Structural Change and Labour Productivity in BRICS

Mungase, Sachin and Nikam, Supriya and Kothe, Satyanarayan

NSS College of Commerce amp; Economics, Mumbai, Mumbai School of Economics and Public Policy, University of Mumbai, Mumbai, Mumbai School of Economics and Public Policy, University of Mumbai, Mumbai

30 July 2024

Structural Change and Labour Productivity in BRICS

1. Introduction

Brazil, Russia, India, China, and South Africa (BRICS) in recent decades are known as emerging economies in the world. The share of BRICS nations in world GDP has gone up from 10.45 to 24 percent from 1991 to 2018 with its 41 percent world labour force. However, these countries have witnessed varying GDP growth rates over recent decades. BRICS grew at an average of 5 percent in the 1990s and paced at 8 percent in the 2000s. Their average growth slowed down to 5.5 percent during 2011 to 2020.

The discussion about the structural changes of being integral to economic progress is evolved for centuries. As per Lewis's classical theory, development occurs when surplus labour moves from the subsistence sector to the modern sectors (Lewis, 1954). This shift enhances overall productivity by transferring labour from a sector with zero marginal productivity to one with positive marginal productivity. Industrialization further enhances aggregate productivity by reallocating labour from less productive agricultural sector to more productive industrial sectors (Kuznets, 1966; Chenery and Syrquin, 1975). The pace and nature of structural change significantly influence long-term economic growth. With the changes in the technology the labour should be shifted from low-productive to high productive sectors (de Vries et al., 2012). Understanding structural change requires accounting for sectoral distinctions. The primary objective is to boost per capita income and productivity growth by diversifying a nation's economic structure and reducing susceptibility to external factors (Naude et al., 2015).

Despite extensive research on the BRICS economies, detailed empirical examinations of their structural transformations since 1980 are scarce. Particularly, investigating

employment shifts in correlation with labour productivity from 1990 to 2018 seeks to comprehend the effects of structural changes and sectoral productivity on overall growth. This analysis aids in determining whether their growth trends align with those of other advanced and developing nations, focusing on sectors driving increased labour productivity and resource allocation. The productivity growth is possible to be attained by reallocating the resources among the sectors is known as structural change in an economy. Studies by Timmer et al. (2010) and Jorgenson and Timmer (2011) have revealed patterns of productivity growth in sub-services such as retail trade, distribution, and financial services. Timmer and de Vries (2015) have further explored structural changes in developing countries, highlighting variations in labour distribution between Africa and Latin America. Nevertheless, queries regarding sectoral productivity variances in retail and wholesale trade services remain unanswered, underscoring the necessity for additional research to comprehend these trends and their implications for overall economic growth. Structural change and labour productivity are pivotal in sustaining economic growth.

However, questions regarding sectoral productivity variances in retail and wholesale trade services remain unanswered, underscoring the necessity for additional research to comprehend these trends and their implications for overall economic growth. Structural change and labour productivity are pivotal in sustaining economic growth.

Thus, the overarching objective of this study is to address these gaps by analyzing the dynamics of employment and productivity within the BRICS countries. Specifically, it involves investigating labour shifts from less productive to more productive sectors, exploring inter-sectoral changes in output and employment patterns, assessing sectoral productivity while considering employment distribution, examining the impact of

structural changes on labour productivity, and analyzing key determinants and challenges influencing labour productivity in these nations.

Thus, the objective is to address these gaps by analysing the dynamics of employment and productivity within the BRICS. The study deals with the shift in labour force from less productive to more productive sectors, exploring inter-sectoral changes in output and employment patterns, assessing sectoral productivity while considering employment distribution, examining the impact of structural changes on labour productivity, and analyzing key determinants and challenges influencing labour productivity in these nations.

2. Literature Review

Caselli and Coleman (2001) proposed a model explaining the labour shift from agriculture to modern industries driven by decreasing education costs and increasing skilled workers. Wolfe (1955) classified industries into three sectors: primary (natural resources), secondary (machinery), and tertiary (human skills), shaping labour productivity growth. Fourastié (1949) added that sectors with higher technological progress and productivity growth rise in importance. With the rise in income, the demand for primary and secondary goods gets insensitive and the demand for services observe a boost.

Acemoglu and Guerrieri (2008) found significant differences in capital intensity across sectors, with Herrendorf et al. (2015) challenging their model by showing agriculture as more capital-intensive than services. Despite the majority of labour being in agriculture, the future for those who transitioned out remains uncertain. Recent studies highlight that the traditional division into three sectors is becoming less relevant as production shifts toward services. High-skilled services are growing, impacting labour

productivity (Buera and Kaboski, 2012; Buera et al., 2015). However, challenges in high-skill-intensive services and a scarcity of highly skilled labour contribute to underdevelopment (Fang and Herrendorf, 2021; Nabar and Yan, 2013; Khor et al., 2016).

Productivity growth varies across service industries. Jorgenson and Timmer (2011) noted that understanding this variation is crucial for comprehending the impact of structural changes on productivity. Buera and Kaboski (2012) and Buera et al. (2015) observed that the sectors require high skills demand more labours with rising GDP which affects the wage gap between skilled and unskilled workers. Sectors like transport and finance outperform manufacturing in productivity and growth rates, benefiting overall labour productivity (Gruss & Novta, 2018).

We find significant discussion on the relationship between employment and sectoral productivity in developing countries. Russia's growth is driven by capital input and multi-factor productivity, while African countries see a shift toward market services. In Asia, the services sector significantly contributes to labour productivity, especially in India. Timmer and de Vries (2015) observed variations in labour distribution due to manufacturing expansion. Helble et al. (2019) found that the services sector is the primary contributor to labour productivity in most Asian economies.

Erumban et al. (2019) found that static structural change positively impacted labour productivity growth in India, but dynamic reallocation effects were not observed. Kothe (2012) explored the structural shifts in employment in India, he observed that India experiences altogether different process of structural shifts in employment. Voskoboynikov (2020) studied Russia's structural changes, noting that labour reallocation from the formal to the informal sector reduced growth. Rincon-Aznar et al. (2021) compared labour productivity across large economies, finding that developed

countries saw declining productivity due to a shift toward services. While exploring labour productivity in Brazil, Nassif et al. (2020) stated that currency appreciation and trade restrictions contributed to stagnation.

There have been studies on the dynamics of labour shifts from agriculture to modern industries, the classification and productivity growth across different sectors, and the impact of structural changes on labour productivity, there remain significant gaps in understanding these processes within the context of BRICS countries. Caselli and Coleman (2001) discussed labour shifts driven by reduced education costs and increased skilled labour, while Wolfe (1955) and Fourastié (1949) provided foundational categorizations of industries and their productivity dynamics. BRICS have unique economic structures and development paths. Their intersectoral shifts in output and employment have been undiscovered.

Moreover, studies by Acemoglu and Guerrieri (2008), Herrendorf et al. (2015), and Buera and Kaboski (2012) highlight the significant differences in capital intensity and productivity growth across sectors, particularly as economies transition towards high-skilled services. Despite these insights, how these structural changes affect labour productivity within the BRICS is uncovered.

Recent research has underscored the importance of sectoral productivity and labour distribution, with studies like those by Fang and Herrendorf (2021) and Gruss & Novta (2018) revealing the productivity challenges and growth potential in high-skill-intensive services. These findings have primarily focused on individual countries or regions, leaving scope for comparative analysis across the diverse economic landscapes of BRICS nations.

Additionally, while Timmer and de Vries (2015) and Erumban et al. (2019) have explored structural changes in developing countries, their insights into the static and dynamic effects of labour reallocation on productivity growth have not been fully extended to the BRICS context. The determinants and challenges influencing labour productivity were found to be undiscovered given the distinct political, economic, and social environments in these countries.

The study is a sincere attempt to explore the dynamics of employment and productivity in BRICS countries. This involves investigating labour shifts from less productive sectors to more productive ones, exploring inter-sectoral changes in output and employment patterns, and assessing sectoral productivity while considering the employment distribution across various sectors. Further, the attempt is to know the impact of structural changes on labour productivity and also to analyse the main determinants and challenges influencing the productivity of labour.

3. Methodology and Data Sources

The Groningen Growth and Development Centre (GGDC) database has now been replaced with the Economic Transformation Database (ETD) is used to investigate the first objective of the study. This database contains data at both current and constant 2015 prices for gross value added in millions of units of country currency, and employment percentages for 12 sectors from 1990 to 2018. The study used data at constant prices for gross value added, as it tells us more about whether the economy is growing. It is also known as the real GDP, whereas the gross value added at current prices is referred to as the nominal GDP. To explore inter-sectoral changes in output and employment patterns, Gemmell's (1982) criteria are used to study the structural change in employment in BRICS countries. To examine the third objective in the

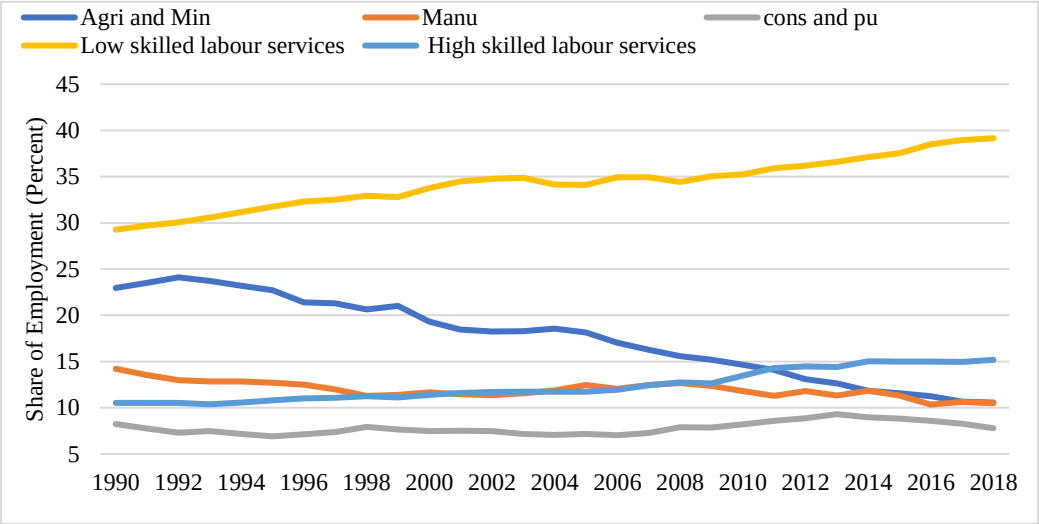
context of the BRICS economies, the analysis utilizes annual ETD (Economic Time Series) data spanning from 1990 to 2018. These data represent gross value added at constant prices in national currencies. Additionally, employment data is incorporated to identify trends in labour productivity. Firpo and Pieri's (2017) formula is used to determine the economy's total productivity for the ET database. The database encompasses 12 major economic sectors, including agriculture, mining, manufacturing, public utilities, transportation, trade, real estate, finance, business services, and government services. To illustrate the speed, severity, and consistency of structural change, McMillan and Rodrik's (2011) methodology is applied. The analysis focuses on the period from 1990 to 2018, with the horizontal axis measuring sector-wise changes in employment share and the vertical axis representing relative productivity levels within each country. Structural change patterns for each country during this period are depicted in charts, examining three dimensions: pace (length of the regression line relative to the intercept), intensity (slope of the regression line), and consistency level (by comparing pace and intensity over the long run).

