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Why Do Real Wages Stagnate in Japan and Korea? *

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Abstract

This study investigates the reasons behind the slowdown in real wages for Japan and Korea based on the aggregate and industry-level data for the respective countries. The findings suggest the following. First, both at aggregate and at industry-level, there is a significant slowdown in both countries in the post-1995 period regarding labor productivity, which explains the overall slowdown in real wages. Second, the main reason for the gap between the growths in real wages and labor productivity is found to be the changes in the labor's terms of trade which is defined as the CPI to GDP deflator ratio. Thus, the wage-labor productivity gap is not systematically connected to changes in labor shares. Finally, to some extent, the overestimation of labor's terms of trade is overstating the slowdown in real wages, especially in Japan.

Keywords: Labor Productivity, Real wage

JEL code: E24, E25

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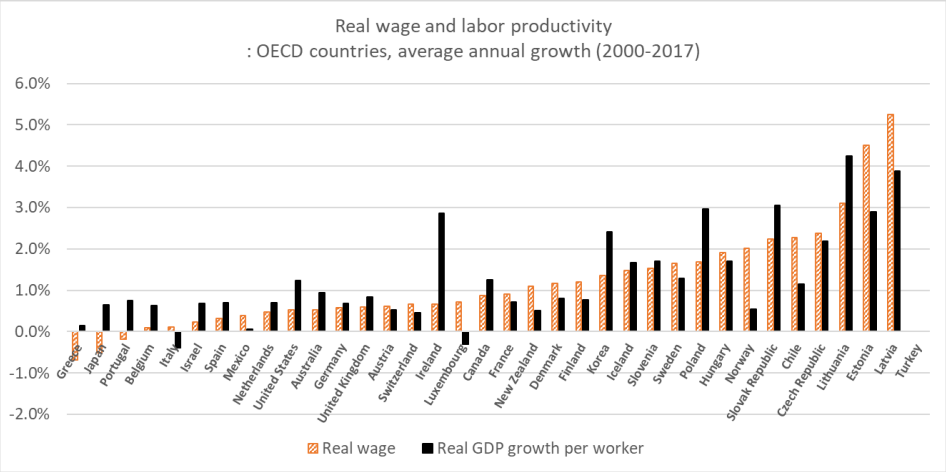
1. Introduction

The real wage growths have been stagnant for many advanced economies in the recent decades. The real wage growth was less than 1 percent per annum on average in 20 of 35 OECD economies for the period of 2000 – 2017. The group includes most of the major economies such as Japan (-0.5%), Italy (0.1%), U.S. (0.5%), Germany (0.6%), UK (0.6%), France (0.9%) etc. Even newly industrialized economies such as Korea had an annual real wage growth of mere 1.4%.

One potential reason behind this slow growth in real wages could be related to observed gaps between the labor productivity and real wages. Many studies compare growth rates of real wage and labor productivity to compare the performance of the economy and the improvement of purchasing power of workers. Measuring real labor productivity by real GDP per worker, we observe that real wage growth fell short of labor productivity growth in 20 of 35 countries for the same period as shown in Figures 1 and 2. This seems to suggest that the outcome of economic growth is not distributed to the workers proportionally. Several studies (Dabla-Norris et al., 2015; ILO, 2018) go further to hastily infer that this gap implies a fall in the labor income share which could be possibly due to the recent growing global trend of labor-saving technological changes. However, there are obvious problems with these inferences and interpretations. The wage-labor productivity gap is influenced by other factors such as the changes in the proportion of non-wage workers, differences in the price indices used in converting GDP and wages into real terms, etc.

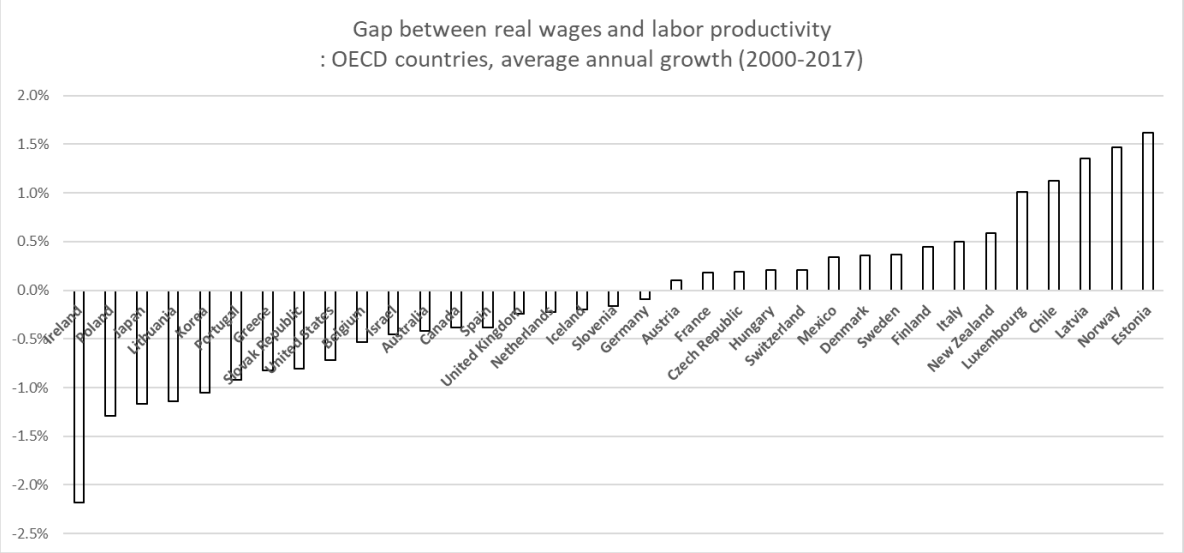
The goal of this study is to decompose the changes in real wage into several meaningful components focusing on labor productivity to understand the recent wage stagnation. We intend to provide a comprehensive data analysis on a pair of countries – Japan and Korea – experiencing low growth in real wages. We have chosen these countries for the reason being that the former belongs to advanced economies group and the latter is one of the newly-industrialized economies.

