

**Driving South Korea's Economic Growth:
Service Sector Productivity and Its Determinants**

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Dissertation

submitted to

the School of Politics and International Studies, University of Leeds

For the Degree of

MA Global Development

2025

Abstract

This dissertation explores the potential of South Korea's service sector as a key driver in addressing its slowing economic growth. Using a panel dataset from 38 OECD countries over 20 years, the study examines the relationship between sector-specific labour productivity and GDP per capita. Findings indicate a 1% increase in service sector productivity corresponds to a 0.77% rise in GDP per capita—more than twice the effect observed in the industry sector. Building on existing literature, this study provides new empirical evidence by introducing a Korea-specific dummy variable and incorporating previously underexplored determinants like R&D investment, government education expenditure, and government effectiveness. Furthermore, subsample analysis by OECD income group shows these determinants have stronger effects in relatively lower-income countries, including South Korea. The results call for a strategic policy framework that rebalances R&D investment towards the service sector, improves education expenditure efficiency, and enhances government effectiveness to promote sustained economic growth.

Acknowledgements

I would like to express my gratitude to my supervisor, Dr Winnifred Bedigen (University of Leeds), for her invaluable guidance and support throughout this dissertation.

I am also grateful to Dr Chungeun Yoon (KDI School of Public Policy and Management) for his insightful advice on the development of the empirical model.

I would also like to thank Dr Adam Tyson (University of Leeds) for his valuable and constructive comments on the final draft.

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Abbreviations and acronyms

TFP: Total Factor Productivity

OECD: Organisation for Economic Co-operation and Development

BGP: Balanced Growth Path

OLS: Ordinary Least Squares

GNI: Gross National Income

GDP: Gross Domestic Product

R&D: Research and Development

FDI: Foreign Direct Investment

UMLH: Upper-Middle and Lower-High income

UH: Upper-High income

1. Introduction

1.1. Research background and rationale

Recently, low economic growth has been a growing concern in South Korea (Kim et al., 2022; Cho, 2023). Although South Korea achieved remarkable economic growth from 1970 to 1990 as one of Asia's four tigers (The Economist, 2019), it has recently been experiencing a decline in economic dynamism. The country's average Gross Domestic Product (GDP) growth rate has decreased from 7.2% in the 1990s to 2.9% in the 2010s, and during the same period, its potential growth rate has also dropped from 7.4% to 3.1% (Kim et al., 2022; OECD, 2024). Furthermore, Kim et al. (2022) predicted a significant decline in South Korea's long-term economic growth rate to around 0.5% in the 2050s, mainly due to an ageing population and the resulting labour force decline. This situation is further aggravated by an exceptionally low fertility rate, which fell below 1.0 in 2018 and dropped to 0.7 in 2023, whereas most OECD countries recorded fertility rates between 1.2 and 1.9 in 2023 (World Bank, 2025). This unprecedented demographic shift suggests that South Korea's growth challenges may be more severe than those of other economies. Such a significant downturn raises critical concerns about the nation's long-term economic stability and highlights the urgent need to identify sustained growth drivers.

Given the severity of South Korea's low economic growth, the service sector is particularly important for addressing this challenge. Often referred to

as the tertiary sector, it is distinct from the primary sector (e.g., agriculture, fishing, and forestry) and the secondary sector (e.g., manufacturing, construction, and mining). Unlike the other sectors, the service sector provides services rather than tangible goods, including activities such as banking, healthcare, retail, social work, education, IT services, and media (Singh, 2018). Structure-change theory suggests that as economies develop, they transition from agriculture-based structures to manufacturing and, ultimately, to service-based economies (Todaro and Smith, 2020). In line with this theory, Francois and Bernard (2010) argue that “the importance of services as a share of employment and production increases with growth and development” (p. 642). Moreover, the service sector has a significant impact on the performance of manufacturing firms because services are integrated into the manufacturing production process as intermediate inputs (Owusu et al., 2020).

Despite the significant role of the service sector, accounting for 60% of added value and 70% of employment in South Korea’s economy (OECD, 2023a, 2023b), its labour productivity, added value, and employment proportion lag behind, not only in comparison to advanced economies but also relative to the manufacturing sector. For instance, labour productivity in South Korea’s service industry was \$65,700 in 2021, ranking 27th among 35 comparable OECD countries and remaining at only 47.5% of the productivity level in the domestic manufacturing sector (Korea Productivity Centre, 2023). Park and Shin (2013b) also highlight that labour productivity in South Korea’s service sector is notably low relative to the manufacturing sector in a global

comparison, considering the country's income level and stage of development.

This underperformance in South Korea's service sector suggests significant growth potential. Accordingly, the South Korean government has implemented several initiatives, including 'The New Growth Strategy 4.0', 'Strategies for the Digitalisation of the Service Sector', and 'Strategies for Revitalising Service Exports' (see Policy Coordination Bureau, 2002, 2023a, 2023b for detailed information about these measures). In particular, my experience working at the Service Industry Policy Division of the Ministry of Economy and Finance from 2020 to 2021 helped shape the motivation for this research. Engagement in the formulation of the 'Service Industry Advancement Strategy' (2021) offered first-hand insight into both the limited role the service sector had played in supporting South Korea's economic growth and its potential as a future engine of growth.

Previous studies have emphasised the importance of enhancing productivity to achieve sustained economic growth. In a classic and highly cited study, Solow (1957), through an empirical analysis of the United States, demonstrated that economic growth cannot be attributed to capital accumulation alone and that technical change—interpreted broadly as productivity improvements—was the principal contributor to long-term growth. Similarly, other studies have highlighted the significant role of productivity improvements in driving economic development, citing the growth experiences of South Korea, Taiwan, Singapore, and Hong Kong (Christensen and Cummings, 1981; Dollar and Sokoloff, 1990; Moon, 1991). Following this

perspective, more recent studies in South Korea have emphasised the need to enhance productivity as a major engine of future growth, especially in the face of population ageing and declining capital accumulation (e.g., Kim et al., 2022; Jeong, 2022; Cho, 2023).

Building on the emphasis on productivity, recent literature has increasingly explored how the service sector and its productivity improvements contribute to economic growth (e.g., Eichengreen and Gupta, 2013; Park and Shin, 2013a; Lee and McKibbin, 2013; Wu, 2015; Hada and Suri, 2019). This marks a significant shift from the classical economic perspective, in which services were regarded as unproductive, as cited in Eltis and Murfin (1990), to the modern view that recognises services as value-creating economic activities (Lovelock and Wright, 1999). In particular, Eichengreen and Gupta (2013) found that the share of high-value-added services—such as finance, health, and legal services—increases as economies advance, and that these services hold significant potential as engines of growth. Furthermore, other studies have also adopted a sub-sectoral approach to identify which service industries drive growth most effectively (e.g., Azebi and Tamuno, 2023; James and Ibrahim, 2023).

However, as the existing literature suggests, few studies have conducted thorough empirical and comparative analyses to explore the potential of South Korea's service sector as a key driver of economic growth, particularly by identifying the determinants of productivity and its effect on GDP per capita (but see Park and Shin, 2013a; Lee and McKibbin, 2013; Pyo and Rhee,

2018). Pyo and Rhee (2018), for instance, employ industry- and firm-level data to show the positive role of Research and Development (R&D) in service productivity, but their analysis does not extend to a broader range of determinants nor to cross-country comparative evidence. By contrast, Park and Shin (2013a) and Lee and McKibbin (2013) conduct macro-level empirical analyses of service sector determinants and their contribution to GDP growth across Asian economies. Yet, they do not fully address critical factors such as R&D investment and government capacity, nor do they explicitly capture Korea-specific effects in their models. This leaves a significant gap in understanding how strengthening the service sector could help address South Korea's sluggish economic growth—especially in the context of its extreme imbalance between manufacturing and services and its unprecedented demographic pressures—and which specific factors are most influential in enhancing productivity within the sector.

1.2. Research Framework

Study aim

This study seeks to critically examine the underutilised potential of South Korea's service sector amid the country's declining productivity and slowing growth momentum. It aims to propose targeted, evidence-based strategies to unlock this potential by enhancing service sector productivity. By empirically identifying the key drivers of service sector productivity in the Korean context,

this study contributes to broader discussions on how to operationalise a balanced growth strategy to achieve sustained economic growth and diversification.

Research question

How can productivity in South Korea's service sector be enhanced to stimulate long-term economic growth and address the country's sluggish economic performance?

Objectives

- To assess the economic significance of service sector productivity by examining its relationship with economic growth.
- To identify and analyse the key determinants of service sector productivity.
- To propose policy recommendations aimed at boosting service sector productivity as a strategy for promoting sustained economic growth.

The reason productivity was chosen as a key analytical variable is based on growth theory. According to Solow's growth model (Solow, 1957; Campante et al., 2021), the accumulation of labour and capital factors cannot sustain growth in the long term; instead, productivity growth is crucial for sustained economic growth.

Building on this theoretical foundation, this study argues that a targeted strategic framework aimed at boosting service sector productivity is essential for revitalising South Korea's long-term economic growth in the face of the

current low-growth challenge. To support this argument, it conducts an empirical analysis of 38 OECD countries, using over 20 years of panel data from the World Bank's World Development Indicators, with a particular focus on the Korean context and differences between income groups. By evaluating the significance and determinants of service sector productivity through regression analysis, the research addresses gaps in existing studies and provides policy-relevant insights for South Korea and other economies facing similar challenges.

1.3. Structure of the dissertation

The rest of this dissertation is structured as follows: Section 2 presents the theoretical framework for this research, drawing on Solow's growth model and the endogenous growth theory. This is followed by a comprehensive literature review on the importance of boosting productivity and the concepts and significance of the service sector. Section 3 presents the data and research methodology, employing Ordinary Least Squares (OLS) regressions to analyse the relationship between labour productivity and GDP per capita, and to examine the determinants of labour productivity. Section 4 analyses the results, including baseline estimates and additional robustness checks. Section 5 concludes with a summary of the research, policy implications, and recommendations.

