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Sectoral Labour Productivity Growth in Japan, Korea and Taiwan

Hidekatsu Asada

Graduate School of Humanities and Social Sciences, Saitama University

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Impacts of Sectoral Labour Productivity Growth in Japan, Korea and Taiwan

Hidekatsu Asada

Graduate School of Humanities and Social Sciences, Saitama University

Sakura-ku Shimo-Okubo 255, Saitama City, 338-8570, Japan

Email: asada@mail.saitama-u.ac.jp

Abstract

Employing the shift-share analysis of labour productivity, this paper examines the growth of sectoral labour productivity in Japan, Korea and Taiwan by decomposing the growth into the within effect, the shift effect and the cross effect. The analysis results indicate the slowdown of labour productivity growth across these economies, particularly in the 2000s. To ensure long-term economic growth, it is imperative for these economies to boost labour productivity. Policies are necessary to facilitate innovation that stimulates the within effect, as well as human capital development that enhances the shift effect of labour productivity.

Keywords: Labour productivity; Shift-share analysis; Manufacturing sector: Services sector

JEL Classification Numbers: E24, J24, O47

1. Introduction

Productivity growth is the key driver of improvements in real income and living standards in the long run. The view expressed by Krugman is widely accepted (Krugman 1997):

"Productivity isn't everything, but, in the long run, it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker."

Labour productivity growth in the long run is contingent upon factors such as innovation, physical capital investment, and human capital development. The proximate forces discussed in this context are influenced by external factors such as market structures, infrastructure, institutional framework, and institutional quality (World Bank 2021). In addition to these macroeconomic factors, the transformation of the industrial structure should be considered. In the process of economic development, factor reallocation from lower-productivity sectors to higher ones has played a key role in overall productivity growth. In the process of industrialisation, overall productivity growth has been driven by labour transitioning from the primary sector to the secondary and the tertiary sector. In the experience of East Asian economies, the reallocation of labour from agriculture to manufacturing and services has been identified as a prominent factor in rapid productivity growth (Helble et al. 2019).

The drivers of labour productivity growth change over time, considering the level of socioeconomic development. Many economies throughout the second half of the 20th century, such as those in Japan, Korea, and Taiwan, profited from the "population bonus," or growing proportion of the working-age population. However, as these economies continue to have a growing ageing population, they must deal with the adverse effects of a partial reversal of the earlier "population bonus," particularly the dropping savings ratio as well as labour inputs.

The trend of labour productivity growth in advanced economies is subdued, in particular, after the Global Financial Crisis in 2017-18 due to a slowdown in capital accumulation and human capital development. The decline of total factor productivity also weighed on the labour productivity growth, reflecting slow improvement of resource allocations across industrial sectors (Dabla-Norris et al. 2015, World Bank 2021). Continued industrial structure

transformation is required to boost labour productivity against this headwind by reallocating resources to higher value-added industries.

Against this backdrop, this discussion paper aims to investigate the influence of sector-specific gains in labour productivity on the overall labour productivity growth of advanced economies in East Asia comprised of Japan, the Republic of Korea (hereafter, Korea) and Taiwan. This will be accomplished through the shift-share analysis of labour productivity, which will be used to address the aforementioned research topics. The shift-share analysis dissects the overall growth in labour productivity by examining the growth of sectoral labour productivity within a specific sector and the impact of inter-sectoral labour reallocation. This analytical approach allows for a detailed understanding of the contributions made by sectoral labour productivity growth to the overall growth in labour productivity.

2. Methodology and data

Following the methodology employed in McMillan and Rodrik (2011), Molnar and Chalaux (2015), and Asada (2020), the shift-share analysis of sectoral labour productivity growth is conducted in the following way.