Figure 1. Real wage and labor productivity growth of OECD countries (average annual growth, 2000 – 2017)



Source: Authors' calculation based on OECD.stat

Figure 2. Gap between real wage and labor productivity growth of OECD countries (average annual growth, 2000 – 2017)



Source: Authors' calculation based on OECD.stat

The claim linking the cause for real wage stagnation with the widening gap between real wage and labor productivity is not accurate for the following reason. The measures for wages and labor productivity used in the usual wage-labor productivity comparisons such as Figure1 have different coverages. The wage variables are derived from wage surveys from the wage income workers. Therefore, it only covers wage conditions of the wage workers obviously. However, the labor productivity is measured usually as the total value-added (GDP) of the economy divided by all workers

including wage and non-wage workers. Thus, the measure is naturally influenced by the conditions of non-wage businesses.

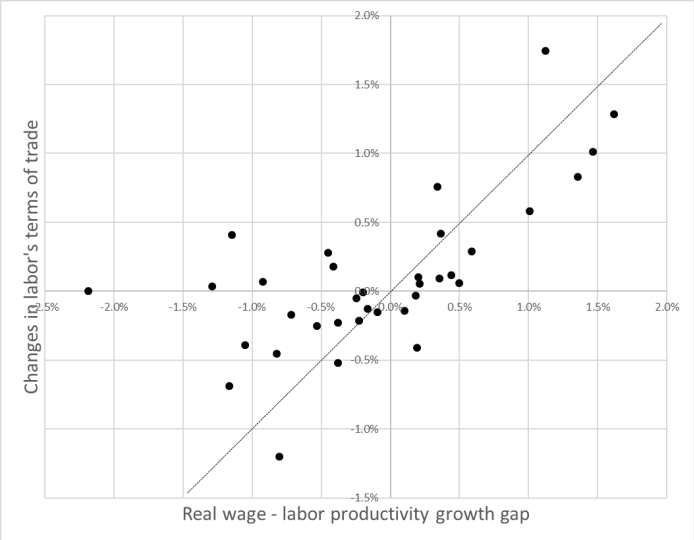
The claim that widening wage-labor productivity gap implies a decline in the labor income share is not precise for the following reason. In wage-labor productivity comparison, different price indices are used to obtain real wages and real labor productivity, respectively. Nominal wage is deflated by CPI, whereas nominal GDP is deflated by GDP deflator to obtain the real terms. Therefore, the widening wage-labor productivity gap in real terms is influenced by the changes in the CPI-GDP deflator differential. We denote the CPI-GDP deflator differential as labor's terms of trade which is the ratio of prices of the products workers produce (GDP deflator) to the prices that they pay as consumers (CPI or PCE deflator). There are studies suggesting that widening wage-labor productivity gaps can be mostly explained by the changes in the labor's terms of trade and not by a labor share decline. Bosworth and Perry (1994), Feldstein (2008), Pessoa and van Reenen (2013), and Bivens and Mishel (2015) found that labor's terms of trade are important factor widening the productivity-wage gap in t he US. Park (2019) also found that most of the real wage-labor productivity gap observed for 2000 – 2017 in Korea can be explained by the changes in the labor's terms of trade.

Most of the observed gap between wage and labor productivity growth disappears for many countries when they are compared in nominal terms and not influenced by the changes in labor's terms of trade as shown in Figure 3. Furthermore, the changes in the labor's terms of trade and real wage-labor productivity growth gap (average annual growth, 2000 – 2017) are positively correlated as shown in Figure 4 with the correlation coefficient of 66.4.

Figure 3. Nominal wage and labor productivity growth of OECD countries (average annual growth, 2000 – 2017)

Source: Authors' calculation based on OECD.stat

Figure 4. Labor's terms of trade and real wage-labor productivity growth gap (average annual growth, 2000 – 2017)



Source: Authors' calculation based on OECD.stat

This study aims to analyze the factors behind the stagnant real wage growth for Japan and Korea. We provide decomposition analyses at both the aggregate and sectoral-level based on relevant datasets. The main focus of the study is the decomposition of the gap between the real wage and labor productivity growth in the two countries. The potential contributing factors to the wage-productivity gap are use of different price deflators (GDP deflator, CPI, Private Final Consumption deflator) in converting to real terms, changes in labor shares, changes in indirect taxes, etc. Analyses on the two sectors – manufacturing and non-manufacturing – will be dealt to see how relative contributions of potential factors are different for these sectors.

We will provide trends in real wage, deflators, labor income share, and labor productivity by sub-periods. We will then explain the gap between the real wage growth and labor productivity growth by decomposing real wage growth into sub-factors: differences in price indicators, changes in labor income share, changes in taxes, and growth in labor productivity etc. The changes in the labor's terms of trade discussed taking into account of the difference between CPI and PCE deflator (private consumption expenditure deflator).

One limitation of the study is the different availability of the detailed data set necessary to decompose the wage-productivity gap in the two countries. Therefore, for some cases, we have applied two distinct procedures to derive estimates for the two countries based on the data availability.

The rest of the paper is structured as follows. Section 2 explains the methodology of decomposition of the wage-labor productivity gap. Section 3 presents the results of decomposition on macro economy of Japan and Korea. Section 4 presents results of decomposition by industry level in Japan and Korea. Section 5 discusses the causes of different labor's terms of trade. Finally, Section 6 concludes.

2. Decomposition of the wage-labor productivity gap

The link between real wage and real labor productivity can be explained by several factors as in the following equation. The decomposition of the link is as follows.

2.1 Decomposition method A

The first equation shows that real wage can be decomposed into four factors: terms of trade, labor share, national income to GDP (NI_0/GDP), and real labor productivity. The difference between the national income (NI) and GDP is the depreciation and indirect taxes. We use this method for Japanese data decomposition.