2. Literature Review

2.1. Theoretical framework

This study employs the Solow model as the theoretical framework. The neoclassical growth theory, such as the Solow model, serves as a useful framework for highlighting the significance of productivity improvements to sustain economic growth (see Solow, 1957; Campante et al., 2021, for the concepts and frameworks related to growth theory). In the Solow model, the growth rate of k (\dot{k}/k) is given by,

$$\dot{k}/k = s \cdot \frac{f(k)}{k} - (n + \delta)$$

where k is the capital per worker, \dot{k} is the change in capital per worker over time, $f(k)$ is a production function with diminishing returns, s is the saving rate, n is the population growth rate, δ is the depreciation rate of capital.

In the Solow model, \dot{k}/k can show short-term growth in the transition to the Balanced Growth Path (BGP) when $s \cdot f(k)/k$ is greater than $(n + \delta)$. However, in the long term, the Solow model does not show growth in per capita income.

This is because, on the BGP, $\dot{k} = 0$, which implies $\dot{y}/y = 0$.

$$\dot{y}/y = \alpha \cdot \dot{k}/k = 0 \quad (\text{on the BGP})$$

With exogenous technological progress in the Solow model—i.e., a positive technology growth rate ($\dot{A}/A > 0$)—per capita income can grow in the long run.

$$\dot{y}/y = \dot{A}/A + \alpha \cdot \dot{k}/k$$

On the BGP,

$$\dot{y}/y = \dot{A}/A$$

Extending the Solow model, endogenous growth theories explain the sources of technological progress. These models—such as Romer (1990) and Lucas (1988)—highlight that innovation through R&D investment or human capital accumulation through education are internal drivers of long-term economic growth. Unlike the exogenous framework of the Solow model, these approaches clarify the role that policy can play in promoting long-run growth.

Viewed collectively, both theoretical frameworks suggest that sustained growth ultimately depends on productivity improvements, particularly through technological advancement. As such, they provide a useful lens for analysing South Korea's recent growth slowdown due to declining productivity and for exploring strategies to address this issue—particularly through enhancing productivity in the service sector.

2.2. Conceptualising services

Before analysing how service sector productivity contributes to South Korea's long-term economic growth, it is important to clarify what 'services' mean in this context, and to explain why this definition matters for understanding productivity and its determinants. The service sector encompasses a broad range of activities that differ from agriculture and manufacturing, making its boundaries less clearly defined (Noland, Park and

Estrada, 2013). Clarifying its conceptual scope is therefore essential for evaluating service sector productivity and for understanding its role in driving economic growth.

Early definitions, such as that by the American Marketing Association (1960), viewed services narrowly as activities offered for sale or provided in relation to goods (Šajbidor, 2023). Regan (1963) expanded this by emphasising their intangible nature and extending the scope to include not only services offered in connection with commodities (e.g., delivery, credit), but also those that directly generate satisfaction (e.g., insurance, housing, transportation). Stanton (1975) further broadened the concept by highlighting the separability and identifiability of services, as well as their independence from physical products and relevance to both consumers and industrial users. Later, Lovelock and Wright (1999) added that services are economic activities that generate value by producing desired change for consumers at specific times and locations.

These evolving definitions reflect not only a deeper conceptual understanding of services but also a growing recognition of their role as independent, identifiable, and value-generating activities. Rather than being viewed merely as auxiliary to goods, services are increasingly acknowledged—as noted by Park and Shin (2013a)—as key contributors to employment and productivity growth. This evolving perspective is particularly relevant in economies like South Korea's, where the service sector constitutes a large share of employment and GDP, yet has received relatively less

attention as a driver of growth. As Park and Shin (2013b) note, this is partly due to a persistent perception that services are less productive and lag behind manufacturing. However, with South Korea facing a period of low economic growth, revisiting the role of the service sector is essential. Clarifying what constitutes a ‘service’ and how its economic value and productivity can be enhanced is therefore critical for revitalising the country’s long-term growth prospects.

2.3. Boosting productivity and fostering the service sector for growth

To understand how South Korea can revitalise its long-term economic growth, this study focuses on two interconnected themes: boosting productivity and fostering the service sector as a key engine of growth—both of which are closely tied to the country’s economic performance. These themes were chosen in light of South Korea’s slowing economic growth and consistently low service sector productivity. Drawing from Solow’s (1957) growth model, which underscores the central role of productivity improvements in sustaining growth beyond input accumulation, this section explores how trends in productivity and service sector development have been empirically examined in relation to economic performance. The following literature review draws on both historical and contemporary studies to explain why enhancing productivity—particularly in high-potential service sectors—is critical to South Korea’s future economic development.

2.3.1. Boosting productivity for sustained growth

Productivity growth is widely recognised as a major contributor to long-term economic performance. Several studies have underscored its significance in driving the rapid economic growth of the four Asian tigers—South Korea, Singapore, Taiwan, and Hong Kong—between the 1960s and 1990s (Christensen and Cummings, 1981; Dollar and Sokoloff, 1990; Moon, 1991). Collectively, these studies highlight the central role of total factor productivity (TFP) growth as a principal engine of South Korea’s economic expansion beyond mere factor accumulation. However, Young (1995), based on the growth accounting presented in Appendix A, offered a contrasting perspective, arguing that growth during this period was largely input-driven, with South Korea’s TFP contributing only 16.5% to growth compared to labour’s 43.7%. However, he also noted that input-driven growth—dependent on one-time increases in labour and capital—may prove unsustainable in the long term. As mentioned in Solow’s (1957) model, factor accumulation is subject to diminishing returns, making productivity improvement essential for long-term growth. In particular, in the case of South Korea, given the severe challenges posed by declining birth rates and a rapidly ageing population (Kim et al., 2022; Jeong, 2022), economic growth based on labour accumulation, as in the past, is no longer a viable strategy. Enhancing productivity is therefore imperative to ensure long-term growth.

Building on this, Jeong (2022) extended the analysis beyond Young’s

period and noted that the decline in South Korea's TFP since the mid-1990s has been a major cause of the country's slowing economy. Kim and Choi (2017) also linked South Korea's declining economic growth to weak TFP growth in the 2010s. These studies point to the need to improve productivity through regulatory reform, narrowing the gap between small and large companies as well as between the service and manufacturing sectors (Jones and Lee, 2016; Jeong, 2022), and undertaking corporate restructuring (Kim and Choi, 2017).

Finally, long-term growth projections through 2050 underscore the importance of productivity improvements. Studies such as Kim et al. (2022) and Cho (2023) demonstrate that South Korea's future GDP growth will depend on TFP performance, with higher GDP growth rates projected under scenarios of stronger TFP growth. These studies argue that enhancing productivity—through a shift towards high-value-added industries and the development of human capital—is essential for sustaining long-term growth.

2.3.2. Fostering the service sector as a driver of growth

The second key theme centres on the rising significance of the service sector in driving economic growth. Classical economists such as Adam Smith and Thomas Malthus considered only physical commodity production to be productive since investable surplus could be generated solely through the production of goods. In contrast, they viewed the service sector as a non-productive domain that merely consumed resources (Eltis and Murfin, 1990).

However, as economies have become more developed and the service sector has expanded, the service sector's role has been redefined. As reflected in the modern definition of the service sector, it is no longer viewed as a resource-consuming, non-productive area, but rather as a sphere of economic activity that creates value (Lovelock and Wright, 1999) and operates in marketable domains (Stanton, 1975).

Empirical research confirms this shift. In developed countries, where the transition to a service-based structure occurred earlier, the growth potential of the service sector was recognised long ago. For instance, Menchik (1980) highlighted the rapid expansion of the service sector in the U.S. during the 1970s, with particular emphasis on its growing role in the economy. Swan (1985), focusing on Western Canada, argued that an increase in service sector productivity could accelerate overall economic growth. Eltis and Murfin (1990), in their analysis of the UK economy during the 1970s and 1980s, found that employment in the service sector increased and that the country's industrial structure was shifting towards services.

This trend has extended to emerging economies as well. Park and Shin (2013a), in their study of 12 Asian countries including South Korea, reported that the proportion of services in both GDP and employment has been increasing, alongside notable gains in productivity, making the sector one of the key engines of growth in the region. Other studies focusing on Asia include Anwar and Sam (2008), Eichengreen and Gupta (2011), Lee and McKibbin (2013), Baek and Joo (2014), Wu (2015), Hada and Suri (2019), and Sadiq et

al. (2023). In Africa, Azebi and Tamuno (2023) observed that the service sector has emerged as the main source of national output in Nigeria, with long-run positive effects on economic growth. In particular, sub-sectors such as financial services, entertainment, and real estate have been identified as key contributors to growth. Additional research on Africa includes Cinyabuguma et al. (2017), Adetokunbo and Edioye (2020), Ishola and Olusoji (2020), and James and Ibrahim (2023).

Importantly, not all services contribute equally. Eichengreen and Gupta (2013) classify service industries into traditional (e.g. retail, transport, public administration), mixed (e.g. education, health, social work), which exhibit features of both traditional and modern services, and modern (e.g. finance, ICT, communication). They argue that economic advancement is accompanied by a shift towards modern services, which generate higher value added and exhibit greater productivity growth. For South Korea, this implies that future growth depends not only on expanding the service sector but also on shifting it towards high-productivity sub-sectors.

Taken together, these two themes are closely aligned with Solow's growth model (1957), which argues that long-term economic growth cannot be sustained through factor accumulation alone due to diminishing returns. Instead, productivity improvements play a pivotal role. In this context, enhancing productivity across sectors—particularly in high-potential areas such as the service industry—is essential for sustained growth. This is especially relevant for countries like South Korea, where service sector

productivity remains relatively low compared to other advanced economies (Korea Productivity Centre, 2023), and demographic and structural challenges persist.