4. Research Findings

4.1 Shift in Employment from low to high productive sectors in BRICS Countries

To distinguish between low and high-productivity sectors, the 12 sectors were reduced to 5: Agriculture and Mining (Agri & Min), Manufacturing (Manu), Construction (Cons), Public Utilities (PU) - including electricity, gas, and water supply, Low-skilled Services - which includes wholesale and retail trade, accommodation and food services, and High-skilled Services - which includes transportation and storage, IT, financial, insurance and business services, and real estate. (Nassif et al., 2020).

Figure 1. 1: Brazil's share of sectoral employment to total employment (percent)

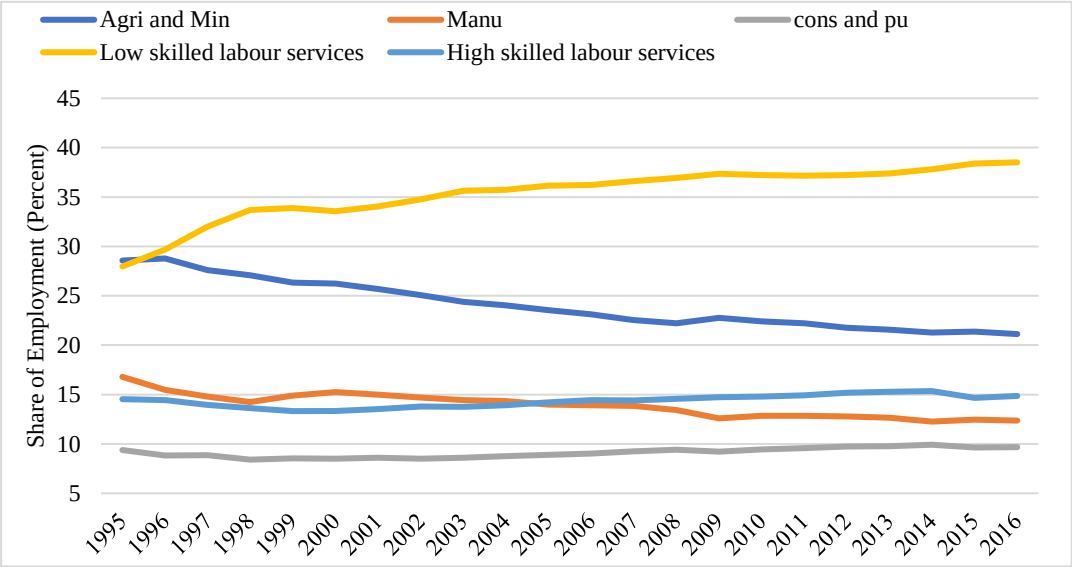


Source: Author Computed based on Economic Transformation Database (ETD), 2021

The figure 1.1 indicates a shift in labour employment from the sectors of agriculture and mining to low-skilled and high-skilled services in Brazil. Interestingly, during the same period, the employment share in services (both low and high-skilled) increased to 39.15 percent and 15.18 percent, respectively. Conversely, the employment share in agriculture and mining declined, falling to 10 percent in 2018. From 1990 to 2018, there was a marginal decrease of 0.46 percent in the proportion of workers employed in the construction and public utilities sectors, while the proportion of manufacturing employment remained steady at 10.50 percent.

The figure 1.2 indicates a shift in labour employment from the sectors of agriculture, mining, and manufacturing to low-skilled services in Russia. In 2018, the percentage of employment in low-skilled services increased to 38.51 percent, while high-skilled services remained at 14.85 percent. The percentage of employment in agriculture-mining has decreased to 21 percent and manufacturing has fallen to around 12 percent in 2018 compared to 1990. Between 1990 and 2018, the proportion of workers employed in construction and public utilities stood at 9.67 percent.

Figure 1. 2: Russia's share of sectoral employment to total employment (percent)



Source: Author Computed based on Economic Transformation Database (ETD), 2021

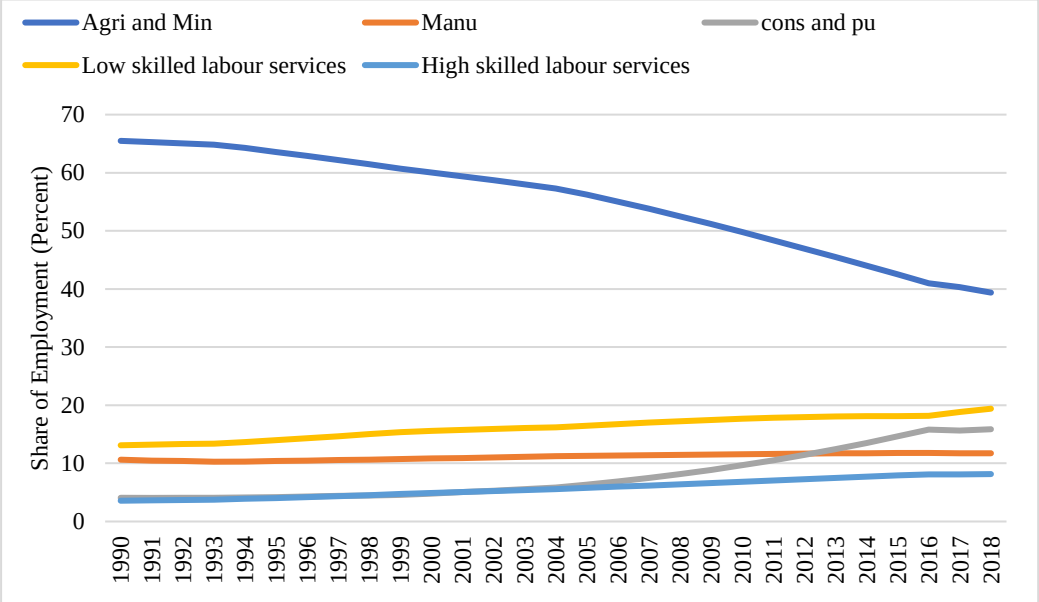
Figure 1.3 indicates a shift in labour employment from the sectors of agriculture and mining to low-skilled and high-skilled services in India, depending on the level of skill. In 2018, the employment share in low-skilled services increased to 19.40 percent, and in high-skilled services, it rose to 8.15 percent. Employment in agriculture and mining came down to almost 40 percent in 2018 compared to 1990. Construction and public utilities employment increased to 16 percent of all employment, while the manufacturing sector remained at 11.75 percent.

India's Economic Surveys in 2015 and 2017 explored the promotion of manufacturing versus services. The 2014-2015 survey suggested that the choice lies between skill-intensive and unskilled-intensive sectors, rather than strictly manufacturing versus services. In contrast, the 2016-2017 survey argued that labour-intensive sectors could better address India's job challenge. The World Economic Outlook for 2018 indicated that shifting from manufacturing to services jobs could enhance welfare and improve productivity. Additionally, it suggested that this shift toward services might lead to faster income convergence for developing countries. Despite India's dominance in

services, particularly in ICT, the roles of manufacturing and services in productivity and income growth require further scrutiny for India's structural transformation.

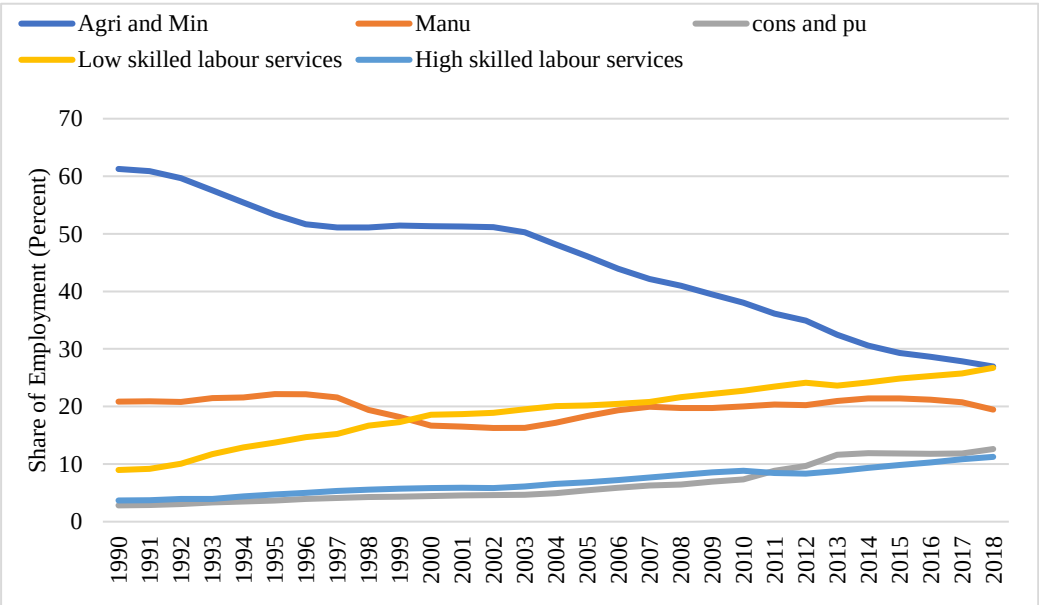
Bhadury et al. (2021) studied labour shifts across three periods: post-liberalization (1991-2002), high growth (2003-2008), and post-GFC (2009-2017). They observed a trend of labour moving toward less productive sub-sectors within services, raising questions about the sector's potential for creating meaningful employment.