$$real\ \ wage = \frac{\mathrm{W}}{P_C} = \left(\frac{1}{P_C}\right)\cdot\left(\frac{WL_0}{Y_0}\right)\cdot\left(\frac{Y_0}{L_0}\right) = \left(\frac{P_G}{P_C}\right)\cdot\left(\frac{WL_0}{Y_0}\right)\cdot\left(\frac{Y_0/P_G}{L_0}\right)$$

$$= \left(\frac{P_G}{P_C}\right)\cdot\left(\frac{WL_0}{Y_0}\right)\cdot\left[\left(\frac{Y_0}{Y}\right)\right]\cdot\left(\frac{Y/P_G}{L_0}\right)$$

$$= \left(\frac{P_G}{P_C}\right)\cdot\left(\frac{WL_0}{NI_0}\right)\cdot\left[\left(\frac{NI_0}{GDP}\right)\right]\cdot\left(\frac{GDP/P_G}{L_0}\right)$$

$$= (terms\ \ of\ \ trade)\cdot(labor\ \ share)\cdot\left[\left(\frac{NI_0}{GDP}\right)\right]\cdot(labor\ \ productivity)$$

$$\left(\frac{NI_0}{GDP}\right) = (1-t)\cdot(depreciation\ \ rate)$$

One well-known difficulty in calculating labor share for the GDP is the existence of self-employed sector. In most detailed set of data related to the functional distribution of income at the national level or industry level, the sectors are broken down to three sectors: corporate, self-employed, and government sectors. The income of the self-employed sector is denoted as "operating surplus of households". The problem is that this income for the self-employed is perceived as a mixed income of labor and capital by nature. Thus, different ways of treating this mixed income will result in different

estimates of labor share. Furthermore, the problem is more complicated by the fact that there are two types of self-employed: ones without employees or with unpaid family workers (SE1) and ones with employees (SE2). Although the naming is "self-employed", we have to be careful in the accounting practice as some of the employee compensation is derived from the SE2 sector, the self-employed sector with employees.

2.2 Decomposition method B.

The second equation derives a relation between the real wage and real labor productivity of all sectors except SE1, the self-employed sector without employees. The equation show that real wage is determined by the following factors: terms of trade, labor share excluding SE1, share of national income determined by all sectors excluding SE1(NI_2/NI_0), share of workers in all sectors without SE1(L_2/L_0), national income to GDP (NI_0/GDP) ratio, and real labor productivity. We use this method for Korean data decomposition.

$$real\ \ wage = \frac{\mathrm{W}}{P_C} = \left(\frac{1}{P_C}\right)\cdot\left(\frac{WL_2}{Y_2}\right)\cdot\left(\frac{Y_2}{L_2}\right) = \left(\frac{P_G}{P_C}\right)\cdot\left(\frac{WL_2}{Y_2}\right)\cdot\left(\frac{Y_2/P_G}{L_2}\right)$$

$$= \left(\frac{P_G}{P_C}\right)\cdot\left(\frac{WL_2}{Y_2}\right)\cdot\left[\left(\frac{Y_2}{Y_0}\right)\cdot\left(\frac{Y_0}{Y}\right)\cdot\left(\frac{L_0}{L_2}\right)\right]\cdot\left(\frac{Y/P_G}{L_0}\right)$$

$$= \left(\frac{P_G}{P_C}\right)\cdot\left(\frac{WL_2}{NI_2}\right)\cdot\left[\left(\frac{NI_2}{NI_0}\right)\cdot\left(\frac{NI_0}{GDP}\right)\cdot\left(\frac{L_0}{L_2}\right)\right]\cdot\left(\frac{GDP/P_G}{L_0}\right)$$

$$= (terms\ \ of\ \ trade)\cdot(labor\ \ share_2)\cdot\left[\left(\frac{NI_2}{NI_0}\right)\cdot\left(\frac{L_0}{L_2}\right)\cdot\left(\frac{NI_0}{GDP}\right)\right]$$
$$\cdot(labor\ \ productivity)$$

where $labor\ \ share_2 = labor\ \ share\ \ excluding\ \ SE1$

Given these decompositions, we define three alternative versions of labor productivity: where labor producticity0 is real GDP per all workers, labor productivity1 is real net value-added per all workers, and labor productivity2 is real net value-added per all workers excluding value-added and workers from SE1 sector.

$$labor\ \ productivity_0 = \frac{GDP/P_G}{L_0}$$

$$labor\ \ productivity_1 = \frac{NI_0/P_G}{L_0} = \left(\frac{NI_0}{GDP}\right)\cdot\left(\frac{GDP/P_G}{L_0}\right)$$

$$labor\ \ productivity_2 = \frac{NI_2/P_G}{L_2} = \left(\frac{NI_2}{NI_0}\right)\cdot\left(\frac{L_0}{L_2}\right)\cdot\left(\frac{NI_0}{GDP}\right)\cdot\left(\frac{GDP/P_G}{L_0}\right)$$

From the equations, we can see that there are several factors bridging the gap between the real wage and the real labor productivity based on GDP per worker ($labor\ \ productivity_0$). More importantly, given the self-employment issue, the more relevant comparison would be the comparison between the real wage and the real labor productivity excluding SE1 ($labor\ \ productivity_2$)

In the following analysis, we use Japanese and Korean macroeconomic data to explain and understand the relationship between changes in real wages and labor productivity by providing these factor decompositions.

3. Results of decomposition analyses

3.1. Aggregate Economy, Japan

Decomposition analyses on the changes of wage-productivity gap in Japan for the last twenty years is provided in this section. The data set used in the analysis is JIP2015, and JIP2018. Due to the limitations on the data availability, we resort to the *decomposition method A* where we account for the aggregate economy and do not exclude the SE1 sector. The wage-productivity gap is then composed of the following three components: terms of trade, labor share, and national income to GDP (NI_0/GDP). It should be noted that, in this method of calculation, the changes in labor share (*labor share*) should be understood as reflecting not only the changes in the ratio of employees' compensation to their value-added (*labor share2*) but also the changes in the self-employed sector (SE1) share of national income and of workers.

We discuss the wage-labor productivity growth gap where we compare hourly real wage with the hourly real labor productivity (*labor productivity1*) calculated based on net value-added. Real wage growths have lagged behind labor productivity growths for the pre-1995 and also for the post-1995 period in Japan. Decompositions of the gap for each period are presented in Panel A and Panel B of Table 1. As seen in Panel A of Table 1, the real wage growth (79.5%) was lower than the real labor productivity growth (81.7%) for the pre-1995 period (1970 – 1995). Likewise, as seen in Panel B of Table 1, the real wage growth (2.6%) was lower than the real labor productivity growth (22.8%) for the post-1995 period (1995 – 2015).