2.4. Research gaps and study contribution

Existing studies have underscored the critical role of productivity growth for long-term economic performance—often based on growth theories—and, through evolving definitions, have increasingly examined the service sector’s role as a key driver of growth (Eichengreen and Gupta, 2011; Noland, Park and Estrada, 2013; Wu, 2015; Hada and Suri, 2019; Ishola and Olusoji, 2020; Kim et al., 2022; Cho, 2023; James and Ibrahim 2023). However, few studies have thoroughly explored the potential of South Korea’s service sector as a driver of growth, particularly through empirical and comparative analyses of the determinants of productivity and its impact on GDP per capita. While studies such as Park and Shin (2013a) and Lee and McKibbin (2013) have employed econometric and comparative approaches—analysing the relationship between productivity and GDP growth and identifying factors affecting productivity in the service sector across Asian countries—their models lack methodological features that directly capture implications for South Korea. For instance, when analysing productivity and GDP per capita, their OLS-based regressions do not include a Korea dummy variable to isolate effects specific to South Korea relative to other countries. Additionally, their analysis of productivity determinants does not include key factors such as

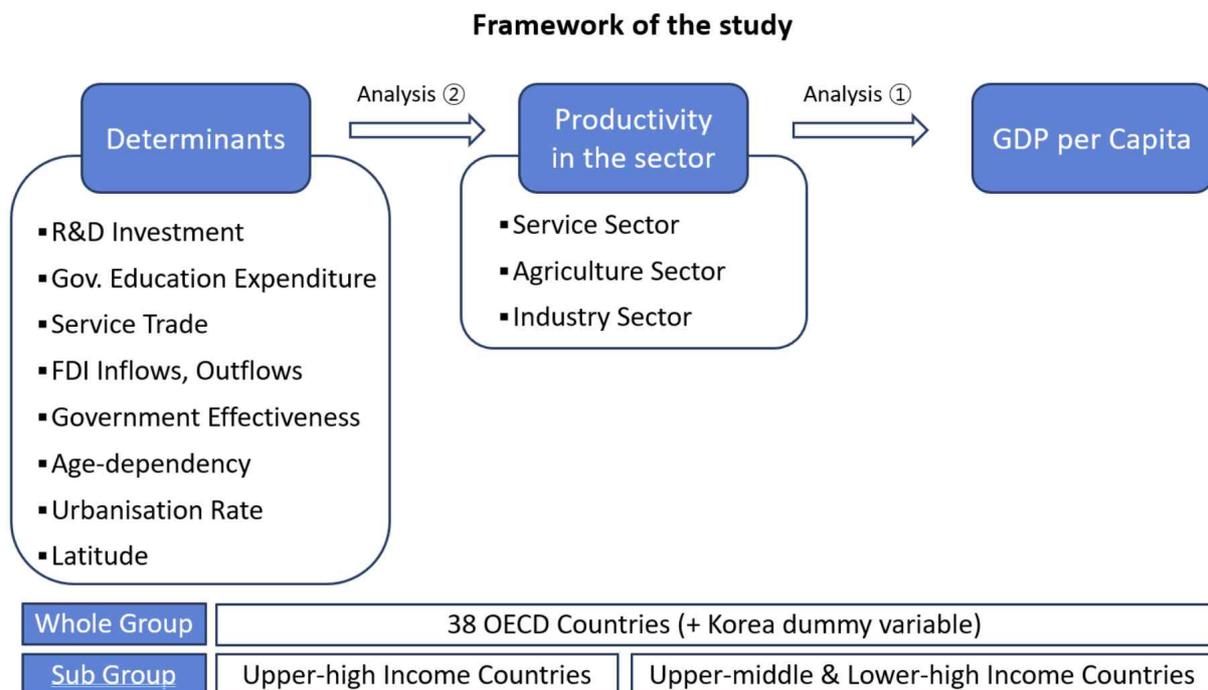
R&D investment and public sector capacity.

Building on the framework of Park and Shin (2013a), this study addresses this gap by empirically identifying the key drivers of service sector productivity and assessing their impact on economic growth. It employs an econometric model that introduces a Korea-specific dummy variable and includes key determinants like R&D investment, government education expenditure, and government effectiveness. The findings will provide policy-relevant insights on which factors are most influential and what policies should be implemented to drive long-term economic growth for Korea.

Second, this study incorporates the primary and secondary sectors (hereafter referred to as the agriculture sector and the industry sector, respectively) alongside the service sector when analysing the relationship between productivity and GDP per capita, as well as the determinants of productivity. Unlike previous studies, this approach enables the evaluation of the relative contribution of service sector productivity to GDP growth compared with that of other sectors. It also enables a sector-specific comparison of how different factors affect productivity. Such an approach can offer insights into how productivity growth across sectors may interact and complement one another in driving economic performance.

Third, instead of focusing solely on Asian countries, this study includes OECD countries in the analysis and, as a robustness check, divides them into sub-groups based on income levels. This is because the effect of service sector productivity on GDP growth, as well as the effects of various factors on

productivity, may differ by level of economic development. By analysing the entire OECD group and its sub-groups—including countries with higher or lower income levels than South Korea—this study enables South Korea to identify context-specific policy strategies based on its relative position among the OECD. The framework of this study is illustrated in the following diagram.



3. Research methodology

3.1. Data and descriptive statistics

This study primarily uses the World Development Indicators database from the World Bank. The database contains a wide range of information across countries over time. The raw data include GDP per capita, value-added per worker (i.e., labour productivity), government education expenditure, trade in services, R&D investment, and demographic information, among others. These sources are invaluable for comparative analysis. This study constructs a panel dataset from 38 OECD countries covering the period from 2002 to 2022, spanning approximately 20 years. As such, the analysis can incorporate recent trends—such as economic structural changes following the 2008 global financial crisis and country-specific responses to COVID-19 since 2020—which were not captured in Park and Shin’s study (2013a), as their data only extended up to 2010.

The reason for selecting OECD member countries as the subject of analysis is that OECD countries are based on market economies and regularly engage in cooperation on a broad range of economic and social issues, including economic policy, international trade, environment, science, and labour. This scope not only includes developed countries in North America, Western Europe, and East Asia but also encompasses developing countries in Latin America and other regions. Furthermore, analysing countries where the

economy has undergone a transition towards a service-oriented structure offers meaningful insights into the relationship between the development of the service sector and GDP growth.

A. The relationship between labour productivity and GDP per capita

The primary dependent variable is log GDP per capita (constant 2015 US\$). The logarithmic transformation of GDP per capita is applied to make it easier to interpret percentage changes and to stabilise variance across countries. Using constant 2015 US\$ enables meaningful comparisons over time by controlling for inflation, ensuring that observed changes in GDP per capita reflect real economic growth rather than inflationary price changes.

This study defines labour productivity—the key explanatory variable—as value-added per worker in each of the service, industry, and agriculture sectors. According to the World Bank (no date a), value-added measures a sector's net output by totalling all outputs and subtracting intermediate inputs. Value-added per worker represents the total value-added in a sector divided by the workforce size within that sector, serving as a measure of labour productivity. In particular, the service sector includes value added from industries such as financial services, restaurants, transportation, wholesaling and retailing, education, and healthcare, among others. Labour productivity serves as an indicator of a country's economic capacity to generate and sustain employment opportunities with fair compensation (World Bank, no date a). The data are also presented in constant 2015 US\$.

B. Determinants of labour productivity

Various factors—including technological progress, human capital development, trade, and demographic characteristics—can influence changes in productivity. This analysis incorporates the following explanatory variables to identify the key drivers of productivity growth in each sector.

R&D investment— R&D expenditure is included in the model to capture the effect of technological innovation on productivity growth. While attempting to extract service sector R&D data, the study encountered limitations: some countries lack comprehensive data, and the available data covers less than ten years in many cases. Therefore, this study uses the logarithmic form of overall R&D expenditure for the regression analysis.

Education— Government education expenditure (as a percentage of total government expenditure), reflecting the government's focus on human capital development, is included in the model to examine its impact on labour productivity.

Trade & FDI— This study incorporates trade in services (exports and imports), foreign direct investment (FDI) inflows, and FDI outflows (as a percentage of GDP). However, while data on service sector exports and imports are available, FDI data are only available in aggregate form, not broken down by sector.

Demography— It includes the age dependency ratio (the share of dependents, defined as those aged under 15 or over 64, relative to the working-age population aged 15 to 64) and the urban population ratio (as a percentage of the total population), to analyse the impact of ageing and urbanisation on labour productivity.

Public sector capacity— Government effectiveness estimate from the Worldwide Governance Indicators dataset is included in the model to examine the effect of institutional factors on labour productivity. According to the World Bank (no date b), the government effectiveness estimates measure how effectively a government formulates and implements public services, ensures a professional and independent civil service, and maintains credibility in its commitments. Its values span from -2.5 (weak governance) to 2.5 (strong governance).

Geography— It includes latitude as a factor affecting labour productivity, as climate and temperature, influenced by proximity to the equator, may impact individual workers' motivation and productivity levels.

Table 1: Summary Statistics

	Observations	Mean	Standard Deviation	Min	Max
log_GDPpercapita(2015US)	798	10.22916	.7086842	8.305313	11.62998
log_services valueperworker	777	10.89488	.6111186	9.158682	12.40654
log_agri valueperworker	777	10.14797	.8818058	8.243262	11.85274
log_industry valueperworker	777	11.01858	.7074989	9.589496	13.04655
Trade_in_services(% of GDP)	792	27.64855	38.32108	4.221986	327.1635
FDI_net_inflow(% of GDP)	798	4.36505	21.33023	-440.1307	234.2487
FDI_net_outflow(% of GDP)	798	4.63927	20.94029	-360.3528	252.9203
Gov_education_expenditure(% of Gov.Exp))	710	12.84789	3.51702	7.111896	32.59158
log_R&D_expenditure	714	22.37203	1.98585	17.47994	27.42726
Urban_population_ratio(% of Total)	798	76.95019	11.07014	50.857	98.153
Age_dependency_ratio(% of aged 15–64)	798	50.71618	5.678444	36.46006	70.257
Government effectiveness(range -2.5-2.5)	798	1.192714	.606917	-.4879076	2.347191
Latitude_distance from equator	798	46.79518	12.97761	4.633333	84.06667

Sources:

1. World Bank: World Development Indicators
2. World Bank: Worldwide Governance Indicators
3. CEPII: GeoDist

3.2. Empirical strategy

Following the methodology of Park and Shin (2013a), this study employs the Ordinary Least Squares (OLS) regression as its primary empirical strategy. It aims to estimate the effect of changes in labour productivity across different sectors on GDP per capita, as well as the impact of various factors on labour productivity within each sector. OLS regression works by finding the line (i.e., the set of parameters) that best fits the data, minimising the sum of squared differences between actual and predicted outcomes.