Figure 1. 3: India's share of sectoral employment to total employment (percent)



Source: Author Computed based on Economic Transformation Database (ETD), 2021

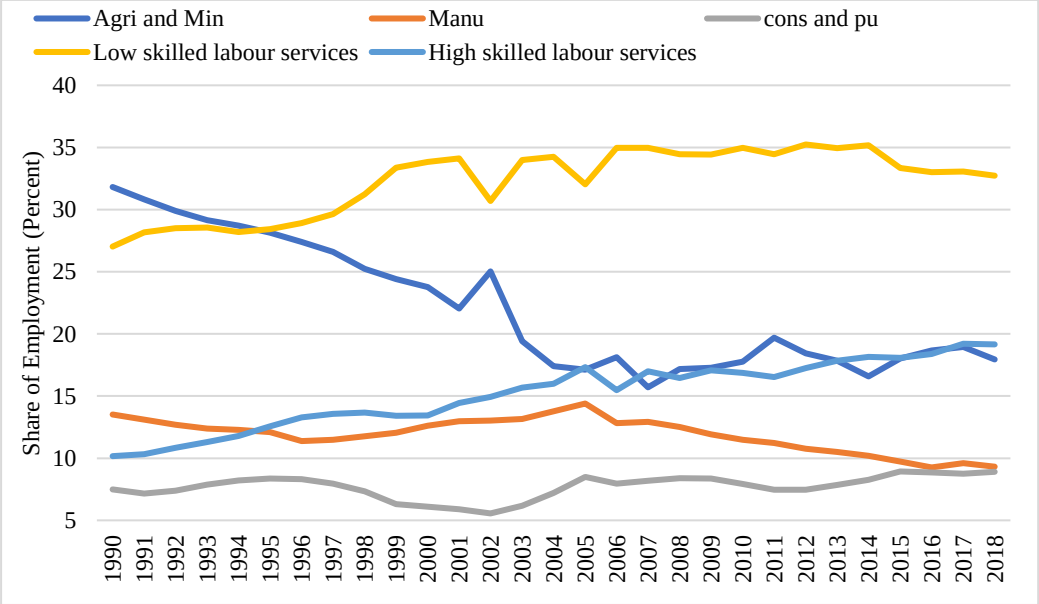
Figure 1. 4: China's share of sectoral employment to total employment (percent)



Source: Author Computed based on Economic Transformation Database (ETD), 2021

Figure 1.4 indicates a shift in labour employment from the sectors of agriculture and mining to low-skilled and high-skilled services in China, depending on the level of skill. In 2018, the employment share in low-skilled services increased to 26.72 percent, and in high-skilled services, it rose to 11.26 percent. Employment in agriculture and mining came down to almost 27 percent in 2018 compared to 1990. Construction and public utilities employment increased to 12.62 percent of all employment, while the manufacturing sector remained at 19.48 percent.

Figure 1. 5: South Africa share of sectoral employment to total employment (percent)



Source: Author Computed based on Economic Transformation Database (ETD), 2021

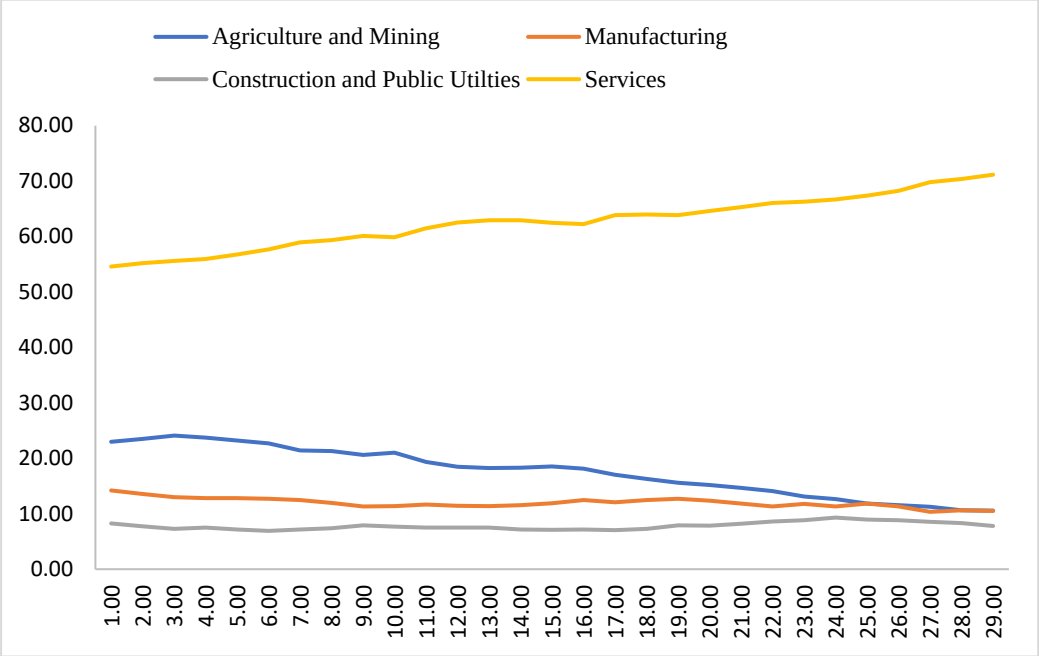
Figure 1.5 indicates a shift in labour employment from the sectors of agriculture, mining, and manufacturing to low-skilled and high-skilled services in South Africa, depending on the level of skill. In 2018, the employment share in low-skilled services ranged between 27 percent and 35 percent, and in high-skilled services, it rose to 19.17 percent. Employment in agriculture and mining came down to almost 18 percent in 2018 compared to 1990. Construction and public utilities employment increased to 9 percent of all employment, while the manufacturing sector declined to 9.33 percent.

4.2 Inter-Sectoral Changes in Output and Employment in BRICS Countries

Fuchs (1968) explored the temporal changes in labour force allocation across different sectors. By examining the anticipated shifts in this allocation, based on dividing economic activities into three sectors, Fuchs related employment proportions to economic growth. His findings revealed that as per capita income rises, the distribution of the labour force changes. Initially, employment in the primary sector decreases rapidly as workers transition to secondary and tertiary sectors. However, as development progresses, the movement of labourers from the primary sector slows down, stabilizing at around 3 percent of the labour force. Ultimately, employment shares in the secondary and tertiary sectors reach 40 and 57 percent, respectively.

As an economy's per capita income rises, employment tends to shift away from the primary sector (such as agriculture) toward other sectors. However, this shift slows down as income increases further (Chenery & Taylor, 1968 and Chenery & Syrquin, 1975). Gemmell (1982) observed that structural change initially leads to increased employment in the secondary and tertiary sectors, drawing workers away from the primary sector. Surprisingly, instead of the expected shift to the secondary sector, the service sector's employment starts rising, surpassing manufacturing. This suggests that the service sector's share grows at the expense of manufacturing jobs. Economic theory supports this trend, as services typically have higher income elasticities of demand than industrial production. Although industrial output initially outpaces services with rising income, eventually, services catch up. Notably, productivity in the service sector grows more slowly than in industry. Consequently, as surplus agricultural labour is absorbed, labour shifts from industry to services to maintain balanced output growth. Baumol (1967) developed a model illustrating these patterns, showing that economies consistently follow similar structural changes as income increases.

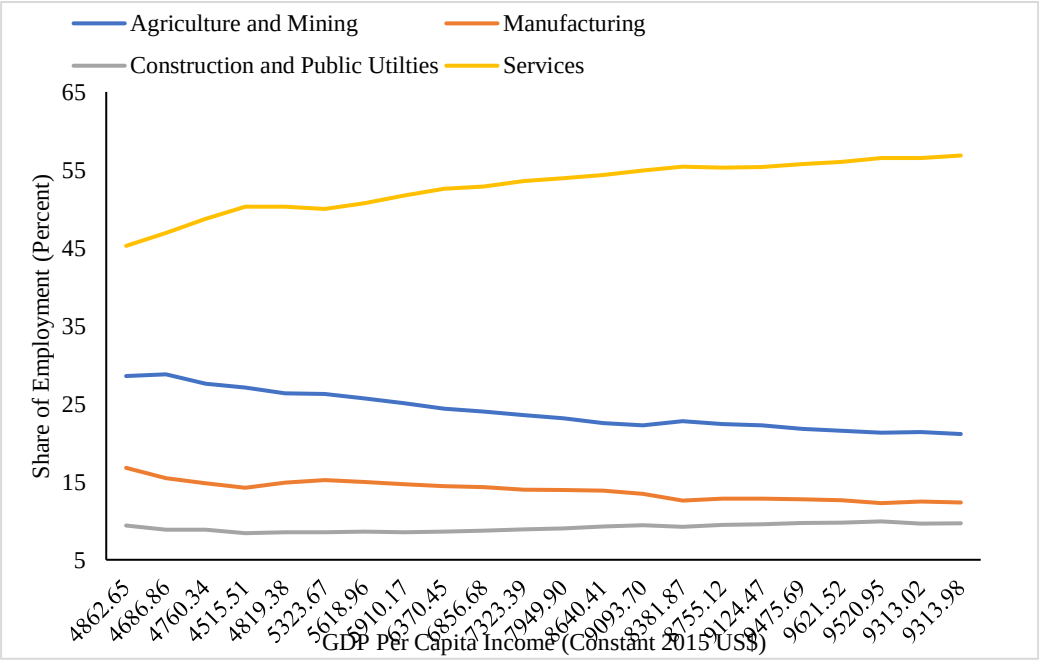
Figure 1. 6: Brazil's Sectoral Share of Employment and Per Capita Income in Percent