In both cases, the main reasons for the gap between the real wage and labor productivity were the

fall in the terms of trade which declined 19.5% and 14.2% for respective periods. However, there is a stark difference in terms of labor income share. There was an increase in the labor income share (17.4%) in the first period to compensate for the fall in the terms of trade (-19.5%). This made the gap between the real wages and labor productivity relatively small (2.2%point). On the contrary, in the latter period, there was a decline in the labor income share (-6.1%) in addition to the fall in the terms of trade (-14.2%) making the gap (20.2%point) wider.

Table 1. Growth rates of real labor compensation, GDP deflator, labor income share, and labor productivity by sub-periods (average annual growth, %, log growth rate): Japan

Panel A

	1970-80	1980-90	1990-95	Total change, 1970-1995
Growth rate of real wage	4.6%	2.2%	2.3%	**79.5%**
Growth rate of GDP deflator/CPI	-1.3%	-0.5%	-0.4%	-19.5%
Growth rate of labor income share	1.6%	-0.6%	1.5%	17.4%
Growth rate of labor productivity1 (NI0)	**4.3%**	**3.2%**	**1.2%**	**81.7%**
Growth rate of capital depreciation rate	0.1%	-0.3%	-0.6%	-5.1%
Growth rate of net indirect tax rate	0.1%	-0.2%	0.1%	-0.6%
Growth rate of labor productivity0 (GDP)	4.1%	3.7%	1.7%	**87.4%**

Panel B

	1995-00	2000-05	2005-10	2010-15	Total change, 1995-2015
Growth rate of real wage	0.3%	0.5%	0.2%	-0.5%	**2.6%**
Growth rate of GDP deflator/CPI	-0.9%	-0.5%	-0.8%	-0.6%	-14.2%
Growth rate of labor income share	-0.3%	-0.7%	0.7%	-1.0%	-6.1%
Growth rate of labor productivity1 (NI0)	**1.5%**	**1.6%**	**0.3%**	**1.0%**	**22.8%**
Growth rate of capital depreciation rate	-0.3%	0.1%	-0.5%	0.2%	-2.1%
Growth rate of net indirect tax rate	-0.1%	0.0%	0.0%	-0.2%	-1.7%
Growth rate of labor productivity0 (GDP)	2.0%	1.6%	0.7%	1.0%	**26.2%**

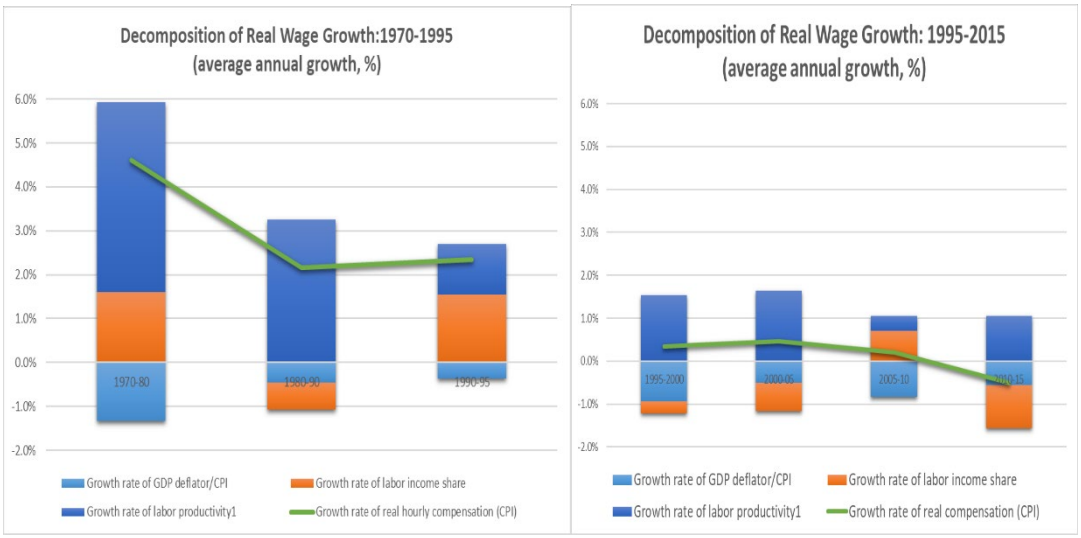
Source: Authors' calculations based on JIP 2015, JIP 2018, and CPI data.

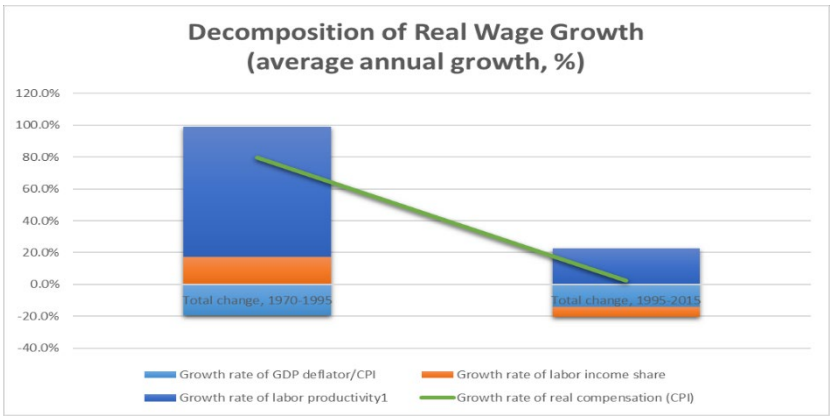
Over time, labor productivity growth exhibits a strong downward trend. For the earlier period, labor productivity growth falls from 4.3% in 1970-1980 to 1.2% in 1990-1995. Labor share rises but

terms of trade falls more. This makes real wage growth slightly lower than labor productivity growth. Figure 5 shows a consistent growth over shorter sub-periods (1975 – 80, 1980 – 90, 1990 – 95).

For the latter period, there was a significant slowdown of labor productivity from 1.5% in 1995-00 to 1.0% in 2010-15. Negative impact due to 'decline in terms of trade' and to fall in the labor income share wiped out the productivity growth effects. The accumulated growth in real wage of the former period was 79.5%, whereas it was only 2.6% in the latter period.

Figure 5. Growth rates of real labor compensation, GDP deflator, labor income share, and labor productivity by sub-periods (average annual growth, %, log growth rate): Japan





Source: Authors' calculations based on JIP 2015, JIP 2018, and CPI data.