In addition to OLS regression, this study also applies two-way fixed effects models. Country and year-fixed effects are used to control for both country-specific features that do not change over time and year-specific shocks that simultaneously affect all countries. This approach enhances the

credibility of the estimation by mitigating omitted variable bias and more effectively capturing the effects of time-varying explanatory variables within countries.

Furthermore, to address potential endogeneity concerns arising from reverse causality and simultaneity between explanatory and outcome variables (e.g., while productivity improvements can lead to economic growth, growth may also stimulate productivity gains, or the two may occur simultaneously), the model includes a one-year lagged explanatory variable (i.e. using data from the previous year). This lag structure also helps capture the delayed effects of the explanatory variable on the outcome, as some impacts—for example, the impact of public spending on productivity—may take time to materialise.

Based on the above, Section A presents the results of OLS regressions assessing the effect of labour productivity on GDP per capita—specifically in the service sector—using two-way fixed effects models with a one-year lag. The analyses also include the industry and agriculture sectors. Section B reports the baseline estimates from two-way fixed effects models with a one-year lag, focusing on how key factors—such as R&D and education investment— affect labour productivity in each sector.

A. The relationship between labour productivity and GDP per capita

The baseline model is presented in equations (1) and (2) as follows:

$$(1) \quad \log Y_{ct} = \alpha + \beta \cdot \log \text{Productivity_S}_{c,t-1} + \delta_c + \sigma_t + \epsilon_{ct}$$

Where c denotes countries and t indicates years, $\log Y_{ct}$ is an outcome variable of GDP per capita (constant 2015 US\$). $\log \text{Productivity_S}_{c,t-1}$ is a one-year lagged explanatory variable, representing the logarithmic value of the value-added per worker in the service sector. This model also includes fixed effects for countries (δ_c) and years (σ_t). The key coefficient in equation (1) is β , the estimated impact of labour productivity in the service sector on GDP per capita. The coefficient β is expected to be positive and statistically significant. Since labour productivity (value-added per worker) adjusts for labour input, it offers a more accurate measure of efficiency in the service sector. This makes it particularly useful for cross-country comparisons, especially when service sector sizes vary.

$$(2) \quad \log Y_{ct} = \alpha + \beta_1 \cdot \log \text{Productivity_S}_{c,t-1} + \beta_2 \cdot \log \text{Productivity_A}_{c,t-1} + \beta_3 \cdot \log \text{Productivity_I}_{c,t-1} + \delta_c + \sigma_t + \epsilon_{ct}$$

This model extends the analysis in equation (1) by incorporating $\log \text{Productivity_A}_{c,t-1}$ and $\log \text{Productivity_I}_{c,t-1}$, which represent productivity in the agriculture and industry sectors, respectively. Including these additional sectors allows for a more thorough insight into the economic structure and its contributions to GDP per capita. It helps to compare the relative efficiency of different sectors, offering insights into how labour productivity growth in agriculture, industry, and services interact and complement one another in driving economic performance.

The following models include a Korea dummy variable to capture any effects that are specific to South Korea relative to other countries. This model is presented in equations (3) and (4) as follows:

$$(3) \quad \log Y_{ct} = \alpha + \beta_1 \cdot \log \text{Productivity}_{-S_{c,t-1}} + \beta_2 \cdot (D_{\text{korea}} \times \log \text{Productivity}_{-S_{c,t-1}}) + \delta_c + \sigma_t + \epsilon_{ct}$$

This model extends the analysis in equation (1) by including a Korea dummy variable, D_{korea} (which equals 1 if the country is South Korea and 0 otherwise), along with an interaction term to capture the effects specific to South Korea relative to other countries. The key coefficient in equation (3) is β_2 , representing the estimated additional impact of service sector productivity on GDP per capita in South Korea. Conversely, coefficient β_1 also indicates the effect in non-Korean OECD countries. If β_2 is negative and statistically significant, it shows that the effect of South Korea's service sector productivity on GDP per capita is smaller than in other countries. If it is not statistically significant, it suggests that the effect of South Korea's service sector productivity on GDP per capita does not differ from that of other countries.

$$(4) \quad \begin{aligned} \log Y_{ct} = & \alpha + \beta_1 \log \text{Productivity}_{-S_{c,t-1}} + \beta_2 \log \text{Productivity}_{-A_{c,t-1}} \\ & + \beta_3 \log \text{Productivity}_{-I_{c,t-1}} + \beta_4 (D_{\text{korea}} \times \log \text{Productivity}_{-S_{c,t-1}}) \\ & + \beta_5 (D_{\text{korea}} \times \log \text{Productivity}_{-A_{c,t-1}}) + \beta_6 (D_{\text{korea}} \times \log \text{Productivity}_{-I_{c,t-1}}) \\ & + \delta_c + \sigma_t + \epsilon_{ct} \end{aligned}$$

This model extends the analysis in equation (2) by including a Korea dummy variable, D_{korea} and its interaction with sector-specific productivity. The

coefficients β_4 through β_6 are the coefficients of interest regarding the Korea dummy variable. Compared to equation (3), it further incorporates the agriculture and industry sectors, allowing for an analysis of the impact of sector-specific labour productivity on GDP per capita. Consequently, it enables a comprehensive examination of the effects observed in equations (1), (2), and (3).

B. Determinants of labour productivity

The baseline model is presented in equation (5) as follows:

$$\begin{aligned}
 \log \text{Productivity}_{ct} = & \alpha + b_1 \cdot \text{Servicetrade}_{c,t-1} + b_2 \cdot \text{FDI_inflow}_{c,t-1} \\
 (5) \quad & + b_3 \cdot \text{FDI_outflow}_{c,t-1} + b_4 \cdot \text{Education}_{c,t-1} + b_5 \cdot \log \text{R\&D}_{c,t-1} \\
 & + b_6 \cdot \text{Urban}_{c,t-1} + b_7 \cdot \text{Age}_{c,t-1} + b_8 \cdot \text{Gov.Effectiveness}_{c,t-1} \\
 & + b_9 \cdot \text{Latitude}_{c,t-1} + \delta_c + \sigma_t + \epsilon_{ct}
 \end{aligned}$$

Where c denotes countries and t indicates years, $\log \text{Productivity}_{ct}$ is an outcome variable of the logarithm of the value-added per worker in each sector. There are various one-year-lagged explanatory variables to examine the factors influencing labour productivity in each sector. It includes trade in services, FDI inflow, FDI outflow, government education expenditure, R&D investment, urbanisation rate, age dependency, government effectiveness, and latitude. This model also includes fixed effects for countries (δ_c) and years (σ_t). The coefficients of interest in equation (5) are $b_1 \sim b_9$, the estimated impact of explanatory variables on the labour productivity in each sector.

Explanatory Variables

Trade in Services $_{c,t-1}$: (Service exports + Service imports) (% of GDP) for country c at $t - 1$

FDL inflow $_{c,t-1}$: Foreign direct investment, net inflows (% of GDP) for country c at $t - 1$

FDL outflow $_{c,t-1}$: Foreign direct investment, net outflows (% of GDP) for country c at $t - 1$

Education $_{c,t-1}$: Government expenditure on education (% of total government expenditure) for country c at $t - 1$

logR&D $_{c,t-1}$: The logarithm of total R&D expenditure for country c at $t - 1$

Urban $_{c,t-1}$: Urban population (% of total population) for country c at $t - 1$

Age $_{c,t-1}$: Population aged under 15 or over 64 (% of 15–64 aged population) for country c at $t - 1$

Gov.Effectiveness $_{c,t-1}$: Government effectiveness estimate (scale -2.5 to 2.5) for country c at $t - 1$

Latitude $_{c,t-1}$: Latitude for country c at $t - 1$

3.3. Limitations

The empirical strategy outlined above has certain limitations in addressing potential endogeneity and capturing the heterogeneity among OECD countries.

First, relying on a one-year lag may not sufficiently mitigate endogeneity issues such as simultaneity bias or reverse causality. Additionally, if the effect of explanatory variables on the outcome variable takes longer than one year to appear, the model may not adequately capture the full extent of the relationship.

Second, using a pooled sample of 38 OECD countries, the model may not account for heterogeneous effects across different subgroups. For instance, as the OECD comprises both advanced and emerging economies, the empirical results may vary across these groups. However, the baseline model does not explicitly account for such group-specific dynamics, which may limit its explanatory power.

4. Results and discussion

4.1. Baseline estimates

4.1.1. The relationship between labour productivity and GDP per capita

Main regression results

Table 2 reports the baseline estimates from equations (1) and (2). The dependent variable is the log of GDP per capita, and the explanatory variables are the log value-added per worker in each sector, representing labour productivity. Column 1 includes only the service sector, while Column 2 incorporates the agriculture and industry sectors. Both specifications control for country and year fixed effects.