The labour productivity (*LP*) of the economy is calculated by the output (*Y*, real GDP is used here) and the number of workers (*L*) as follows. The suffix *i* represents each sector, and *t* represents the year.

$$LP_t = \frac{Y_t}{L_t} \tag{1}$$

Furthermore, the overall labour productivity of the economy is shown by the weighted average of the share of the number of workers in each sector in the total number of workers as follows.

$$LP_t = \sum_i LP_{it} \frac{L_{it}}{L_t} \tag{2}$$

Decomposition of sectoral labour productivity growth (ΔLP_{it}) is given by:

$$\Delta LP_{it} = \sum_i \Delta LP_{it} \frac{L_{i\,t-1}}{L_{t-1}} + \sum_i LP_{i\,t-1}\, \Delta \left(\frac{L_{it}}{L_t}\right) + \sum_i \Delta\, LP_{it} \Delta \left(\frac{L_{it}}{L_t}\right) \tag{3}$$

The three effects that are described in this shift-share analysis are as follows.

The initial term is referred to as the within effect, which signifies the impact of labour productivity growth within each sector on the overall labour productivity growth. This assumption is made on the condition that the number of workers in each sector remains constant. For instance, capital accumulation and technological advancements could yield labour productivity growth. Skills development is an additional factor contributing to this phenomenon.

The second term refers to the shift effect, which denotes the influence of sectoral labour reallocation on the overall labour productivity growth under the assumption that labour productivity remains constant within each sector. This phenomenon exhibits a positive outcome when there is a redistribution of labour from sectors with low labour productivity to sectors with high labour productivity.

The third term is referred to as the cross effect, which is the residual (or interaction) component of the within effect and the shift effect.

Regarding data for the analysis, the APO Productivity Database 2022 Version 1, produced by the Asian Productivity Organization (APO), is used (APO, 2022). This database provides consistent and detailed annual data on sectoral output and employment in East Asian countries from the 1980s to 2019. While data for 2020 are available, they are excluded due to potential bias caused by the economic impact of COVID-19.

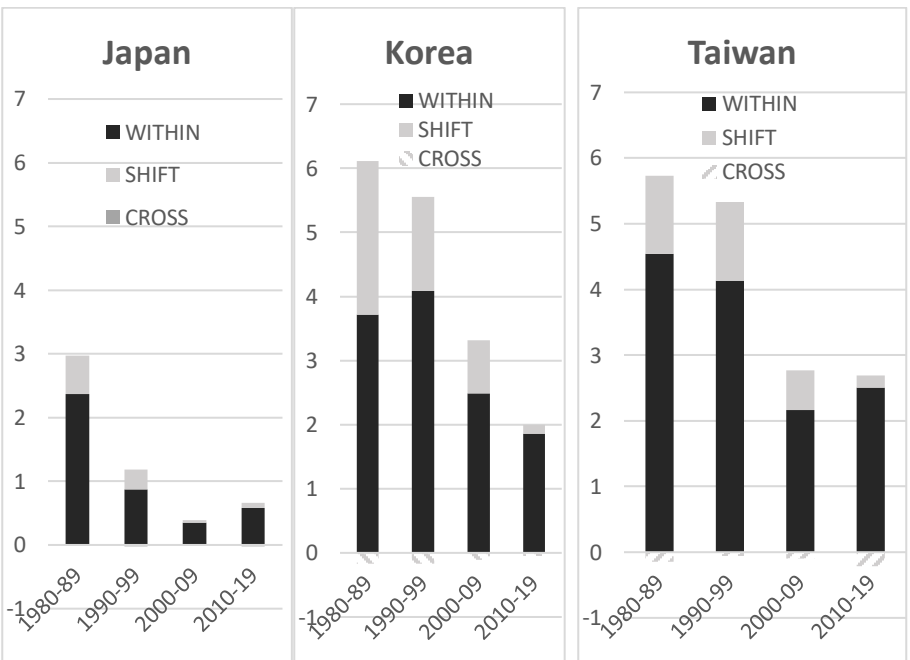
The following nine sectors are used for sector classification: (1) Agriculture, hunting, forestry, and fishing; (2) Mining and quarrying; (3) Manufacturing; (4) Electricity, gas, and water supply; (5) Construction; (6) Wholesale and retail trade, repair of vehicles and household goods, hotels and restaurants; (7) Transport, storage and communications; (8) Financial intermediation, real estate, renting and business activities; and (9) Community, social and personal services.