Source: Author Computed based on Economic Transformation Database (ETD), 2021

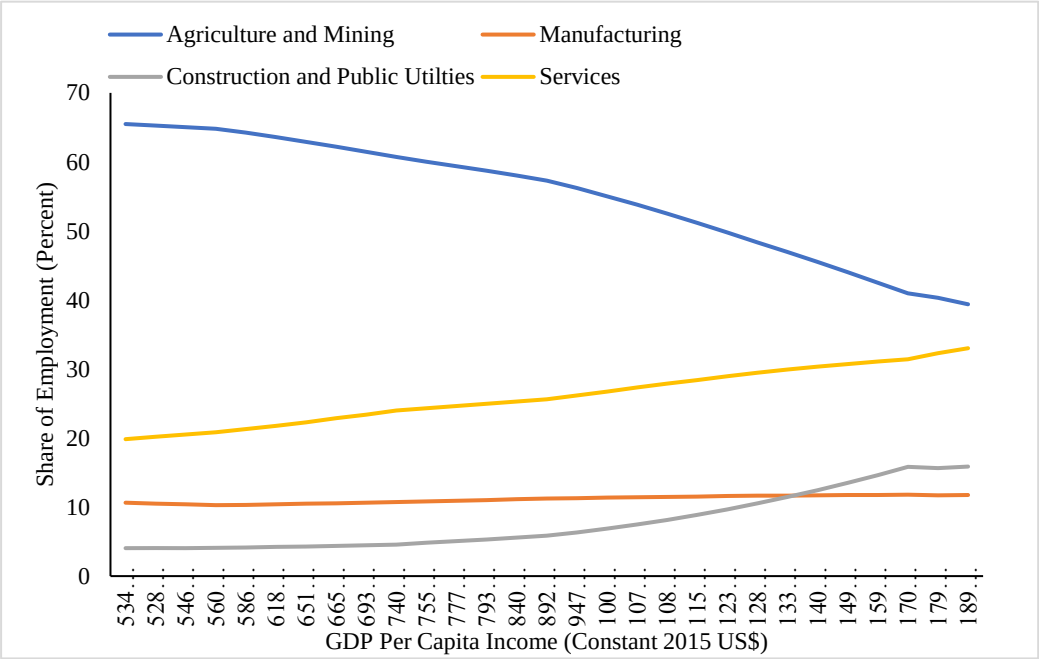
In Figure 1.7, Brazil's employment patterns partially meet the Gemmell criteria. While there is a significant inter-sectoral employment shift from agriculture to services, the same is not observed for the manufacturing sector. This suggests that the expected employment shift from agriculture to manufacturing, as per capita income increases (as proposed by Fuchs, Gemmell, and Baumol), has not significantly occurred in Brazil. Instead, a huge amount of employment has moved from agriculture to the services sector, more so than to manufacturing.

Figure 1. 7: Russia's Sectoral Share of Employment and Per Capita Income in Percent



In Figure 1.8, Russia's employment patterns partially meet the Gemmell criteria. While there is a change in sectoral employment from agriculture to services, the same is not observed for the manufacturing sector. This suggests that the expected employment shift from agriculture to manufacturing, as per capita income increases (as proposed by Fuchs, Gemmell, and Baumol), has not significantly occurred in Russia. Instead, the share of employment shift from agriculture to the services sector, while the share of employment in manufacturing declines.

Figure 1. 8: India's Sectoral Share of Employment and Per Capita Income in Percent



Source: Authors Computed based on ETD (2021) and WDI

In Figure 1.9, the sectoral change in employment in India partially aligns with the Gemmell criteria. While there is a significant shift from agriculture to services, the same is not true for the manufacturing sector. This shows that the expected shift from agriculture to manufacturing with rising per capita income (as suggested by Fuchs, Gemmell, and Baumol) has not significantly materialized in India. Instead, a huge amount of labour has moved from agriculture to services, and the manufacturing share

of employment has more or less remained the same. However, there has been a significant increase in the employment share in Construction and Public Utilities.

Data shows a strong positive trend in services and a mild upward trend in manufacturing, indicating rapid job creation in services. Like other developing economies, India's employment share is shifting from agriculture to services, bypassing manufacturing. This could mean India skipped the traditional industrialisation phase, leading to 'premature deindustrialisation' (Dasgupta and Singh, 2006; Rodrik, 2016). Recent observations (Lamba and Subramanian, 2020) confirm this trend and note that the traditional structural transformation of labour from low-productivity agriculture hasn't occurred in India, potentially affecting income distribution and hindering income convergence with advanced countries.

In Figure 1.10, the sectoral change in employment in China aligns with the Gemmell criteria. As the agriculture sector reaches the point of stagnant growth, employment should shift to the manufacturing sector as per the structural change theory, but instead, the service sector's employment begins to rise, taking over from the manufacturing sector. It shows that the share of the service sector is comparatively greater than the share of the manufacturing sector, and its share increases at the expense of manufacturing jobs. However, there has been a significant increase in the employment share in Construction and Public Utilities.

Figure 1. 9: China's Sectoral Share of Employment and Per Capita Income in Percent

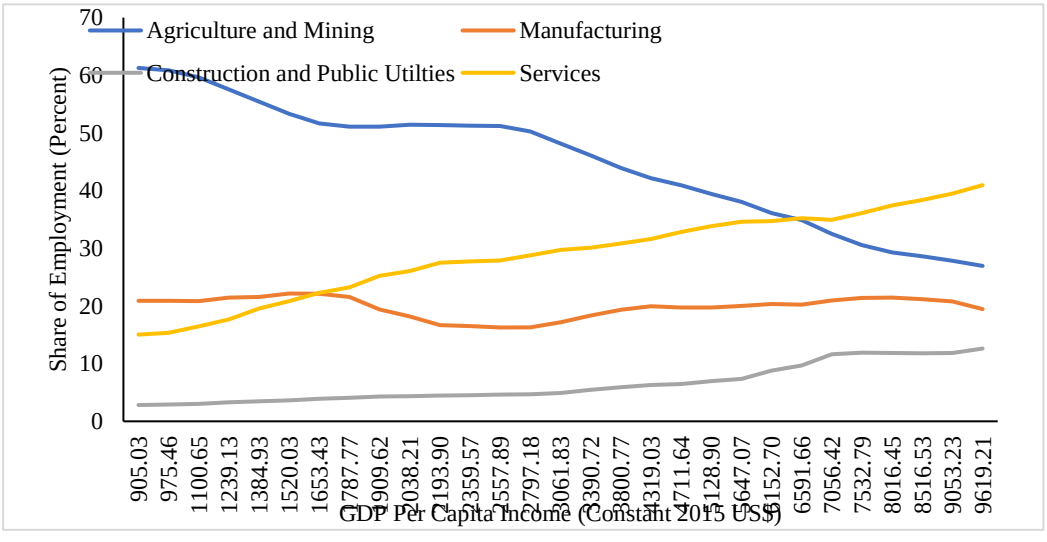
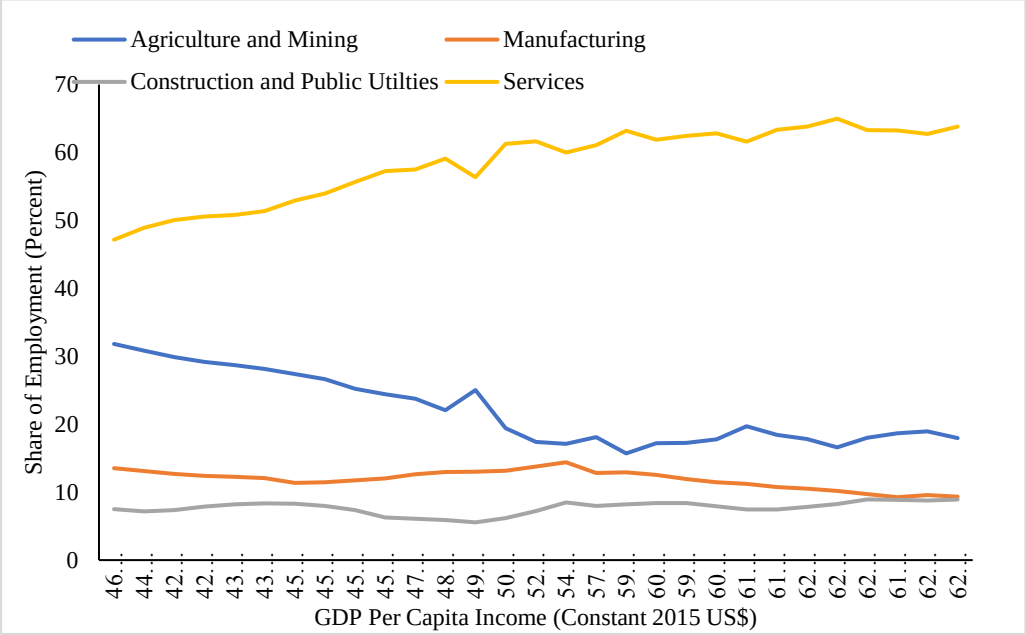


Figure 1. 10: South Africa's Sectoral Share of Employment and Per Capita Income in Percent



Source: Authors Computed based on ETD (2021) and WDI

In Figure 1.11, the sectoral change in employment in South Africa partially aligns with the Gemmell criteria. While there is a significant shift from agriculture to services, the same is not true for the manufacturing sector. This shows that the expected shift from agriculture to manufacturing with rising per capita income (as suggested by Fuchs, Gemmell, and Baumol) has not significantly materialized in South Africa. Instead, a huge amount of labour has moved from agriculture to services, and the manufacturing share of employment has more or less remained the same.

Therefore, the pattern of development in BRICS countries is different from that of any other country in the world, as observed by many economists. The pattern of development in BRICS does not satisfy the conditions outlined by Fisher, Clark, and Fuchs.