Table 2: The Effect of Sectoral Labour Productivity on GDP per Capita

	Dependent Variable: log GDP per capita	
	(1)	(2)
log Service valueadded per worker	0.9768*** (0.0395)	0.7693*** (0.0363)
log Agriculture valueadded per worker		0.0449*** (0.0122)
log Industry valueadded per worker		0.3090*** (0.0217)
Constant	-0.4174 (0.4307)	-2.0151 (0.3814)
Country FE	Yes	Yes
Year FE	Yes	Yes
No. of Observations	740	740
Within R-squared	0.4718	0.6166

Note. Two-way fixed effects regression. Column (1) reports the results of equation (1), which includes only the service sector. Column (2) reports the results of equation (2), which includes all three sectors. Standard errors are in parentheses. Within R-squared shows how well the model explains changes in GDP per capita over time within each country.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The results across all specifications in Table 2 are positive and significant. Specifically, in Column 2, a 1% increase in service sector

productivity is linked to a 0.7693% growth in GDP per capita. Similarly, a 1% increase in industry and agriculture sector productivity is linked to 0.3090% and 0.0449% growth in GDP per capita, respectively. These findings indicate that while the impact of productivity growth in the agriculture sector on GDP per capita is minimal, the positive effect of productivity growth in the service sector on GDP per capita is substantial—more than twice the effect observed in the industry sector. In conclusion, an analysis of data from the past 20 years for OECD member countries reveals that productivity improvements in the service sector are key drivers of economic growth.

Including a Korea dummy variable

Table 3 reports the baseline estimates from equations (3) and (4). The dependent variable is the logarithm of GDP per capita, while the explanatory variables consist of the one-year lagged logarithm of value-added per worker and its interaction terms with a Korea dummy variable. Column 1 focuses solely on the service sector, while Column 2 also encompasses the agriculture and industry sectors. Both specifications control for country and year fixed effects.

For the service sector, the coefficients associated with the interaction term ($D_{\text{Korea}} * \log \text{Productivity}$) are statistically insignificant across all specifications. In the industry and agriculture sectors, these estimates are also statistically insignificant. These findings suggest that increases in productivity

across all sectors in South Korea are likely to generate growth effects similar to those typically observed in other countries.

Table 3: The Effect of Sectoral Labour Productivity on GDP per Capita with a Korea Dummy

	Dependent Variable: log GDP per capita	
	(1)	(2)
log Service valueadded per worker	0.9660*** (0.0402)	0.7650*** (0.0368)
D _{Korea} *log Service valueadded per worker	0.1885 (0.1306)	-0.0223 (0.3245)
log Agriculture valueadded per worker		0.0447*** (0.0123)
D _{Korea} *log Agriculture valueadded per worker		0.1165 (0.1899)
log Industry valueadded per worker		0.3075*** (0.0218)
D _{Korea} *log Industry valueadded per worker		-0.0742 (0.2960)
Constant	-0.3540 (0.4326)	-1.9525 (0.3865)
Country FE	Yes	Yes
Year FE	Yes	Yes
No. of Observations	740	740
Within R-squared	0.4734	0.6172

Note. Two-way fixed effects regression including a Korea dummy variable (1 if Korea, 0 otherwise). Column (1) reports the results of equation (3), which includes only the service sector; Column (2) presents the results of equation (4), which includes all three sectors. Standard errors are in parentheses. Within R-squared indicates how well the model explains changes in GDP per capita within each country over time.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

A synthesis of the analyses from equations (1) through (4) reveals that, based on data from the past 20 years for OECD countries, the service sector contributes more to GDP per capita than the industry or agriculture sectors. Specifically, the effect of service sector productivity on GDP per capita in South Korea is not statistically different from that observed in other countries. This implies that, although productivity in South Korea's service sector remains low (as discussed in Section 1.1), improvements in this area could lead to growth effects comparable to those seen in other OECD economies (coefficient = 0.7650; see Table 3).

4.1.2. Determinants of labour productivity

Main regression results

Table 4 reports the baseline estimates from equation (5), with the dependent variable defined as the log of the value-added per worker in each sector, representing labour productivity. Column 1 shows the results for the service sector, Column 2 for the agriculture sector, and Column 3 for the industry sector. All three columns include a wide range of explanatory variables, along with country and year fixed effects. Although the time-invariant variable latitude was included in the dataset, its effect is absorbed by country fixed effects and thus is not reported in the results.

Table 4: Determinants of Sectoral Labour Productivity
(Dependent Variable: log Labour Productivity in Each Sector)

	Service Productivity	Agriculture Productivity	Industry Productivity
	(1)	(2)	(3)
Trade in services ratio (% of GDP)	-0.00045** (0.00021)	0.00025 (0.00073)	0.00439*** (0.00036)
FDI net inflows ratio (% of GDP)	0.00030* (0.00017)	0.00038 (0.00058)	0.00045 (0.00029)
FDI net outflows ratio (% of GDP)	-0.00032* (0.00017)	-0.0011* (0.0006)	-0.0012*** (0.0003)
Gov. education expenditure ratio (% of gov.total exp.)	0.0113*** (0.0019)	-0.0166*** (0.0064)	0.0094*** (0.0032)
log R&D expenditure	0.1182*** (0.0111)	0.1110*** (0.0377)	0.1528*** (0.0187)
Urban population ratio (% of Total population)	0.0022 (0.0016)	-0.0193*** (0.0055)	-0.0087*** (0.0027)
Age dependency ratio (% of 15-64 aged population)	-0.0008 (0.0009)	0.0015 (0.0031)	0.0072*** (0.0015)
Government effectiveness index (range -2.5-2.5)	0.0413*** (0.0143)	0.1714*** (0.0484)	0.0768*** (0.0240)
Latitude	-	-	-
Constant	7.9980 (0.3061)	9.1404 (1.0376)	7.5977 (0.5152)
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
No. of Observations	625	625	625
Within R-squared	0.2944	0.1088	0.3302

Note. Two-way fixed effects regression based on Equation (5). Column (1) reports results for the service sector, Column (2) for agriculture, and Column (3) for industry. Standard errors are in parentheses. Within R-squared indicates how well the model explains changes in productivity within each country over time.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Trade in services

Trade in services exhibits a significant positive relationship with industry sector productivity. A 1 percentage point rise in the trade in services ratio leads to a 0.44% increase in industry sector productivity. This suggests that, as services are integrated into the manufacturing production process as intermediate inputs (Owusu et al., 2020), the process of trade in services could have had a positive impact on manufacturing productivity. By contrast, trade in services shows a negative, but minor, impact on service sector productivity. A 1 percentage point rise in the trade-in-services ratio corresponds to a 0.045% decrease in service sector productivity.

Then, why does service trade correlate positively with industry sector productivity but not as effectively with service sector productivity? The reasons can be explored as follows: service trade is said to have a positive correlation with service sector productivity (Love and Mansury, 2009; Morikawa, 2015; Fu et al., 2023). However, the above analysis did not yield the expected results, which could be due to various constraints affecting the manifestation of positive impacts of service trade on the service sector. Firstly, the existence of barriers and the non-tradable nature of services might be attributed to these issues. Service trade liberalisation has been shown to enhance service sector productivity through the channels of increased technology spillover and market competition (Fu et al., 2023). However, these effects could be limited by the presence of barriers and the inherent characteristics of services as

non-tradable goods. Particularly, the service sector comprises various subfields such as finance, education, retail, and social work, each with different levels of trade openness. This heterogeneity and the presence of sub-sectors with low trade openness, such as social work, could dilute the effects of these channels.

Next, the participation in service trade might be limited compared to manufacturing due to the smaller number of firms engaged and the lower proportion of the economy they represent. Using firm-level evidence from Japan, Morikawa (2015) found that firms engaged in service trade typically exhibit higher levels of productivity and wages relative to domestic firms. However, fewer firms participate in service trade than in goods trade. This is because the fixed costs of initiating service trade are higher than those of initiating goods trade, stemming from challenges like asymmetric information in assessing service quality, differences in institutions and languages, and high transportation costs. Therefore, in the sample countries, the limited number of firms participating in service trade relative to manufacturing might have dampened the positive effects of service trade on service sector productivity.

FDI inflows and outflows

Next, an analysis is conducted on the variables related to FDI inflows and outflows at the national level. According to previous studies, FDI inflows are associated with positive effects such as increased cross-border

technology transfer and investment in infrastructure in the receiving countries, all of which contribute to greater productivity and efficiency in production (Woo, 2009; Baltabaev, 2014; Le et al., 2024). Consistent with previous research, this study shows that FDI inflows have a statistically significant positive association with service sector productivity. For example, a 1 percentage point rise in the FDI net inflow ratio corresponds to a 0.03% increase in service sector productivity. Positive coefficients are also observed in the industry and agriculture sectors; however, these estimates are not statistically significant. Le et al. (2024) mention that the productivity-enhancing impacts of FDI inflows can be diminished due to inefficient technology transfer caused by ineffective management. They also point out that excessive concentration of FDI in specific sectors may lead to adverse effects. In this context, it is plausible that the positive impacts of FDI inflows in the industry and agriculture sectors may have been partially offset by such factors.

By contrast, FDI outflows have a statistically significant negative effect on productivity across all sectors. For instance, a 1 percentage point rise in the FDI net outflow ratio corresponds to a 0.032% decrease in service sector productivity, 0.11% in agriculture, and 0.12% in industry. According to previous studies, if FDI outflows and domestic investment are substitutes, the outward movement of capital can reduce the capacity for domestic investment at the national level—reflecting a substitution effect that potentially harms domestic investment and capital accumulation (Feldstein, 1995; Desai et al., 2005; Herzer and Schrooten, 2007). Conversely, if FDI outflows are more likely to

generate returns or transfer technology that feeds back into the domestic economy, such outflows may have a positive impact on domestic investment and GDP growth in the long term (Herzer and Schrooten, 2007; Dasgupta, 2016). The consistently negative effects across all sectors observed in the results of Table 5 suggest that, in this context, FDI outflow primarily functions as a substitute for domestic investment, thereby exerting a negative effect on investment and productivity.