4. Results and discussion

Figure 1 displays the overall trend of labour productivity in Japan, Korea and Taiwan in the last four decades, respectively (see Appendix for detailed results). The labour productivity growth largely declined in the last four decades among these three economies. In particular, the decline accelerated after the 2000s, which is in line with the observation of the trend across the advanced economies.

Figure 1 Shift-share analysis of labour productivity

Average yearly growth, %



Source: Author's calculations.

The results of the sectoral contributions of the aggregated labour productivity growth of the latest decade over 2010-2019 is dsiplayed in Figure 2.

Figure 2 Sectoral contributions of the aggregated labour productivity growth

2010-2019, %

Note: Services sector is comprised of Wholesale and retail trade, repair of vehicles and household goods, hotels and restaurants; Transport, storage and communications; Financial intermediation, real estate, renting and business activities; and Community, social and personal services. Other sectors is comprised of Agriculture, hunting, forestry and fishing; Mining and quarrying; Electricity, gas and water supply; and Construction

Source: Author's calculations

Implying the role of the manufacturing sector as an engine of growth, the within effect gains of the manufacturing sector accounted for a substantial part of the aggregated labour productivity growth of each economy. The ratio of contributions was 62.5% for Japan, 34.1% for Korea: 57.9% for Taiwan.

The results of an additional shift-share analysis of the manufacturing sector of these economies are presented in Table 1.

Table 1 Key contributors of the within effect of the manufacturing sector

2010-2019

Japan	Electric machinery (30.4%)	Basic metals (23.3%)	Other machinery and equipment (11.7%)
Korea	Refined petroleum products, chemicals, plastics, etc. (31.1%)	Medical, precision and optical instruments (21.0%)	Electric machinery (18.8%)
Taiwan	Electric machinery (68.9%)	Other machinery and equipment (11.4%)	Basic metals (5.3%)

Notable observations in the services sector include:

1) The within effect of the wholesale and retails, repair of vehicles and household goods, hotels and restaurants sector was also large, while the shift effect was negative (Table 2). Growth of the within effect could benefitted from innovations in information and communication technology (ICT) such as retail, inventories and supply chain management (Dabla-Norris et al. 2015).

Table 2 Shift-share analysis of the wholesale and retails, repair of vehicles and household goods, hotels and restaurants sector

Average yearly growth, %

	Within	Shift	Cross	Overall
Japan	0.15	-0.19	0.00	-0.04
Korea	0.28	-0.07	-0.01	0.21
Taiwan	0.76	-0.37	-0.01	0.38

3) The within effect and the shift effect of the financial intermediation, real estate, renting and business activities were high and positive in Korea and Taiwan. Contrary to this, Japan's growth in this sector was subdued (Table 3).

Table 3 Shift-share analysis of the financial intermediation, real estate, renting and business activities

Average yearly growth, %

	Within	Shift	Cross	Overall
Japan	0.10	0.01	-0.01	0.11
Korea	0.35	0.19	-0.01	0.54
Taiwan	0.32	0.06	-0.01	0.37

4) The shift effect of the community, social and personal services was high, particularly in Japan, which accounted for 59.3% of the aggregated labour productivity growth. Growth was also relatively high in Korea and Taiwan (Table 4). The growth of the shift effect could reflect labour reallocation to the elderly care sector, which is in line with the acceleration of ageing in these economies.