4.3 Sectoral productivity and Employment share in BRICS Countries

McMillan & Rodrik (2014) methodology is employed to examine the relationship between labour productivity and employment flow across several sectors within the

BRICS economies. The data analysis spans from 1990 to 2018, plotting the natural logarithm of sectoral productivity relative to total productivity against changes in sectoral employment share. In the figure, circle size represents the sectoral share of employment in 2018. When the linear regression line slopes upward, it indicates that structural changes either stimulate or restrain growth. Assuming these changes involve resource shifts from less productive to more productive sectors, we expect a decline in employment proportion in less productive sectors (lower left quadrant) and an increase in more productive sectors (uppermost right quadrant). A positive slope in the regression line suggests that structural changes promote growth, with employment shifting away from lower-productivity industry sectors (e.g., agriculture, retail, and wholesale trade) toward higher-productivity sectors (e.g., manufacturing, financial, business, insurance services). Conversely, when structural changes reduce growth, the regression line may not show a positive slope, and the calculated coefficients may be statistically insignificant.

Firpo and Pieri's (2017) formula is used to determine the economy's total productivity for the ET database. The productivity of the sector i at the moment t is represented by the natural logarithm of the ratio of the Gross value-added share of sector i to its employment share.

Symbolically,

$$P_{t,i,ETD} = \ln\left(\frac{GVA_{t,i,ETD}}{EMP_{t,i,ETD}} \Big/ \frac{GVA_{t,ETD}}{EMP_{t,ETD}}\right) = \ln\left(\frac{GVA_{t,i,ETD}}{EMP_{t,i,ETD}}\right) - \left(\frac{GVA_{t,ETD}}{EMP_{t,ETD}}\right)$$

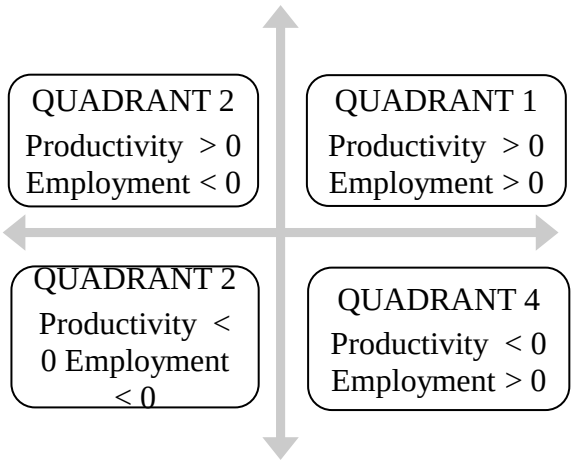
$$= \ln\left(\frac{GVA_{t,i,ETD}}{GVA_{t,ETD}}\right) - \ln\left(\frac{EMP_{t,ETD}}{EMP_{t,i,ETD}}\right) \quad (1.1)$$

Where P stands for the level of productivity, t is for the year, i stands for each sector and ln is the natural log, ETD denotes Economic Transformation Database, GVA

stands for gross value-added, while EMP refers to the count of individuals employed, in such a way that $GVA_{ETD} = \sum_{i=1}^{9} GVA_{i,ETD}$ and $EMP_{ETD} = \sum_{i=1}^{9} EMP_{i,ETD}$.

In the context of the BRICS economies, the analysis utilizes Economic Transformation Data (ETD) spanning from 1990 to 2018. These data represent gross value added at constant prices in national currencies. Additionally, employment data is incorporated to identify trends in labour productivity. The database covers 12 major economic sectors, including agriculture, mining, manufacturing, public utilities, transportation, trade, real estate, finance, business services, and government services. To illustrate the speed, severity, and consistency of structural change, McMillan and Rodrik's (2011) methodology is applied. The analysis focuses on the period from 1990 to 2018, with the horizontal axis measuring sector-wise changes in employment share and the vertical axis representing relative productivity levels within each country. Structural change patterns for each country during this period are depicted in charts, examining three dimensions: pace (length of the regression line relative to the intercept), intensity (slope of the regression line), and consistency level (by comparing pace and intensity over the long run).

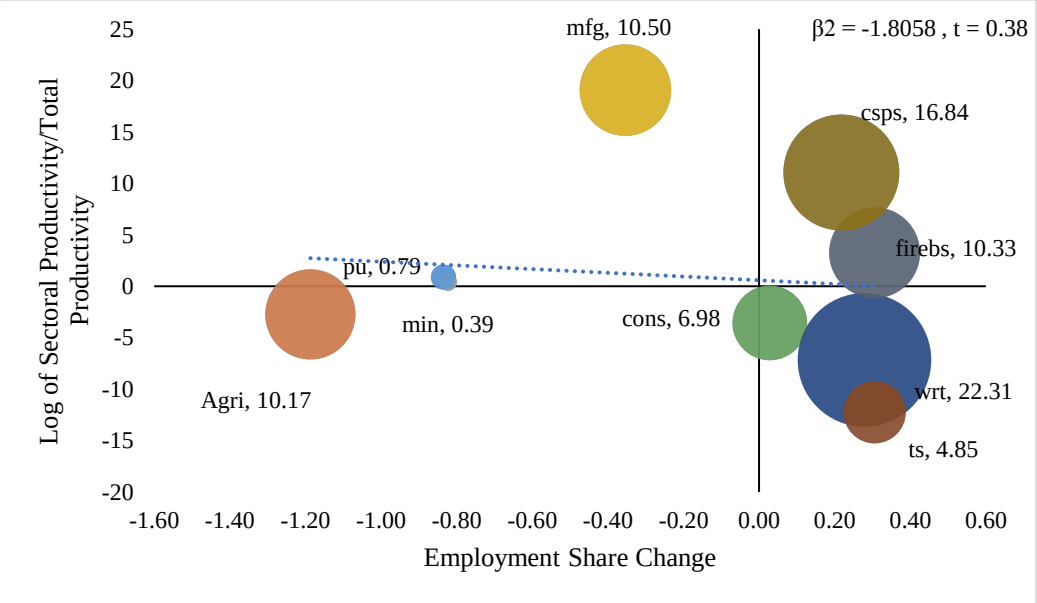
Figure 1. 11: Quadrant showing sectoral employment and productivity changes



Source: Decomposition by Baily et al. (1996)

To investigate the long-term connection between productivity improvements and structural changes. For each of the four quadrants, four-level of changes in employment and productivity of sectors are considered: sectors where employment and productivity increased in the long run, sectors where productivity increased and employment declined, sectors where employment and productivity declined and sectors where employment increased and productivity declined. The abbreviations used in the figures are as follows: 'Agri' stands for agriculture, 'min' for mining, 'mfg' for manufacturing, 'pu' for public utilities, 'cons' for construction, 'wrt' for wholesale and retail trade, 'ts' for transportation and storage, 'firebs' for financial and insurance, real estate and business services, and 'csps' for community, social and personnel services.

Figure 1. 12: Brazil's sectoral productivity and the employment share change

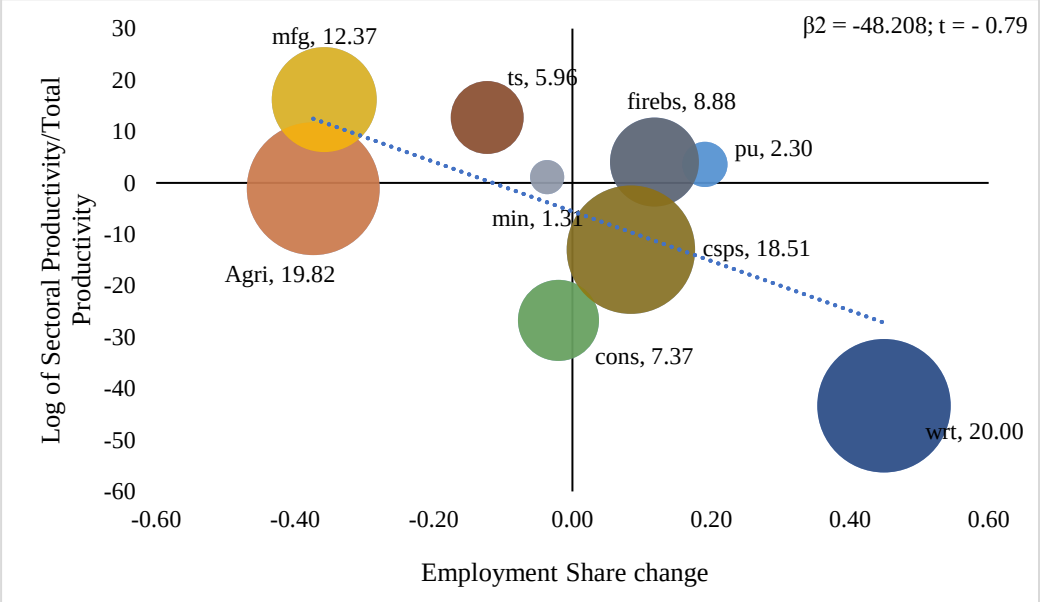


Note: The circle's size corresponds to the employment share in 2018, β2 the regression coefficient representing the change in ln(yi/Y) produced by each unit change in employment share: ln(yi/Y) = β1 + β2 ΔEmp. Share
Source: Authors Calculations based on Economic Transformation Database (2021)

In Figure 1.13, sectoral employment in Brazil exhibits interesting patterns. The less productive agricultural sector (bottom left quadrant) sees a shift toward relatively more productive manufacturing (top left quadrant), while wholesale and retail trade (bottom right quadrant) become key employers. Among non-tradable sectors, personal and

community services, real estate, banking, insurance, and business services experience rapid growth, falling within quadrant 1 where both employment and productivity are high. Conversely, the bottom right quadrant includes retail and wholesale trade, transportation, storage, and communications, characterized by low productivity but a significant employment share. The slight negative slope of the regression line suggests that structural change may marginally slow growth.