Government education expenditure

Third, this study analyses the effect of government education expenditure on productivity. According to prior studies, investment in education can lead to the accumulation of technological skills and human capital, thereby enhancing productivity and driving GDP growth (Mekdad et al., 2014; Runde et al., 2023; Coronel and Díaz-Roldán, 2024). In line with previous research, this study shows that the government education expenditure ratio has a statistically significant positive effect on productivity in both the service and industry sectors. For the service sector, a 1 percentage point rise in the government education expenditure ratio is associated with a 1.13% growth in productivity, highlighting the strong link between education investment and productivity improvements. Additionally, a 1 percentage point rise in the government education expenditure ratio in the industry sector leads to a 0.94% growth in productivity. Notably, the effect is substantially larger in the service sector—approximately 20% greater than in the industry sector.

R&D expenditure

Fourth, R&D expenditure is found to significantly enhance the productivity of all sectors. The findings suggest that a 1% rise in total R&D expenditure corresponds to a 0.1182% growth in service sector productivity, a 0.1110% increase in agriculture sector productivity, and a 0.1528% increase in industry sector productivity. This aligns with the general belief that R&D contributes to productivity improvement. (Griffith et al., 2004; Onyekwere, 2019; Fieldhouse and Mertens, 2004).

Age dependency

Next, this study examines the demographic structure. A higher age dependency ratio is generally expected to reduce productivity, as many studies have shown that ageing leads to a decline in labour supply and a decrease in the national saving rate, both of which negatively affect productivity (Shin and Whang, 2005; Feyrer, 2008; Gómez and Hernández de Cos, 2008; An and Kim, 2014; Aiyar et al., 2016; Jung, 2020). In line with prior research, this study observes a negative association between the age dependency ratio and productivity in the service sector; however, the estimate is not statistically significant. By contrast, in the industry sector, the age dependency ratio shows a positive correlation with productivity, contrary to common expectations. A 1 percentage point rise in the age dependency ratio corresponds to a 0.72% growth in productivity in the industry sector. This can

be explained by other studies suggesting that labour shortages caused by population ageing may stimulate technological innovation, such as automation, which can offset the negative effects of ageing and even lead to increases in total factor productivity (Acemoglu and Restrepo, 2017). Additionally, declining birth rates and an extended lifespan may lead to increased investment in education and the accumulation of human capital (Kalemli-Ozcan et al., 2000; Gradstein and Kaganovich, 2003), which can also help offset the adverse effects of ageing.

Urban population

As expected, urbanisation is found to correlate with a decline in productivity in the agriculture sector. A 1 percentage point increase in the urban population ratio corresponds to a 1.93% decrease in agriculture sector productivity, and this relationship is statistically significant. This can be interpreted as the result of rural outmigration caused by deepening urbanisation, which ultimately undermines the productivity of agriculture based in rural areas. In contrast to the agriculture sector, what about the industry and service sectors, which are primarily based in urban areas? The impact of urbanisation on productivity in these two sectors can be examined from both positive and negative perspectives. From a positive perspective, urbanisation may enhance productivity through agglomeration economies, such as improved matching of skilled labour via labour market pooling, knowledge spillovers, and the sharing of inputs among industries with similar production

processes (Rosenthal and Strange, 2004; Mukkala, 2004; Behrens et al., 2014). However, urbanisation may also generate adverse effects due to excessive urban congestion, including increased rents and wages, together with higher transportation costs arising from congestion externalities (Henderson, 2000; Lall et al., 2004). In the service sector, a positive association is observed between urbanisation and productivity. Although not statistically significant, this finding may suggest that the benefits of agglomeration could outweigh the negative effects of congestion. By contrast, in the industry sector, a significant negative relationship between urbanisation and productivity is observed. A 1 percentage point increase in the urban population ratio corresponds to a 0.87% decrease in industry sector productivity. This could be attributed to excessive urban congestion, which suggests that the positive effects of urbanisation may be outweighed by the negative ones.

Government effectiveness

Finally, improvements in government effectiveness are generally believed to encourage the private sector to operate at full capacity, positively impacting GDP growth and overall economic development. Kaufmann et al. (1999) provide empirical evidence that improvements in governance, including government effectiveness, have a strong positive causal impact on per capita income. Consistent with their findings, the quantitative analysis conducted in this study indicates that government effectiveness significantly increases

productivity across all sectors. For the service sector, a 0.1 point rise in the government effectiveness index (its values span from -2.5 to 2.5) leads to a 0.41% growth in productivity. For the industry sector, a 0.1 point rise in the government effectiveness index leads to a 0.77% growth in productivity. Based on the results, institutional factors are found to have a significant positive impact on productivity.

4.2. Alternative specifications and robustness checks

4.2.1. Robustness of lag structure: Two-year lag

First, the model is re-estimated using a two-year lag. This approach allows us to better address concerns related to potential endogeneity between variables, and also to more effectively capture cases where the effects of explanatory variables on outcomes occur with a longer lag.

A. The relationship between labour productivity and GDP per capita

Table 5 reports the estimates from equations (3) and (4) with a two-year lag. The results align with the main findings in Section 3. In Column 2, the service sector contributes more to GDP per capita (0.6752) than either the agriculture (0.0308) or the industry sector (0.3370). The positive effect of productivity growth in the service sector on GDP per capita is approximately 2 times the effect observed in the industry sector. Furthermore, the effect of

service sector productivity on GDP per capita in South Korea is not statistically different from that observed in other countries.

Table 5: The Effect of Sectoral Labour Productivity on GDP per Capita with a Korea Dummy (Two-year lag)

	Dependent Variable: log GDP per capita	
	(1)	(2)
log Service valueadded per worker	0.8753*** (0.0459)	0.6752*** (0.0421)
$D_{\text{Korea}} \cdot \log$ Service valueadded per worker	0.2293 (0.1463)	-0.1256 (0.3716)
log Agriculture valueadded per worker		0.0308*** (0.0134)
$D_{\text{Korea}} \cdot \log$ Agriculture valueadded per worker		0.0972 (0.2228)
log Industry valueadded per worker		0.3370*** (0.0245)
$D_{\text{Korea}} \cdot \log$ Industry valueadded per worker		0.0133 (0.3164)
Constant	0.6351 (0.4932)	-1.1354 (0.4456)
Country FE	Yes	Yes
Year FE	Yes	Yes
No. of Observations	703	703
Within R-squared	0.3778	0.5401

Note. Two-way fixed effects regression including a Korea dummy (1 if Korea, 0 otherwise) with a two-year lag. Column (1) reports the results of equation (3), which includes only the service sector; Column (2) presents the results of equation (4), which includes all three sectors. Standard errors are in parentheses. Within R-squared indicates how well the model explains changes in GDP per capita within each country over time. *Significance levels:* *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

B. Determinants of labour productivity

Table 6 reports the estimates from equation (5) with a two-year lag. The results align with the main findings in section 3. The only difference is that, whereas the main results of Section 3 indicate a positive but statistically insignificant effect of FDI inflow on industry sector productivity, the two-year

lagged model reveals a statistically significant effect. The robustness check based on the two-year lag model supports the validity of the one-year lag model analysis.

Table 6: Determinants of Sectoral Labour Productivity (Two-year lag)
(Dependent Variable: log Labour Productivity in Each Sector)

	Service Productivity	Agriculture Productivity	Industry Productivity
	(1)	(2)	(3)
Trade in services ratio (% of GDP)	-0.00041* (0.00023)	0.00118 (0.00079)	0.00491*** (0.00038)
FDI net inflows ratio (% of GDP)	0.00035** (0.00017)	-0.00055 (0.00056)	0.00044* (0.00027)
FDI net outflows ratio (% of GDP)	-0.00035** (0.00017)	-0.0010* (0.0006)	-0.0014*** (0.0003)
Gov. education expenditure ratio (% of gov.total exp.)	0.0104*** (0.0020)	-0.0149** (0.0067)	0.0097*** (0.0032)
log R&D expenditure	0.1090*** (0.0115)	0.0919*** (0.0388)	0.1497*** (0.0185)
Urban population ratio (% of Total population)	0.0025 (0.0016)	-0.0185*** (0.0055)	-0.0083*** (0.0026)
Age dependency ratio (% of 15-64 aged population)	-0.0010 (0.0009)	0.0025 (0.0032)	0.0078*** (0.0015)
Government effectiveness index (range -2.5-2.5)	0.0400*** (0.0145)	0.1566*** (0.0490)	0.0593*** (0.0233)
Latitude	-	-	-
Constant	8.2115 (0.3126)	9.4476 (1.0589)	7.6181 (0.5047)
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
No. of Observations	592	592	592
Within R-squared	0.2726	0.1014	0.3484

Note. Two-way fixed effects regression based on Equation (5) with a two-year lag. Column (1) reports results for the service sector, Column (2) for agriculture, and Column (3) for industry. Standard errors are in parentheses. Within R-squared indicates how well the model explains changes in productivity within each country over time.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2.2. Sub-sample analysis across income groups

Next, sub-sample analyses are conducted by dividing the 38 OECD countries into two groups based on income level, as the impacts may vary depending on the level of economic development. This approach allows us to

examine whether similar patterns and results emerge across income groups, and to assess the consistency of the findings between the full sample and the sub-samples.

For this analysis, we set the median Gross National Income (GNI) per capita of OECD countries in 2023—\$42,000—as the threshold for balancing the two sub-samples. Countries with GNI per capita above this threshold are classified as upper-high-income (UH) countries, and those below as upper-middle & lower-high-income (UMLH) countries, with 19 countries in each group. South Korea ranks 22nd among the 38 OECD countries and falls into the UMLH group (see Appendix B). Even if the OECD average GNI per capita (\$44,000) were used instead, the classification would remain unchanged, as the figure is close to the median of \$42,000, and the same 19 countries would be included in each sub-sample. This suggests that the 38 OECD countries show a relatively balanced income distribution.

A. The relationship between labour productivity and GDP per capita

Main regression results

Table 7 reports the estimates based on equations (1) and (2) with a one-year lag. The dependent variable is the log of GDP per capita, and the explanatory variables are the log value-added per worker in each sector. Columns 1 and 2 show the results for the UMLH group, while Columns 3 and 4 present results for the UH group.