3.2. Aggregate Economy, Korea

Decomposition analyses on the changes in the wage-productivity gap in Korea for the last twenty years are provided in this section. Using a detailed complementary data, we resort to the *decomposition method B* where we account for the aggregate economy broken down to exclude the effect of changes in the share of SE1 sector. The wage-productivity gap is then composed of the following components: terms of trade, labor share excluding SE1 (*labor share2*), share of national income determined by all sectors excluding SE1(NI_2/NI_0), share of workers in all sectors without SE1(L_2/L_0), and national income to GDP (NI_0/GDP) ratio.

We discuss the wage-labor productivity growth gap where we compare annual real wage with the annual real labor productivity (*labor productivity1*) calculated based on net value-added. Different from Japan's case, both variables are calculated on annual basis (not hourly) due to the limitation on the data availability. In Korea, the growth rates of real wage and those of real labor productivity have not been synchronous and the discrepancy between the two variables is observed over the last twenty years. There have been periods where real wage growth surpassed labor productivity growth, and in other periods, the reverse pattern was observed. In particular, as seen in Table 2, the real wage growth (134.2%) was higher than the real labor productivity growth (111.6%) for the pre-1995 period (1975 – 1995). However, on the contrary, the real wage growth (31.0%) was lower than the real labor productivity growth (53.8%) for the post-1995 period (1995 – 2017), as shown in Table 2.

In both sub-periods, the main reasons for the gap between the growth in real wage and labor productivity were the changes in 'the terms of trade'. However, there is a distinct difference for the two sub-period. In the first period (1975 – 1995), the growth in real wage was higher than that of labor productivity by 22.6%p. The main contributing factor was the increase in terms of trade by 25.1%. The remaining gap is explained by the increase in labor income share (10.8%) and the effect due to changes in the proportion of SEs in terms of value-added and of the workers (-13.3%).

In the second period (1995 – 2017), the growth in real wage was lower than that of labor productivity by 26.5%p. The main contributing factor was the fall in terms of trade by 15.5%. The remaining gap is explained by a mild fall in labor income share (-3.9%) and the effect due to changes in the proportion of SEs in terms of value-added and of the workers (-7.2%).

The real wage increased much more than labor productivity in the early period, whereas the labor share rose only slightly. In the latter period, real wage lagged much behind labor productivity growth, while the change in labor share was insignificant. Interestingly, in both cases, the terms of trade explain most of the gap. In the earlier period, the terms of trade contributed positively to the real wage growth, but it was the contrary in the latter period.

Table 2. Growth rates of real labor compensation, GDP deflator, labor income share, and labor productivity by sub-periods (average annual growth, %, log growth rate)

Panel A

	1975-80	1980-85	1985-90	1990-95	Total change, 1975-1995
Growth rate of real compensation (CPI)	8.3%	4.8%	6.9%	6.8%	**134.2%**
Growth rate of GDP deflator/CPI	2.4%	0.1%	1.1%	1.4%	**25.1%**
Growth rate of labor income share2	0.6%	-0.1%	1.1%	0.5%	**10.8%**
Growth rate of labor productivity2 (NI2)	5.2%	4.8%	4.7%	5.0%	**98.3%**
Change in ratio (NI2/NI0)	3.8%	0.9%	0.5%	1.0%	**31.0%**
Change in ratio (L0/L2)	-2.6%	-2.8%	-2.3%	-1.1%	**-44.3%**
Growth rate of labor productivity1 (NI0)	4.0%	6.7%	6.5%	5.1%	**111.6%**
Growth rate of capital depreciation rate	-0.4%	-0.4%	-0.4%	-0.4%	**-7.7%**
Growth rate of net indirect tax rate	-0.4%	0.2%	0.2%	0.0%	**-0.3%**
Growth rate of labor productivity0 (GDP)	5.0%	7.1%	6.2%	5.7%	**119.9%**

Panel B

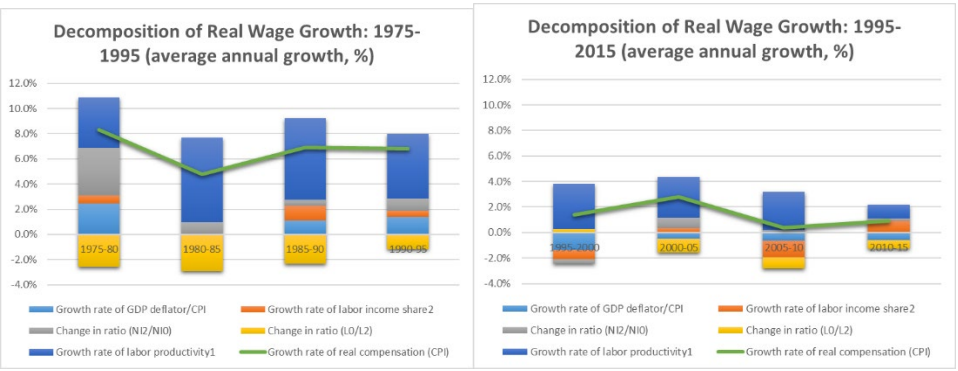
	1995-2000	2000-05	2005-10	2010-15	Total change, 1995-2015
Growth rate of real compensation (CPI)	1.4%	2.8%	0.4%	0.9%	**27.2%**
Growth rate of GDP deflator/CPI	-1.4%	-0.5%	-0.6%	-0.6%	**-15.5%**
Growth rate of labor income share2	-0.7%	0.3%	-1.3%	0.9%	**-3.9%**
Growth rate of labor productivity2 (NI2)	3.5%	2.9%	2.3%	0.6%	**46.7%**
Change in ratio (NI2/NI0)	-0.3%	0.8%	0.2%	0.2%	**4.2%**
Change in ratio (L0/L2)	0.3%	-1.1%	-0.8%	-0.7%	**-11.4%**
Growth rate of labor productivity1 (NI0)	3.5%	3.2%	3.0%	1.1%	**53.8%**
Growth rate of capital depreciation rate	-0.8%	0.0%	-0.1%	-0.3%	**-6.4%**
Growth rate of net indirect tax rate	-0.2%	0.1%	0.0%	0.1%	**0.3%**
Growth rate of labor productivity0 (GDP)	4.6%	3.1%	3.0%	1.2%	**59.9%**

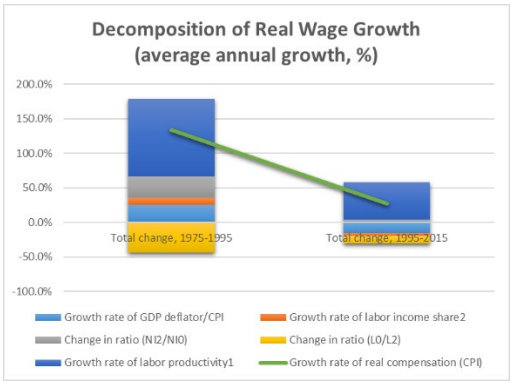
Source: Authors' calculation based on National Accounts, Bank of Korea.

