	-46.0%	-56.2%
2	-0.5%	-0.5%	-0.6%	-0.5%	-0.2%	-1.3%	-1.2%	-1.9%	-1.3%	-0.1%
3	-1.1%	-1.8%	-2.8%	-2.2%	-1.7%	-6.5%	-7.9%	-8.5%	-6.7%	-6.5%
4	-0.6%	-1.1%	-1.0%	-1.8%	-3.9%	-3.4%	-4.9%	-5.4%	-6.0%	-6.6%
5	-1.3%	-1.9%	-0.8%	-0.8%	-1.1%	-2.8%	-2.9%	-4.3%	-2.5%	-2.4%
6	-0.3%	-0.1%	-0.1%	-0.3%	-0.1%	-0.1%	-0.2%	-0.1%	-0.1%	-0.1%
7	-0.1%	-0.2%	-0.3%	-0.3%	-0.3%	-0.8%	-1.0%	-1.7%	-1.2%	-1.2%
8	-0.6%	-0.5%	-0.6%	-0.4%	-0.5%	-1.8%	-1.7%	-3.0%	-2.6%	-3.2%
9	-0.1%	-0.1%	-0.2%	-0.1%	-0.2%	-0.7%	-0.4%	-1.0%	-0.8%	-1.0%
10	-0.5%	-1.9%	-0.9%	-0.6%	-1.3%	-4.6%	-4.6%	-4.8%	-3.0%	-3.4%
11	-0.5%	-0.7%	-0.5%	-0.4%	-0.7%	-2.0%	-2.0%	-2.9%	-2.9%	-2.7%
12	-0.1%	-0.1%	-0.2%	-0.2%	-0.2%	-0.4%	-0.7%	-1.3%	-1.2%	-1.1%
13	-0.2%	-0.5%	-0.5%	-0.4%	-0.7%	-2.0%	-1.7%	-3.9%	-2.5%	-2.8%
14	-0.9%	-0.9%	-0.3%	-0.3%	-5.2%	-6.4%	-6.1%	-5.6%	-5.6%	-7.2%
15	-0.2%	-0.2%	-0.1%	-0.2%	-0.2%	-0.4%	-0.3%	-0.7%	-1.3%	-0.7%
16	-1.3%	-1.8%	-0.9%	-0.7%	-1.2%	-6.6%	-7.5%	-6.2%	-4.3%	-4.2%
17	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.2%	-0.2%	-0.2%
18	0.5%	0.1%	0.9%	1.0%	1.0%	1.1%	0.2%	7.6%	8.2%	7.1%
19	-11.5%	-10.4%	-8.0%	-11.3%	-15.8%	-14.5%	-11.8%	-7.1%	-8.9%	-8.5%

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20	1.1%	1.6%	3.1%	3.2%	6.0%	6.4%	5.2%	3.1%	3.5%	4.2%
21	-0.2%	-0.3%	-0.4%	-0.7%	-0.8%	-1.2%	-1.1%	-2.5%	-2.7%	-2.8%
22	-0.2%	-0.2%	-0.5%	-0.1%	0.0%	-0.2%	-0.1%	-0.2%	-0.2%	-0.2%
23	-2.3%	-1.7%	-2.7%	-2.3%	-1.4%	-1.0%	-0.7%	-1.3%	-1.3%	-1.5%
24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25	-0.5%	-0.4%	-0.5%	-1.0%	-1.3%	-1.2%	-0.8%	-1.6%	-1.4%	-1.2%
26	-6.8%	-7.4%	-7.4%	-7.2%	-6.1%	-7.9%	-5.4%	-6.3%	-5.5%	-6.0%
Total	-16.7%	-15.6%	-14.2%	-10.8%	-11.7%	-11.7%	-11.6%	-8.1%	-5.5%	-5.0%
1	-18.4%	-26.4%	-23.6%	-30.0%	-32.0%	-47.5%	-28.4%	-39.5%	-46.0%	-56.2%
2~16	-0.7%	-1.1%	-0.9%	-1.1%	-1.6%	-2.7%	-3.2%	-4.4%	-3.4%	-3.4%
17~26	-11.7%	-11.0%	-13.3%	-12.0%	-11.5%	-10.4%	-7.7%	-5.9%	-4.9%	-4.7%

Source: Input-output tables, Bank of Korea.

According to Table 5, the absolute magnitudes of these adjustments have decreased. This phenomenon can be interpreted as the economy's approach to a stable state. The adjustment is the biggest in the agricultural sector. The adjustments in the service sector have also gradually reduced, while they have been bigger than those in the manufacturing sector. The adjustments in sectors 18 (construction) and 20 (food services and accommodation) are positive since π_i is bigger than 1 in these sectors.

The labor income shares of the entire economy obtained by all three methods are depicted in Figure 11. We observe that (i) all three methods show similar trend, (ii) the estimates by the third method is adjusting the estimates by the first method roughly with ratio of two to one, and (iii) the estimates by all three methods show increasing trend, and that the smaller the income shares, the steeper the trend.

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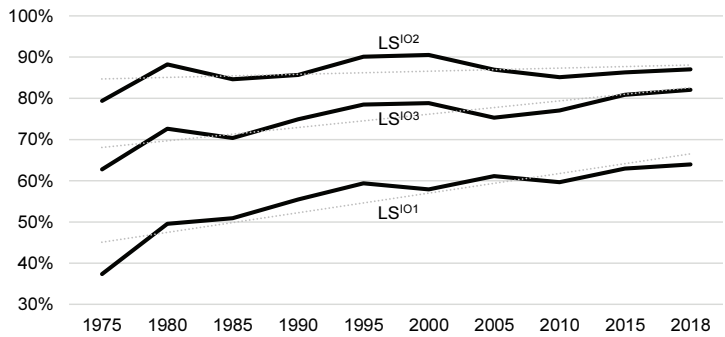
Figure 11. Labor income shares of the entire economy using IO tables: Methods 1~3



5 Conclusion

The contribution of this paper is to estimate the sectoral labor income shares in Korea with the same methods over a long period. For this purpose, I harmonized the IO tables of Korea for the period 1975-2018 according to a common 26-sector classification, and applied various methods for computing labor income shares to the variables available in IO tables and the accompanying employment tables. It is expected that the results of this paper can be utilized in a variety of studies.

In this paper, three methods were applied. First method is to use CE, the narrowest definition of labor income, as the labor income. Second method is to assume that the average labor income of non-wage workers equals the average wage level of employees. Third method is to estimate the average labor income of non-wage workers using micro survey data. All three methods use DI, the sum of CE and OS, as the total factor income. In this paper, I used the estimates by Im (2020) for the third method.

The economy-wide labor income share by the first method is highly close to the official income share published by the Bank of Korea, and is believed to underestimate the true labor income share. On the other hand, the share by the third method is expected to highly overestimate the true value. The accuracy and the reliability of the estimated shares can be greatly improved by estimating the relative average labor income share of non-wage workers more thoroughly based on more accurate survey data.

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