Table 4 Shift-share analysis of the community, social and personal services

Average yearly growth, %

	Within	Shift	Cross	Overall
Japan	-0.22	0.38	0.00	0.16
Korea	0.21	0.16	0.00	0.37
Taiwan	-0.06	0.17	-0.02	0.08

5. Conclusion

This study observed the following through the use of shift-share analysis to examine the growth of sectoral labour productivity in Japan, Korea and Taiwan:

1) The labour productivity growth largely declined in the past four decades among these three economies. In particular, the decline accelerated after the 2000s, aligning with the observed trend across advanced economies.

2) In the latest decade, over 2010-2019, the contribution of the manufacturing sector, in particular, its within effect was a key driver of the aggregated labour productivity growth of each economy. This role could be attributed to the comparative advantage exhibited by the high-tech sector, particularly the electric machinery industry in these economies.

3) In the services sector, key observations include:

- The within effect of the wholesale and retails, repair of vehicles and household goods, hotels and restaurants sector exhibited substantial impact, presumably benefiting from ICT innovation.
- The within effect and the shift effect of the financial intermediation, real estate, renting and business activities were high and positive in Korea and Taiwan. Contrary to this, Japan's growth in this sector was subdued, and
- The shift effect of the community, social and personal services was high, particularly in Japan, and relatively high in Korea and Taiwan.

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Appendix

Sectoral impact on labour productivity: Japan

2010-2019

	Within	Shift	Cross	Overall
Agriculture, hunting, forestry and fishing	-0.01	-0.03	0.00	-0.04
Mining and quarrying	0.00	0.00	0.00	0.00
Manufacturing	0.40	-0.01	-0.01	0.38
Electricity, gas and water supply	0.01	-0.01	0.00	-0.01
Construction	0.11	-0.07	0.00	0.04
Wholesale and retail trade, repair of vehicles and household goods, hotels and restaurants	0.15	-0.19	0.00	-0.04
Transport, storage and communications	0.04	0.00	0.00	0.04
Financial intermediation, real estate, renting and business activities	0.10	0.01	-0.01	0.11
Community, social and personal services	-0.22	0.38	0.00	0.16
Total labour productivity growth	**0.58**	**0.07**	**-0.02**	**0.64**

Sectoral impact on labour productivity: Korea

2010-2019

	Within	Shift	Cross	Overall
Agriculture, hunting, forestry and fishing	0.06	-0.07	0.00	-0.02
Mining and quarrying	0.00	-0.01	0.00	-0.01
Manufacturing	0.67	0.00	0.00	0.67
Electricity, gas and water supply	0.15	-0.11	-0.02	0.01
Construction	-0.02	0.01	0.00	-0.01
Wholesale and retail trade, repair of vehicles and household goods, hotels and restaurants	0.28	-0.07	-0.01	0.21
Transport, storage and communications	0.17	0.04	0.00	0.20
Financial intermediation, real estate, renting and business activities	0.35	0.19	-0.01	0.54
Community, social and personal services	0.21	0.16	0.00	0.37
Total labour productivity growth	**1.86**	**0.14**	**-0.04**	**1.96**

Sectoral impact on labour productivity: Taiwan

2010-2019

	Within	Shift	Cross	Overall
Agriculture, hunting, forestry and fishing	0.00	-0.02	-0.01	-0.03
Mining and quarrying	0.00	0.00	0.00	0.00
Manufacturing	1.50	-0.06	0.00	1.44
Electricity, gas and water supply	0.02	0.00	0.00	0.02
Construction	0.02	0.01	0.00	0.02
Wholesale and retail trade, repair of vehicles and household goods, hotels and restaurants	0.76	-0.37	-0.01	0.38
Transport, storage and communications	-0.06	0.40	-0.04	0.30
Financial intermediation, real estate, renting and business activities	0.32	0.06	-0.01	0.37
Community, social and personal services	-0.06	0.17	-0.02	0.08
Total labour productivity growth	**2.50**	**0.19**	**-0.10**	**2.59**