Table 7: The Effect of Sectoral Labour Productivity on GDP per Capita by Income Group

	Dependent Variable: log GDP per capita			
	Upper Middle&Lower High		Upper High	
	(1)	(2)	(3)	(4)
log Service valueadded per worker	0.9532*** (0.0535)	0.7760*** (0.0501)	0.8290*** (0.0710)	0.4672*** (0.0584)
log Agriculture valueadded per worker		0.0300 (0.0186)		0.0487*** (0.0150)
log Industry valueadded per worker		0.3351*** (0.0386)		0.3283*** (0.0215)
Constant	-0.2773 (0.5576)	-2.2176 (0.5279)	1.3761 (0.8081)	1.1597 (0.6109)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of Observations	380	380	360	360
Within R-squared	0.4820	0.6042	0.2976	0.6034

Note. Two-way fixed effect regression with a one-year lag. Columns (1)&(2) report the regression results for the upper-middle&lower-high income group, while Columns (3)&(4) present the results for the upper-high income group. Standard errors are reported in parentheses.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

As in the full-sample analysis, service sector productivity shows the largest coefficients across all sectors in both groups, as shown in Columns 2 and 4. In the UMLH group, a 1% rise in service sector productivity corresponds to a 0.7760% growth in GDP per capita, whereas the corresponding estimate for the UH group is 0.4672%. For the industry sector, the coefficients for the UMLH and UH groups are 0.3351 and 0.3283, respectively. In the agriculture sector, the estimates are smaller—0.0300 and 0.0487 for the UMLH and UH groups, respectively. Notably, the difference is most pronounced in the service sector, with a coefficient of 0.7760 for the UMLH group compared to 0.4672 for the UH group.

In conclusion, an analysis of data from the past 20 years for OECD countries suggests that improvements in service sector productivity are major

contributors to GDP growth. However, the impact appears to be significantly stronger for countries in the relatively lower-income UMLH group, particularly in the service sector.

Hypothesis tests

Next, these results can be verified through a hypothesis test. The hypothesis test aims to determine whether the differences in coefficients between the two income groups are statistically significant in each sector. The hypothesis test is conducted as follows.

- Null Hypothesis (H_0): The coefficients of the explanatory variables (e.g., labour productivity in services) on the outcome variable (e.g., GDP per capita) do not differ between the two income groups.
- Alternative Hypothesis (H_1): The coefficients of the explanatory variables differ between the two income groups.

Table 8: Hypothesis Test Results: Differences in Productivity Effects across Income Groups

Sector	F-statistic	p-value	Conclusion
Service	15.82	0.0001	Significant difference b/w the two groups
Agriculture	0.09	0.7614	No significant difference
Industry	0.95	0.3304	No significant difference

The null hypothesis (H_0) is rejected if the p -value is below 0.05, indicating a significant difference in the effect of labour productivity on GDP per capita between the two income groups. For the service sector, the p -value falls below this threshold, providing evidence that the effect of service sector productivity on GDP per capita differs significantly between the UMLH and UH groups. Conversely, the p -values for the agriculture and industry sectors exceed 0.05, suggesting that productivity in these sectors has a statistically similar effect on GDP per capita across income groups.

These results not only confirm the earlier findings that service sector productivity has a larger estimated effect on GDP per capita in the UMLH group than in the UH group, but also indicate its greater potential as a driver of growth for the UMLH group among OECD countries, which includes South Korea.

B. Determinants of labour productivity in each sector

Main regression results

Table 9 presents the estimates based on equation (5) with a one-year lag. The results are reported in six columns (1)-(6) by determinant, categorised by two income-level groups (upper-middle & lower-high income (UMLH) and upper-high income (UH)), and three sectors (service, agriculture, and industry).

Table 9: Determinants of Sectoral Labour Productivity by Income Group
(Dependent Variable: log Labour Productivity in Each Sector)

	Service Productivity		Agriculture Productivity		Industry Productivity	
	UMLH (1)	UH (2)	UMLH (3)	UH (4)	UMLH (5)	UH (6)
Trade in services ratio (% of GDP)	0.00099 (0.00148)	0.00018 (0.00019)	0.0092* (0.0053)	0.00012 (0.00071)	0.0053*** (0.0021)	0.0052*** (0.0005)
FDI net inflows ratio (% of GDP)	0.00045 (0.00168)	0.00018 (0.00013)	0.0020 (0.0060)	0.00027 (0.00048)	-0.0050** (0.0024)	0.0004 (0.0003)
FDI net outflows ratio (% of GDP)	-0.00010 (0.00168)	-0.00033*** (0.00013)	-0.0029 (0.0060)	-0.00073 (0.00049)	0.0044* (0.0024)	-0.0011*** (0.0003)
Gov. educ. exp. ratio (% of gov. total exp.)	0.0187*** (0.0029)	-0.0004 (0.0030)	-0.0132 (0.0104)	-0.0032 (0.0111)	0.0068* (0.0041)	0.0198*** (0.0071)
log R&D expenditure	0.1329*** (0.0160)	0.0738*** (0.0165)	0.0893 (0.0571)	0.1322** (0.0613)	0.1395*** (0.0225)	0.1211*** (0.0393)
Urban population ratio (% of Total)	-0.0018 (0.0023)	0.0005 (0.0022)	-0.0344*** (0.0084)	0.0048 (0.0082)	-0.0088*** (0.0033)	-0.0101* (0.0053)
Age dependency ratio (% of 15–64 aged)	-0.0046*** (0.0012)	0.0075*** (0.0015)	-0.0082* (0.0043)	0.0141*** (0.0054)	0.0025 (0.0017)	0.0213*** (0.0035)
Gov. effectiveness index (range -2.5–2.5)	0.0823*** (0.0201)	-0.0289 (0.0189)	0.2060*** (0.0720)	0.1059 (0.0703)	0.1363*** (0.0283)	-0.0295 (0.0451)
Latitude	–	–	–	–	–	–
Constant	7.6810 (0.4169)	9.2995 (0.4428)	10.3529 (1.4916)	6.5255 (1.6477)	7.6971 (0.5872)	8.1399 (1.0571)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	319	306	319	306	319	306
Within R-squared	0.4389	0.1921	0.1716	0.0695	0.3731	0.3756

Note. The two-way fixed effects regression is estimated based on equation (5). UMLH stands for the upper-middle & lower-high group, while UH denotes the upper-high group. Columns (1) and (2) report the results for the service sector, Columns (3) and (4) for agriculture, and Columns (5) and (6) for industry. Standard errors are in parentheses. Within R-squared indicates how well the model explains changes in productivity within each country over time.

Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Trade in services

First, trade in services shows a significant positive relationship with industry sector productivity in both income groups, which is consistent with the full-sample analysis. A 1 percentage point rise in the trade-in-services ratio results in a 0.53% increase in industry sector productivity for the UMLH group and a 0.52% increase for the UH group.

On the other hand, when service sector productivity is used as the dependent variable, the trade-in-services coefficients are positive across all income groups, although the estimates are not statistically significant. Notably, the negative correlation observed in the full-sample analysis disappears in this case.

FDI inflows and outflows

Overall, FDI inflows tend to be positively associated with sectoral productivity, while FDI outflows tend to be negatively associated across income groups. These coefficient signs are consistent with those observed in the full-sample analysis; however, statistical significance is lost in many cases. For example, while FDI inflows showed a significant positive relationship with service sector productivity in the full-sample analysis, this significance disappears in the subgroup analysis.

Government education expenditure

The government education expenditure ratio shows a statistically significant and positive effect on industry sector productivity in both income groups. Specifically, a 1 percentage point increase in the government education expenditure ratio corresponds to a 0.68% increase in productivity for the UMLH group and a 1.98% increase for the UH group. On the other hand, no statistically significant correlation is observed in the agriculture sector. For the service sector, while the UMLH group exhibits a statistically significant positive effect of 1.87%, no significant relationship is found in the

UH group. This suggests that government education expenditure has a positive impact on service sector productivity in relatively lower-income countries.

R&D expenditure

R&D expenditure is found to significantly enhance productivity across all sectors, except in the agriculture sector of the UMLH group, where a positive association is observed but lacks statistical significance. For the service sector, the results show that a 1% rise in total R&D expenditure corresponds to a 0.1329% growth in service sector productivity for the UMLH group and a 0.0738% growth for the UH group. For the industry sector, a 1% rise in total R&D expenditure results in a 0.1395% productivity growth for the UMLH group and 0.1211% growth for the UH group. These findings indicate that the positive impact of R&D investment on productivity is greater in the UMLH group.

Age dependency

In the UMLH group, the age dependency ratio exhibits a significant negative relationship with productivity in the service and agriculture sectors. In contrast, the UH group shows a positive relationship across all sectors. As observed in the industry sector in the full-sample analysis, high-income developed countries appear to be effectively managing ageing populations through technological advancement, investment in education, and other innovations, thereby offsetting the adverse effects of the ageing population.

Urban population

As with the full-sample analysis, in the UMLH group, urbanisation shows a significant negative correlation with agriculture sector productivity, leading to a 3.44% decrease. However, in the UH group, no such negative relationship is observed. This implies that in higher-income countries, the negative impact of urbanisation on agricultural productivity weakens—possibly because the UH group might be better at addressing rural population decline through technological innovation and automation. For the service sector, no statistically significant association exists between urbanisation and productivity in either income group, consistent with the findings from the overall sample analysis. For the industry sector, a significant negative relationship between urbanisation and productivity is observed across all income groups, which is also consistent with the overall sample analysis.

Government effectiveness

Finally, in the UMLH group, as expected, government effectiveness significantly increases productivity across all sectors. Specifically, a 0.1 point rise in the government effectiveness index leads to a 0.82% growth in service sector productivity and a 1.36% increase in industry sector productivity. However, in the UH group, the effect is not statistically significant. This indicates that the positive effect of government capacity on productivity is more evident in countries with relatively lower income levels.