Over time, labor productivity growth does not vary strongly but exhibit a moderate downward trend. For the earlier period, labor productivity shows a consistent growth over shorter sub-periods (1975 – 80, 1980 – 90, 1990 – 95). For this period, most of the variation in real wage growth across these sub-periods can be explained by the fluctuation of the 'changes in terms of trade'.

For the latter period, there was a significant slowdown of labor productivity. In addition, negative impact of 'changes in terms of trade' aggravated the dramatic fall in the real wage growth compared to the former period. The accumulated growth in real wage of the former period was 134.2%, whereas it was only 27.2% in the latter period.

Figure 6. Growth rates of real labor compensation, GDP deflator, labor income share, and labor productivity by sub-periods (average annual growth, %, log growth rate)





Source: Authors' calculation based on National Accounts, Bank of Korea.

4. Results of decomposition analyses by Industry-level

4.1. Industry-Level Analysis for Japan

This section provides analysis broken down to two sectors: manufacturing sector and non-manufacturing sector. As for the data set, JIP 2015 is used for 1970 – 1995 period and JIP 2018 is used for 1995 – 2015 period. To be consistent with the earlier analysis, we discuss the wage-labor productivity growth gap based on the comparison between real wage with the real labor productivity (*labor productivity1*) calculated based on net value-added.

Table 3. presents analysis for the aggregate economy, manufacturing, and non-manufacturing sectors for the 1970 – 1995 period. The real wage growth (71.8%) was lower than the labor productivity growth (124.4%) for the manufacturing. The main reason for the gap was again the strong decline in the terms of trade (-82.0%). Considering this factor, labor income share actually improved (29.3%). Decomposition analysis of manufacturing sector is somewhat similar to that of the whole economy. As for the non-manufacturing sector, the real wage (83.0%) grew at a faster pace than the labor productivity (68.3%). There was a slight fall in the terms of trade (-5.0%) which was more than compensated by the rise in the labor income share (19.7%). In conclusion, the growth in labor productivity was far stronger in the manufacturing sector than the non-manufacturing sector. However, on the contrary, the real wage growth was rather higher in the non-manufacturing sector than the manufacturing sector due the contrasting changes in the 'terms of trade' in the respective sector.

Table 3. presents analysis for the aggregate economy, manufacturing, and non-manufacturing sectors for the 1995 – 2015 period. The real wage growth was lower than the labor productivity growth for both manufacturing and non-manufacturing sector in the given period. The gap was greater for the manufacturing sector (40.4%point) than that of the non-manufacturing sector (19.6%point). The fall in the terms of trade explains the most of the gap for the manufacturing sector (-34.0%), but is a minor influence for the non-manufacturing sector (-9.4%). Furthermore, we observe that the fall in the labor income shares (-6.3%, -10.1%) are common for the both sectors. We also see that the productivity growth slowed down from the earlier period but is still significantly higher in the manufacturing than the non-manufacturing sector.

Table 3. Growth rates of real wage, deflators, labor income share, and labor productivity: manufacturing and non-manufacturing, Japan, 1970 – 1995, 1995 – 2015 (accumulative growth %)

	All Industry		Manufacturing		Non-Manufacturing	
	1970-95	1995-2015	1970-95	1995-2015	1970-95	1995-2015
Growth rate of real hourly compensation (CPI)	79.5%	2.6%	71.8%	11.9%	83.0%	-2.7%
Growth rate of GDP deflator/CPI	-19.5%	-14.2%	-82.0%	-34.0%	-5.0%	-9.4%
Growth rate of labor income share	17.4%	-6.1%	29.3%	-6.3%	19.7%	-10.1%
Growth rate of labor productivity1	81.7%	22.8%	124.4%	52.2%	68.3%	16.9%
Growth rate of capital depreciation rate	-5.1%	-2.1%	-2.3%	-8.7%	-9.3%	-2.0%

Growth rate of net indirect tax rate	-0.6%	-1.7%	-2.2%	-2.8%	-3.0%	-2.6%
Growth rate of labor productivity0	87.4%	26.6%	129.0%	63.7%	80.5%	21.5%
Contribution of labor quality improvements	17.6%	5.3%	14.8%	5.9%	20.9%	6.5%
Contribution of capital deepening	41.4%	12.1%	36.4%	22.1%	40.1%	12.1%
Contribution of TFP growth	28.5%	8.7%	77.7%	33.8%	19.5%	3.2%

Why did labor productivity decline in Japan? As seen Table 3, the main contributing factor of the decline in labor productivity (*labor productivity0*) was the slowdown of TFP growth for both manufacturing and non-manufacturing sectors. Weakening in both capital deepening and labor quality improvements also contributed to the declining trends for both sectors.

The high TFP growths contributing to labor productivity growth in the manufacturing sector failed to strengthen real hourly compensation growth as they were almost canceled out by the decline in the GDP deflator/CPI ratio. For the period of 1995 – 2015, the increases in labor productivity due to labor quality improvement outpaced the real hourly compensation growth in the nonmanufacturing sector and in the total economy. This implies that the real hourly compensation growth after controlling for labor quality improvements was negative for these sectors.

4.2. Industry-Level Analysis for Korea

As for the industry-level analysis for Korean economy, we will only consider corporate sector for the following reasons. According to Korea's National Accounts, aggregate economy is comprised of three types of business sectors: corporate sector, self-employed sector, and government sector. Given the total value-added of the aggregate economy, value-added share of the corporate sector is 67.9% while self-employed sector share is 21.2% and government sector share is 10.8% in 2016. National Account data nor KIP do not contain information about the distribution of self-employed across industries in detail. Without this information, it is not possible to adjust the labor share to reflect the changes in the self-employed sector at the industry-level. Thus, we have decided to provide decomposition analysis on corporate sectors for all industry, manufacturing, and non-manufacturing.