Figure 1. 13: Russia's sectoral productivity and the employment share change



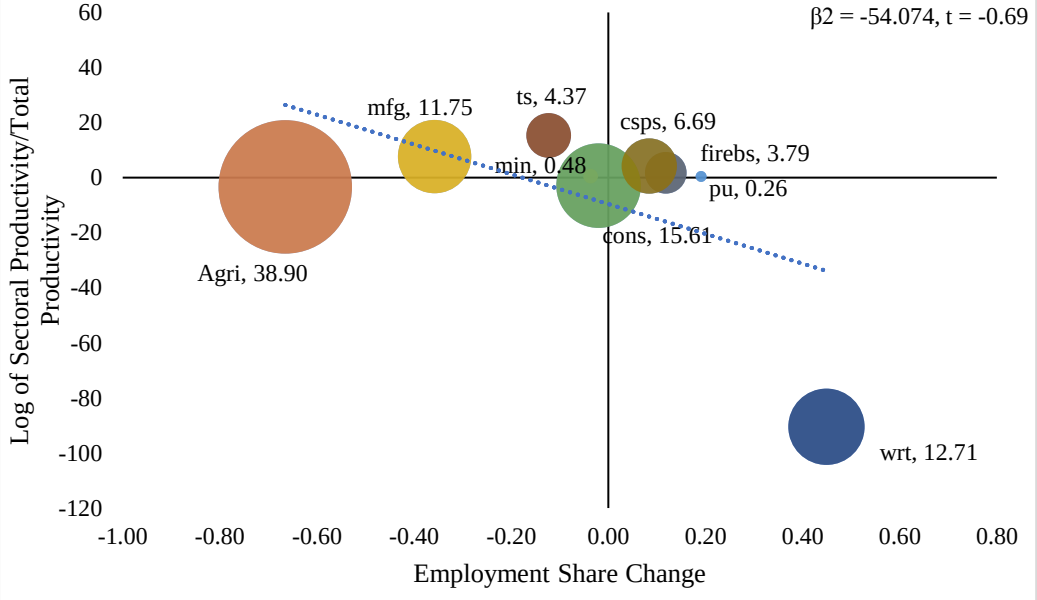
Source: Authors Calculations based on Economic Transformation Database (2021)

In Figure 1.14, Employment in each sector shifts from the less productive sector of agriculture (bottom left quadrant) to the relatively more productive manufacturing (top left quadrant), and then mostly back to the less productive sectors of wholesale and retail trade, personal and community services (bottom right quadrant), where employment has increased. Among the non-tradable sectors, public utilities, real estate, banking, insurance, and business services experienced the most rapid growth. These sectors are in quadrant 1, where both employment and productivity are high. The sector which comes under the bottom right quadrant shows a low level of productivity but the high level of employment share includes retail and wholesale trade, personal and

community services. The regression line's downward slope implies that growth may be significantly reduced by structural changes.

In Figure 1.15, Employment in each sector shifts to less productive sectors such as the wholesale and retail sectors and construction sectors. The sectoral employment moves from the less productive sector of agriculture (bottom left quadrant) towards relatively more productive manufacturing, transport, storage and communication (top left quadrant) than construction, wholesale and retail trade (bottom right quadrant) which are now key employers in India. Among the non-tradable sectors, personnel and community services real estate, banking, insurance, and business services experienced the most rapid growth. These sectors are in quadrant 1, where both employment and productivity are high. The sector which comes under the bottom right quadrant shows a low level of productivity but the high level of employment share includes only wholesale and retail trade and construction.

Figure 1. 14: India's sectoral productivity and the employment share change

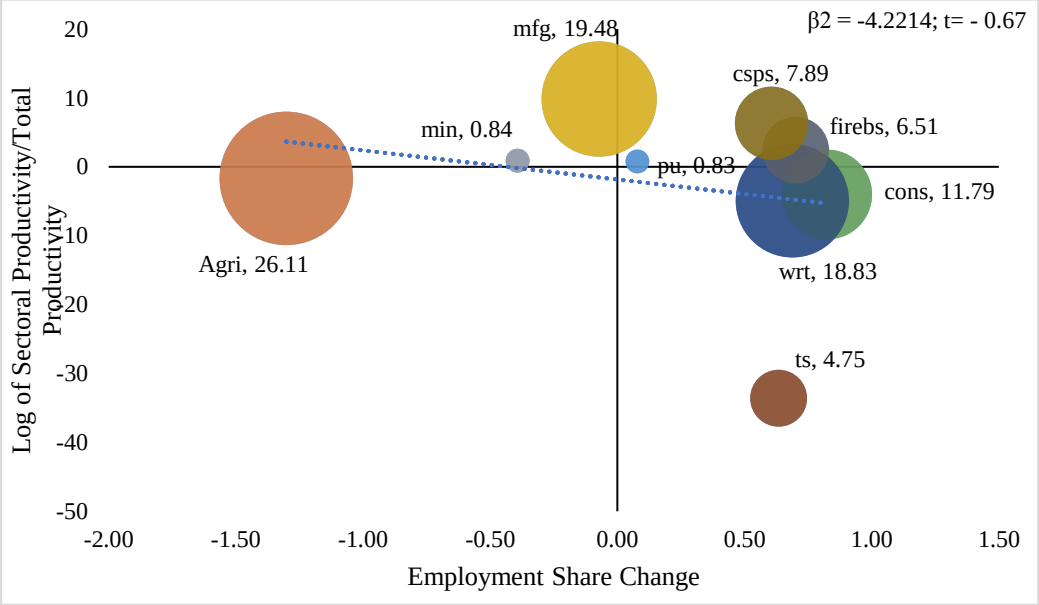


Source: Authors Calculations based on Economic Transformation Database (2021)

In Figure 1.16, Employment has shifted from less productive agriculture to more productive manufacturing and less productive retail, wholesale trade, and construction.

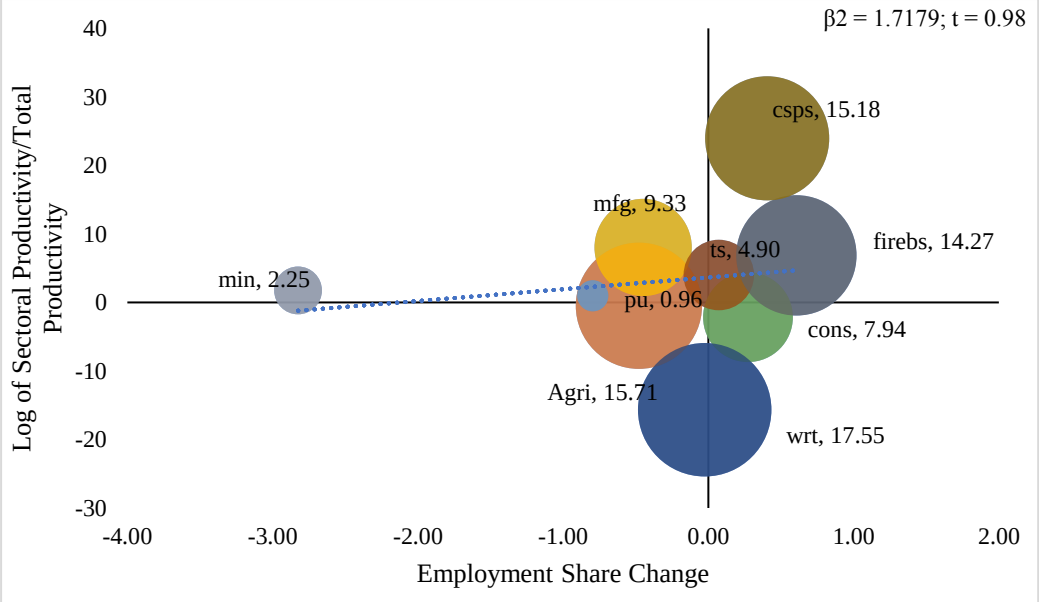
Non-tradable sectors like personal and community services, real estate, banking, insurance, and business services saw rapid growth, with high employment and productivity. Retail, wholesale trade, construction, transportation, and storage have high employment but low productivity. The slight negative slope of the regression line suggests structural change may marginally slow growth.

Figure 1. 15: China's sectoral productivity and the employment share change



Source: Authors Calculations based on Economic Transformation Database (2021)

Figure 1. 16: South Africa sectoral productivity and the employment share change



Source: Authors Calculations based on Economic Transformation Database (2021)

In Figure 1.17, employment has shifted from less productive agriculture to more productive manufacturing and less productive retail, wholesale trade, and construction. Non-tradable sectors like personal and community services, real estate, banking, insurance, and business services saw rapid growth, with high employment and productivity. Retail, wholesale trade, and construction have high employment but low productivity. The slight positive slope of the regression line suggests structural change may slightly accelerate growth.

Employment in South Africa's mining and manufacturing sectors has declined due to the sector's downturn, falling commodity prices, and increased capital intensity. Conversely, employment has risen in the less productive wholesale and retail trade sector, which now employs a significant portion of the workforce, particularly in informal sector activities.

BRICS economies share trends of shifting labour from agriculture to manufacturing and services, boosting productivity and job creation. India skipped manufacturing, moving directly to services. As global growth slows, balancing productivity and quality employment is challenging, especially for youth and vulnerable groups. MSMEs are key job creators but often have low productivity (ITC, 2022). Some countries bypass manufacturing for services, which can still drive productivity (ILO, 2023). In Brazil, labour shifted to low-skilled services, with limited structural change (Nassif et al., 2020). Policies improving education and labour productivity may be more beneficial (Firpo and Pieri, 2017). Russia's growth could benefit from enhanced labour mobility and regional development initiatives (McKinsey & Company, 2009).

Post-independence, India's economy grew steadily, accelerating from 3.5 percent to 6 percent in the 1990s and 7.8 percent from 2001-2008, maintaining 6.8 percent from 2009-2019. The employment structure shifted from agriculture to services, especially

IT, but job growth lagged behind economic growth (Chandrasekhar, 2016). China's economy transformed over 40 years, with a 24-fold increase in GDP per capita and a shift from agriculture to urban industrialization, driven by 10 percent productivity growth (Brandt et al., 2020; Bosworth & Collins, 2007). South Africa faced premature deindustrialization, with manufacturing's GDP contribution falling from 21 percent in 1994 to 13 percent in 2016, leading to job losses and a shift to a service-heavy economy without full manufacturing benefits (Bell et al., 2018; Bhorat & Rooney, 2017).