Taken together, an analysis of data from the past 20 years for OECD countries suggests that in the service sector, the positive effects of government education expenditure, R&D investment, and government effectiveness on productivity remain valid. However, the magnitude of these effects tends to be larger or more significant in countries with relatively lower income levels. Meanwhile, the negative effect of the age dependency ratio on productivity is evident in the UMLH group but not in the UH group. This highlights the need for efforts to address ageing populations through technological innovation and increased investment in education. The above conclusions for the service sector can also be confirmed by the results of the hypothesis test shown in Table A4 of Appendix C.

5. Conclusion

5.1. Summary of key findings

This study examined the relationship between sector-specific productivity and GDP per capita using a panel dataset of 38 OECD countries over the past two decades. The results show that improvements in service sector productivity are a key driver of GDP per capita growth. Specifically, a 1% increase in service sector productivity is associated with a 0.77% growth in GDP per capita—more than twice the effect observed in the industry sector. Importantly, this impact is greater in the upper-middle and lower-high income (UMLH) group (0.78%) than in the upper-high income (UH) group (0.47%), underscoring the strategic importance of the service sector for countries in the UMLH group. Notably, the Korea dummy analysis indicates that South Korea, which belongs to the UMLH group, can expect growth effects from service sector productivity improvements comparable to those observed in other OECD countries.

This analysis identifies three major determinants that have a significant positive effect on service sector productivity: R&D investment, which enhances technological competitiveness; government education expenditure, which fosters human capital accumulation; and government effectiveness, which provides a favourable environment for private sector activity. These effects are more pronounced in the UMLH group than in the UH group. However, we also find that demographic challenges, such as low birth rates

and an ageing population, can negatively affect service sector productivity, especially in the UMLH group. In contrast, in the UH group, the association between the age dependency ratio and service sector productivity turns positive, suggesting that advanced economies may offset these negative effects through technological advancement and human capital accumulation, consistent with prior research (e.g., Acemoglu and Restrepo, 2017).

5.2. Policy implications and recommendations

The findings have clear implications for South Korea amid its current low-growth challenge. Developing a targeted strategic framework that rebalances R&D investment towards the service sector, improves the efficiency and the allocation of government education expenditure, and strengthens government effectiveness is critical to enhancing service sector productivity and revitalising long-term economic growth. First, rebalancing R&D investment towards the service sector is crucial, as the current R&D structure is heavily skewed towards manufacturing. According to Jones and Lee (2016), approximately 90% of South Korea's total R&D spending from 2011 to 2013 was concentrated in manufacturing, whereas only around 7% was allocated to services—considerably under the average of 38% across OECD countries. Baek and Joo (2014) argue that low R&D intensity is a critical factor behind the low productivity of the service sector. Addressing this gap through targeted R&D policies for the service sector is essential to

enhancing technological competitiveness and driving productivity growth, especially in emerging areas such as artificial intelligence (AI), which are expected to increasingly influence high-value-added service sectors including healthcare, finance, and digital content services.

Second, assessing whether South Korea's government education expenditure effectively fosters a highly skilled workforce is necessary. For instance, in South Korea, about 21% of national tax revenues are allocated to local education grants for primary and secondary schools by law. Because the system is rigid and does not reflect the declining school-age population, it results in overspending at these levels and underinvestment in higher and lifelong education, relative to the OECD average (Kim, 2021). Thus, institutional reforms are needed to eliminate these inefficiencies and better align educational spending with evolving industrial demands amid the ongoing AI-driven transformation, which is rapidly reshaping the service sector.

Third, comprehensive policy efforts are needed to enhance government effectiveness in areas such as public sector innovation, fiscal management, and regulatory reform. Although South Korea's public sector has demonstrated strong performance in policy implementation and digitalisation (OECD, 2025), it has also shown shortcomings in organisational innovation (Kim and Kim, 2022) and inefficiencies in fiscal projects execution (Kang et al., 2018). To address these issues, it is necessary to revise public management frameworks to better reflect market orientation and innovation and to reinforce the linkage between performance evaluations and future budget allocations. In

addition, excessive regulatory burdens in the service sector may constrain private sector capacity. For example, Park et al. (2014) reported that, as of 2013, the service sector in South Korea was particularly overregulated, with 3,601 major regulations—including 712 in finance/insurance, 298 in professional R&D services, and 294 in education services—roughly ten times as many as in the manufacturing sector. Strengthening public sector capacity, alongside streamlining regulations, is essential for fostering innovation and productivity in the private sector.

5.3. Research limitations and future research directions

Nevertheless, this study has limitations. First, while the study attempts to mitigate potential endogeneity issues by including two-way fixed effects and lagged variables, these efforts may not fully address reverse causality or omitted variable bias. Future studies could apply instrumental variable approaches or dynamic panel methods, such as the system Generalised Method of Moments (GMM), to more rigorously address endogeneity concerns.

Furthermore, although this study includes subgroup analysis by income level through a robustness check, it does not provide an analysis of sub-sectors within the service industry. This may not have fully captured specific dynamics and implications at the sub-sector level. Future research could focus on the relationship between productivity, its key determinants, and economic output in individual service sub-sectors to identify sector-specific characteristics.

5.4. Concluding remarks

In sum, South Korea experienced rapid economic growth between the 1970s and 1990s, largely driven by intensive labour and capital inputs. However, it now faces structural challenges such as a declining labour force, diminishing returns on capital investments, and a slowdown in economic dynamism. This study highlights that improving service sector productivity is vital to revitalising South Korea's growth potential. To reverse the declining growth trajectory, a balanced growth strategy harnessing the underutilised service sector is essential—one that rebalances R&D investment towards high-value-added service sectors, reforms government education expenditure to foster a highly skilled workforce aligned with evolving industrial demands, and strengthens public sector capacity to promote innovation and efficiency in the private sector. Such a transformation could provide a renewed engine of economic growth, enabling South Korea to adapt to demographic transitions while maintaining its competitiveness.

Appendices

Appendix A: Young's (1995) growth accounting and the results

Table A1: Growth Accounting - Asia's Four Tigers

	Output Growth ($\Delta Y/Y$)	Labor Share (wL/Y)	Capital Share (rK/Y)	Employment Growth ($\Delta L/L$)	Capital Stock Growth ($\Delta K/K$)	TFP ($\Delta A/A$)
Hong Kong (1966-91)	0.073	0.628	0.372	0.032	0.080	0.023
Singapore (1966-90)	0.087	0.509	0.491	0.057	0.115	0.002
Taiwan (1966-90)	0.094	0.743	0.257	0.049	0.123	0.026
South Korea (1966-90)	0.103	0.703	0.297	0.064	0.137	0.017

Note. This table reprocesses data and content from Young, A. (1995).

Table A2: Percentage Contributions to Growth

	Labor Deepening	Capital Deepening	TFP Contribution
Hong Kong (1966-91)	27.5%	40.8%	31.5%
Singapore (1966-90)	33.3%	64.9%	2.3%
Taiwan (1966-90)	38.7%	33.6%	27.7%
South Korea (1966-90)	43.7%	39.5%	16.5%

Note. This table reprocesses data and content from Young, A. (1995).

Appendix B: Income group classification and GNI per capita (US\$)

Table A3: GNI per Capita by Income Group Classification (2023)

(upper-high vs. upper-middle & lower-high Income Countries)

Upper-high income group		Upper-middle & Lower-high income group	
Countries (19)	GNI per capita (US\$)	Countries (19)	GNI per capita (US\$)
Norway	102,910	Japan	39,350
Switzerland	95,070	Italy	37,920
Luxembourg	83,980	South Korea	35,490
United States	80,450	Spain	32,830
Iceland	80,400	Slovenia	30,860
Ireland	78,970	Estonia	27,620
Denmark	73,340	Czechia	27,370
Australia	63,150	Portugal	26,150
Netherlands	62,540	Lithuania	25,080
Sweden	60,480	Slovak Republic	22,790
Austria	55,030	Latvia	22,630
Germany	54,800	Greece	22,590
Israel	54,650	Poland	19,900
Belgium	54,580	Hungary	19,670
Canada	54,040	Chile	15,800
Finland	53,230	Costa Rica	14,260
New Zealand	48,220	Mexico	11,980
United Kingdom	47,700	Turkiye	11,730
France	45,180	Colombia	6,810

Note: This table reprocesses data from World Bank (2023), Income classification based on GNI per capita

Appendix C: Hypothesis test results

Table A4: Hypothesis Test Results for Equation (5)

Explanatory Variable	Sector	F-statistic	p-value	Conclusion
Trade in Services	Service	1.91	0.1676	Not significant
	Agriculture	6.46	0.0113	Significant difference b/w the two groups
	Industry	0.45	0.5016	Not significant
FDI Net Inflows	Service	0.00	0.9661	Not significant
	Agriculture	0.02	0.9025	Not significant
	Industry	5.16	0.0235	Significant difference
FDI Net Outflows	Service	0.16	0.6929	Not significant
	Agriculture	0.01	0.9415	Not significant
	Industry	5.22	0.0227	Significant difference
Gov. Education Exp.	Service	16.84	0.0	Significant difference
	Agriculture	1.49	0.2233	Not significant
	Industry	3.88	0.0495	Significant difference
R&D Exp.	Service	26.92	0.0	Significant difference
	Agriculture	1.94	0.1643	Not significant
	Industry	9.11	0.0027	Significant difference
Urban Population	Service	0.68	0.4098	Not significant
	Agriculture	6.9	0.0088	Significant difference
	Industry	2.45	0.1181	Not significant
Age Dependency	Service	7.69	0.0057	Significant difference
	Agriculture	2.44	0.1185	Not significant
	Industry	20.65	0.0	Significant difference
Gov. Effectiveness	Service	5.48	0.0196	Significant difference
	Agriculture	0.00	0.9666	Not significant
	Industry	5.87	0.0157	Significant difference

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