Data on corporate sector is available from *Financial Statement Analysis*, Bank of Korea. Given the population of firms who filed corporate tax, the *Financial Statement Analysis* data is derived from a sampling of firms up to the year 2008. Since 2009, the dataset is a complete aggregate of the total corporate firm population of the economy. Data for non-manufacturing is only available up to one-digit

industry level and we have only included industries with data available back to 1995. Value-added share of the excluded industries is minimal. Industry-level GDP deflators are obtained from Bank of Korea. We take value-added weighted averages of industry-level GDP deflators to derive all industry, manufacturing, and non-manufacturing GDP deflators.[1]

We discuss the wage-labor productivity growth gap where we compare real wage with the real labor productivity (*labor productivity2*) calculated based on net value-added and excluding SE sectors. The analysis is different from that of the aggregate Korean economy in that we have excluded SE sectors. Table 4. presents decomposition analyses on real wage growth and labor productivity growth for corporate sector in Korea for the period of 1995 – 2015. As for all industry corporate sector, real wage growth (39.3%) was lower than the labor productivity growth (61.8%). Most of the observed gap can be explained by the decline in the terms of trade (-26.4%). Considering this effect, we even see a slight gain in the labor share (3.9%). This pattern of decomposition resembles the analyses on the aggregate Korean economy for the same sample period in Panel B of Table 4.

The real wage growth was lower than the labor productivity growth for both manufacturing and non-manufacturing corporate sector in the given period. The gap was greater for the manufacturing sector than that of the non-manufacturing sector. There is a clear contrast for the two sectors. The gap in the manufacturing sector can be mostly explained by the fall in the terms of trade (-44.5%) with a moderate rise in the labor income share (10.3%). However, the gap in the non-manufacturing sector is due to both a slight fall in the terms of trade (-4.3%) and a slight decline in the labor income share (-5.0%). We also can see that the productivity and wage growth are significantly higher in the manufacturing than the non-manufacturing sector.

Table 4. Growth rates of real wage, deflators, labor income share, and labor productivity: manufacturing and non-manufacturing, Korea, 1995 – 2015 (accumulative growth %)

	All Industry	Manufacturing	Non-Manufacturing
Growth rate of real wage	**39.3%**	64.3%	22.5%
Growth rate of GDP deflator/CPI	**-26.4%**	-44.5%	-4.3%
Growth rate of labor income share	**3.9%**	10.3%	-5.0%
Growth rate of labor productivity2*	**61.8%**	98.5%	31.8%

[1] All industry, here, is defined as the sum of manufacturing and non-manufacturing industries considered in this analysis. This implies that some non-manufacturing sub-industries with lack of long time series are excluded.

Source: Authors' calculation based on *Financial Statement Analysis*, Bank of Korea. (all except SE1, SE2)

5. Why did GDP deflator to CPI ratio decline?

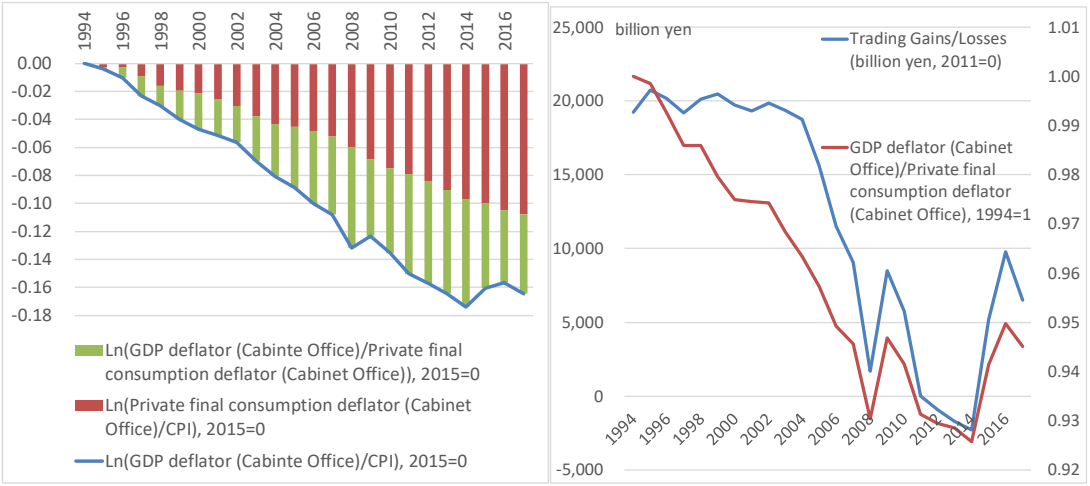
The decline of the ratio of GDP deflator to CPI can be decomposed into changes in the GDP deflator-PFCD ratio and the PFCD-CPI ratio. Both the CPI and PFCD are two primary measures of the consumer prices. But the construction method and scope of CPI and PFCD are different. We first compare the output deflator to consumption deflator within the framework of the National Accounts where the two deflators share same method. Thus, the ratio of CPI to PFCD shows the extent to which the methodological difference of the consumption deflators contributes to the gap between the GDP deflator and the CPI.

The consumer price index (CPI) that measures prices paid by urban consumers for a basket of consumer goods and services. The price index of private final consumption (PFC) that measures price paid for goods and services by the household sector in the National Income and Product Accounts. The two prices are correlated but move differently over time because of differences in method, weight, and scope. First, the CPI uses the fixed Laspeyres index while the FCE price index does the chain Laspeyres one. Second, the relative weights of item prices in the CPI is based on the household survey, which are different from the relative weights in FCE price index. For example, owners' equivalent rent is included in the FCE index, but not in the CPI. Third, the scope of the two prices is not the same. Finally, the seasonal adjustments are also different in the two prices. McCully et al. (2007) find that the US CPI grew 0.4 percentage point (pp) per year faster than the private consumption expenditure price index in 2000-2007.

5.1 Japan

Komaki and Yajima (2013) examine the difference between the CPI and the Household Domestic Consumption Deflator (HDCD, which is very close to the PFCD). In Japan, Komaki and Yajima (2013) find that the CPI grew 0.77 percentage point per year faster than the Household Domestic Consumption Deflator (HDCD, which is very close to the Private Final Consumption Deflator (PFCD) in 2002-2012.