4.4 Structural Change in BRICS and Growth in Labour Productivity

There are two methods to increase labour productivity in a given economy. First, through capital investment, improving technology, or controlling reallocation across the sector to raise the productivity 'within' economic sectors. Second, the economy's overall labour productivity can be raised by shifting labour to highly productive sectors from low-productive ones. McMillan, Rodrik & Verduzco-Gallo (2014) decomposition technique is used to measure productivity:

$$\Delta P_t = \sum_{i=n} e_{i,t-k}\, \Delta p_{i,t} + \sum_{i=n} p_{i,t-n}\, \Delta e_{i,t} \qquad (1.2)$$

Where $p_{i,t}$ and P_t refer to levels of labour productivity in different sectors and the entire economy, and $e_{i,t}$ employment share in sector i. The Δ indicates the difference between $t-n$ and t in terms of productivity or $t-k$ and t in terms of employment shares. The productivity changes within each sector can be broken down into two components. First, there's the "within effect," which accounts for the total change in productivity within a sector, adjusted by employment weights. These weights represent the initial shares of employment in each sector. Second, we have the "structural change" term, which measures the impact of labour shifts between sectors on productivity. When there's a direct relationship between employment share shifts and productivity levels,

the economy's growth is influenced by structural changes. However, it's essential to consider gaps in labour productivity across sectors. For example, if the service sector experiences high productivity, but its employment share falls, this could lead to ambiguous effects on overall economic development. Relocating labour from higher to lower productivity industries may even result in negative growth for the economy.

When a country is in its early stages of development, structural improvements that stimulate economic growth are known as productivity-enhancing structural changes. On the other hand, these changes are referred to as growth-reducing structural changes when the rise in labour productivity is caused by sectoral or internal change and if it is not followed by any structural change. An improvement in labour productivity is mainly determined by changes within sectors, rather than significant structural changes. Until the country adopts new techniques in the production process, growth may not increase without these structural changes. In comparison, the gains in labour productivity will increase the growth of a developing country when these gains come from sectoral change or within effects and are converted to structural change effects (McMillan and Rodrik, 2011).

Here labour productivity of the BRICS economies was calculated for three periods: 1990-2000; 2001- 2010; and 2011-2018. The first period, 1990-2000, was a period wherein Brazil's and Indian economies faced problems like the balance of payment crisis, fiscal crisis and high inflation rates. As a result, the Indian economy has passed through the transition phase through the adoption of the New Economic Policy and Brazil falls into a recession phase due to low levels of investment and high inflation rates. During the second period 2001-2010 where all the countries maintained internal stability and increase economic growth. The 2008 world financial crisis marked this

period, resulting in a recession in global economic growth. However, from 2011 to 2018, the countries of BRICS exhibited stable economic development.

Both the internal and external factors affect productivity growth in Russia. The internal factor was the Russian Federation's development in the 1990s. Then, during the early 2000s, external factors started to affect the situation. The earlier slowdown within the economic sectors was brought on by inefficiency, which lowers productivity (Ickes 2008). Then from 2000 onwards entering of new institutions and growing trade with the world economy were initiated. The other factors that have brought structural changes are the availability of international credit, the inflow of FDI, domestic firms growing share in the global supply, ICT advancement, and the merging of those sectors whose productivity level is low.

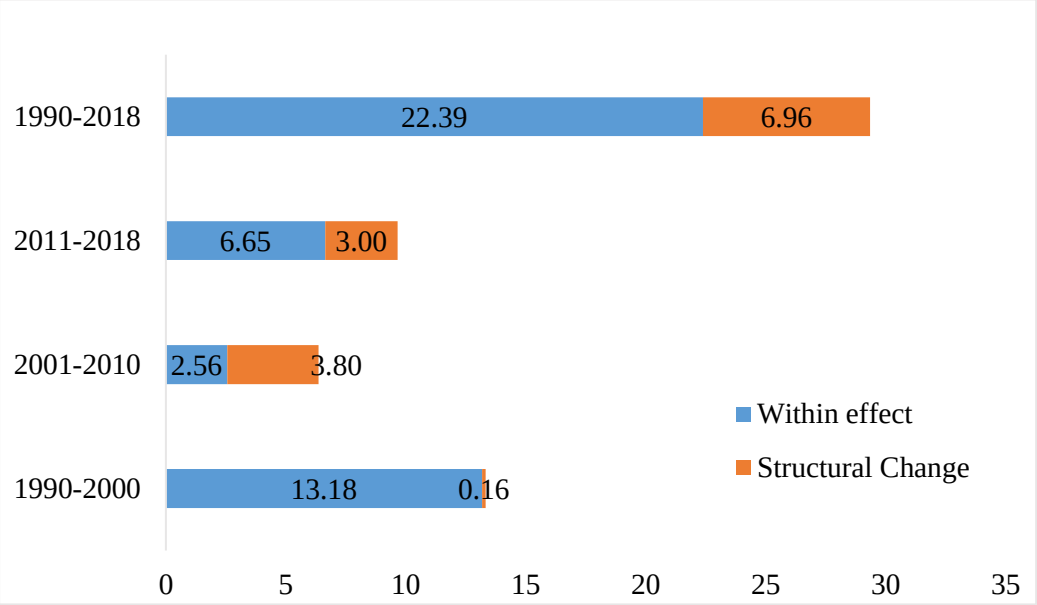
A crucial element of structural changes for long-term economic growth and development is the shift from a highly productive sector to a less productive one. As a result, the research has looked at the level of structural change that the region and the countries that make up it is undergoing or may have experienced. Since the manufacturing sector is not fully integrated into the process of structural changes brought by industrialization, the revival of the African economy is not attributable to it Rodrik (2014). In a similar vein, McMillan and Harttgen (2014) note structural shifts in the form of a large expansion in services without any comparable rise in manufacturing.

According to research by Bhorat et al. (2017), since 2000 in Africa, there is significant growth in the services sector and deceleration in the manufacturing sector. So, the question arises: Will structural shifts ultimately provide rising economies like Africa with a different development path? Instead of being a manufacturing-led path, this one could be a service-led one. It is noteworthy that there is an appealing and important

research question, whether the emerging economies might be able to develop themselves and undergo structural change through services sectors.

Figure 1.18 shows that Brazil's labour productivity growth from 1990-2000 was driven by a "Within effect" of 13.18 percent, with minimal structural change (0.16 percent). From 2001-2010, growth was 2.56 percent due to "Within effect" and 3.80 percent due to structural change. For 2011-2018, the figures were 6.65 percent and 3 percent, respectively. Overall (1990-2018), "Within effect" contributed 22.39 percent to productivity growth, while structural change contributed 6.96 percent. This growth is attributed to capital investment, technological progress, and modern management practices, especially in manufacturing, which increased productivity but reduced manufacturing jobs (Bonelli, 2004).

Figure 1. 17: Labour Productivity decomposition for Brazil, 1990–2018

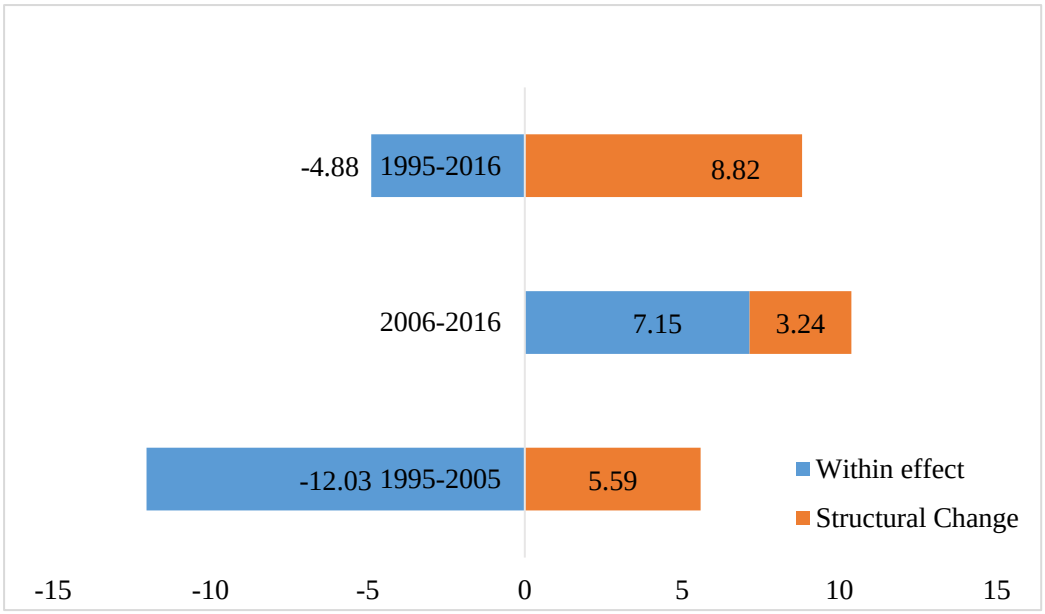


Source: Authors Calculations based on Economic Transformation Database (2021)

Figure 1.19 shows that Russia's labour productivity growth from 1995-2005 decreased due to a negative "Within effect" of -12.03 percent, with a positive "Structural Change" contribution of 5.59 percent. From 2006-2016, "Within effect" and "Structural Change" contributed 7.15 percent and 3.24 percent, respectively. The rise in productivity is

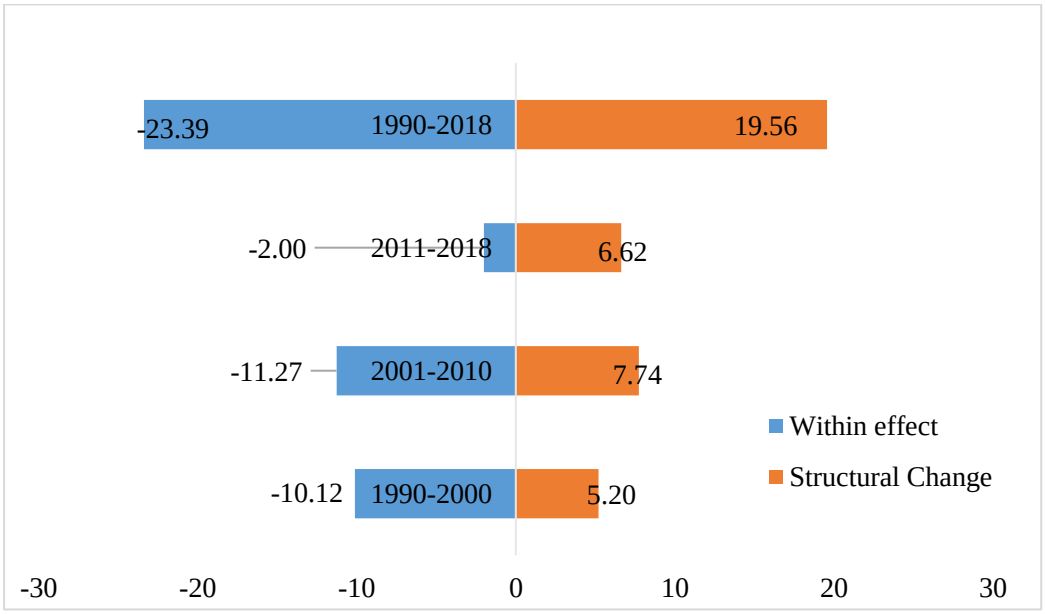
attributed to changes within sectors, industry performance, and new product creation, influenced by labour movement and resource allocation. Capital investment in mining, low-skill services, and modern technology in various sectors also played a key role (Voskoboynikov, 2020; Timmer and Voskoboynikov, 2016).