Figure 7. Accumulative Price Index Gaps in Japan (%)



Source: Authors' calculations based on National Accounts (Cabinet Office) and CPI data.

This gap between CPI and HDCD in Japan is twice as high as that of Korea and US. About 55% of the gap is explained by the following four factors. First, differences in weights within consumer durable goods (CPI 5.5%, HDCD 9.5%), prices of which decline quickly. Second, differences in coverage of households (CPI weights did not include single households before 2018) single households tend to be younger and consume more ICT related goods and services. HDCD can be seen in the significant decline in prices of ICT related goods and services over CPI. Third, the difference of estimation method in the deflator for imputed rent. The deflator for imputed rent in the CPI always tends to be higher than HDCD. Fourth, difference in the range of the target items when constructing deflator. For example, financial services are included in the HDCD, but not CPI. Also, health care cost that are borne by government and firms are included in the HDCD.

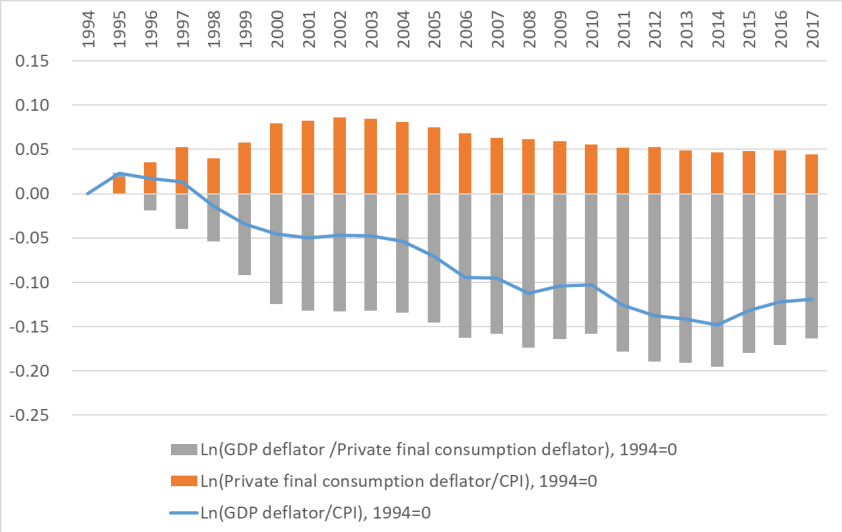
For the above four factors, the difference in the CPI and HDCD is not statistical illusion. The CPI seems to overestimate the increase in prices, so that we underestimate real wage increases when using the CPI as the deflator.

5.2 Korea

In Korea, the CPI grew approximately 0.3 percentage point per year faster than the PFC price index since 2000. The difference between the growth rates of the two consumption prices are also stable in the period. About half of this difference is explained by the different index method. The fixed weight

index typically overestimates the inflation rates because consumers substitute away from items with faster rises in prices toward items with slower rises or falls.

Figure 8. Accumulative Price Index Gaps in Korea (%)



Source: Authors' calculation based on National Accounts, Bank of Korea.

During the 1990s, however, the PFCD grew approximately 1.5 percentage point per year faster than the CPI. One of main underlying factor for this large difference is owners' equivalent rent. In the 1990s, the PFC housing price that includes owners' equivalent rent much faster than the CPI one. A large difference in the growth rates of food price between the two deflators also significantly contributes to the faster rise in PFCD, which might be attributable to different seasonal adjustments.

After 2000, the Statistics Korea adopted a new method to reduce seasonal volatility in the CPI (Bank of Korea, 2019), the food price gap in the two deflators significantly reduced. The inflation gap between the two prices due to the different index method is relatively stable and also has a similar magnitude before and after 2000 periods. Overall, the growth rates of two consumption deflators in Korea are quite similar since 2000 (except for the late 1990s). This confirms that the large difference between output and consumption deflators is not driven by the methodological difference in the deflator construction.

6. Concluding Remarks

In both Japan and Korea, the real wage stagnation is related to slowdown in labor productivity growth. Both at aggregate and at industry-level, there is a significant slowdown in labor productivity in the post-1995 period relatively to pre-1995 period.

We also observe gaps between real wage growth and labor productivity growth. In Japan, the real

wage growth was consistently lower than labor productivity growth mainly due to the decline in labor's terms of trade for all periods. One interesting finding is that the fall in the terms of trade was greater than the wage-productivity gap in the pre-1995 period which led to an increase in the labor share. On the other hand, that the fall in the terms of trade was less than the wage-productivity gap in the post-1995 period which led to a fall in the labor share

In Korea, labor's terms of trade were again the main reason behind the gap between the growths in labor productivity and real wages. The real wage growth was higher than labor productivity growth in the pre-1995 period mainly because the terms of trade increased by 25.1%. The resulting change in labor share was only 10.8%. On the other hand, the real wage growth stagnated in the post-1995 period primarily due to the fall in the terms of trade by 14.2%. Again, the labor share only changed a mere -3.9%. For both periods, the shrinking value-added shares of self-employed sector is additionally contributing to the widening gap.

The wage-labor productivity gaps at the industry level are also strongly influenced by the changes in the terms of trade in both Japan and Korea. The gap is large in the manufacturing sector due to a strong decline in the terms of trade, whereas the gap is small in the non-manufacturing sector due to a mild fall in the terms of trade.

The labor's terms of trade, the CPI to GDP deflator ratio, have fallen for both countries. There are two reasons. First, the genuine difference between the price of what is produced and the price of what is consumed. Second, CPI may be overstating the actual changes that the consumers face. Assuming PFCD has less bias in calculation, we find that this overstatement was large for Japan. As for Korea, we find a mild overstatement for the post-2000 period.

The findings in this study emphasize the need for paying attention to labor's terms of trade in understanding changes in real wages. In many cases, economists have focused only on labor productivity and labor shares to explain changes in real wages. The changes in labor's terms of trade have been neglected in most analyses and discussions. As globalization in production is advancing increasingly, the correlation between the CPI and GDP deflator will become weaker. In the future research, it would be beneficial to investigate the systematic changes in the terms of trade.

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