Figure 1. 18: Labour Productivity decomposition for Russia, 1995–2016



Source: Authors Calculations based on Economic Transformation Database (2021)

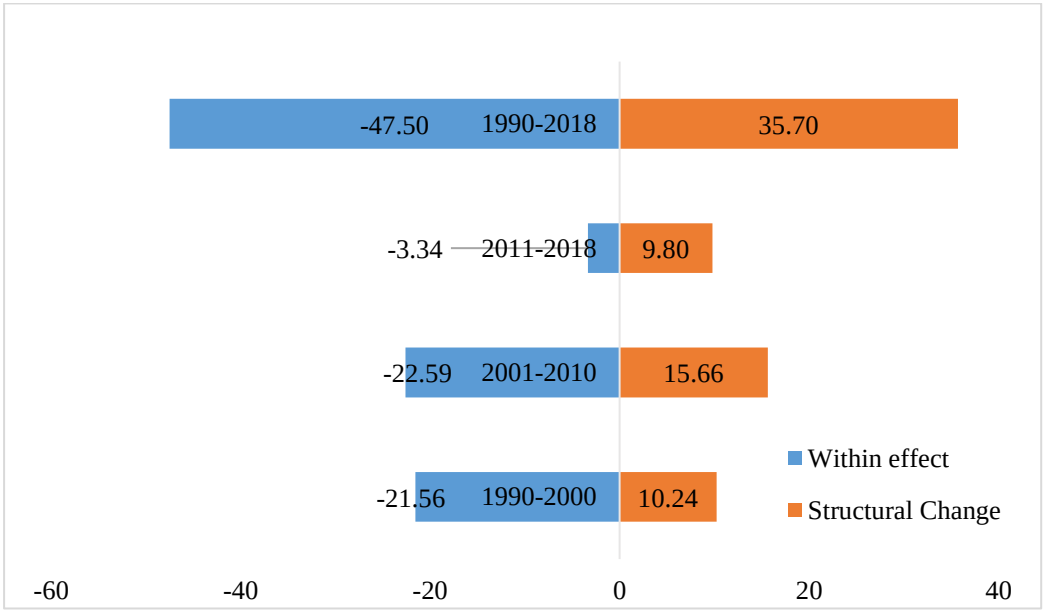
Figure 1. 19: Labour Productivity decomposition for India, 1990–2018



Source: Authors Calculations based on Economic Transformation Database (2021)

Figure 1.20 shows that India's labour productivity growth from 1990-2000 decreased due to a negative "Within effect" of -10.12 percent and a positive "Structural Change" of 5.20 percent. From 2001-2010, the "Within effect" was -11.27 percent, while "Structural Change" was 7.74 percent. For 2011-2018, the "Within effect" was -2 percent and "Structural Change" was 6.62 percent. Overall (1990-2018), "Structural Change" contributed 19.56 percent to productivity growth, while "Within effect" was -23.39 percent. The shift of labour to more productive sectors, especially from agriculture to services, significantly boosted productivity (Dieppe, 2020; Krishna et al., 2022).

Figure 1. 20: Labour Productivity decomposition for China, 1990–2018

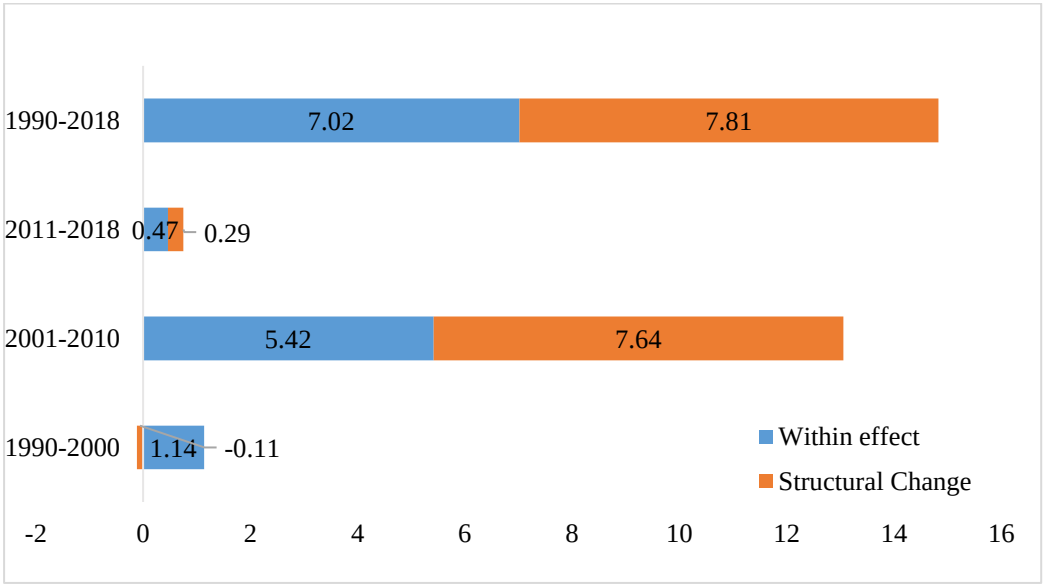


Source: Authors Calculations based on Economic Transformation Database (2021)

Figure 1.21 shows that China's labour productivity growth from 1990-2000 decreased due to a negative "Within effect" of -21.56 percent, with a positive "Structural Change" of 10.24 percent. From 2001-2010, the "Within effect" was -22.59 percent, while "Structural Change" was 15.66 percent. For 2011-2018, the "Within effect" was -3.34

percent and “Structural Change” was 9.80 percent. Overall (1990-2018), “Structural Change” contributed 35.70 percent to productivity growth, while “Within effect” was -47.50 percent. The shift of labour from agriculture to manufacturing and services significantly boosted productivity, though services’ marginal productivity grew more slowly than industry’s (Bulman & Kraay, 2011).

Figure 1. 21: Labour Productivity decomposition for South Africa, 1990–2018



Source: Authors Calculations based on Economic Transformation Database (2021)

Figure 1.22 shows that South Africa’s labour productivity from 1990-2000 increased slightly due to a “Within effect” of 1.14 percent, with a small negative structural change of -0.11 percent. From 2001-2010, productivity grew by 5.42 percent due to “Within effect” and 7.64 percent due to structural change. For 2011-2018, productivity declined to 0.47 percent and 0.29 percent, respectively. Overall (1990-2018), “Within effect” contributed 7.02 percent and structural change 7.81 percent. Growth is attributed to capital investment, technological progress, and labour movement across sectors, with employment shifting from agriculture to manufacturing, retail, wholesale trade, and construction.

Table 1. 1: Overall Labour productivity growth (1990–2018)

	Total Labour Productivity (Percent)	Contribution of	
		"Within effect" (Percent)	Structural Change (Percent)
Brazil	29.35	22.39	6.96
Russia	3.94	-4.88	8.82
India	-3.83	-23.39	19.56
China	-11.79	-47.50	35.70
South Africa	14.83	7.02	7.81

Source: Authors Calculations based on Economic Transformation Database (2021)

The table shows that, except for Brazil and South Africa, the "within effect" negatively impacted labour productivity in China, India, and Russia. In China and India, higher internal effects counteracted the benefits of structural change, leading to negative productivity growth. Brazil and South Africa experienced significant contributions from both "within effect" and "structural change." Russia's productivity was positive due to significant structural changes despite a negative "within effect." The shift from primary to tertiary sectors boosted overall productivity and incomes in BRICS countries. The nature and pace of structural changes are key factors differentiating the progress of these countries (McMillan and Rodrik, 2011). Economic reforms in the 1980s and 1990s led to dissatisfaction in China and India. The shift to higher productivity activities decreased labour productivity growth to 11.73 percent in China and 3.83 percent in India (1990-2018). Since India's reforms, privatization, foreign direct investment, and outsourcing have rapidly increased employment in construction, communications, and business services (Kochhar et al., 2006). Dougherty et al. (2008) notes that manufacturing in China and India remained stable with few structural changes, except for increased textile employment. Brazil and South Africa saw structural changes that boosted growth. Internal factors, not just globalization, influenced these changes. Variations in productivity growth rates among countries are

due to different patterns of "within effects" and "structural change." Brazil's productivity growth was higher than South Africa's and Russia's, partly due to increased exposure to international competition. Structural change wasn't affected by 1990s trade liberalization, but sector productivity likely benefited. Firpo and Pieri (2017) and Muendler (2004) found that trade liberalization increased productivity and eliminated loss-making industries. Variations in structural change patterns among nations may be due to development gaps. China and India experienced structural changes that decreased productivity, while Brazil and South Africa saw increases. Despite Russia's large economy, its internal and structural change effects are lower compared to other nations.

Kapelyushnikov et al. (2012) found that Russia's sectoral employment remained constant despite fluctuations in gross value added, reflecting the economy's transitional and recovery phases, and the 2009 financial crisis. Labour movement and resource allocation influenced these changes (Voskoboynikov, 2020). Timmer and Voskoboynikov (2016) noted that capital investment in mining, low-skill services, and modern technology in various sectors primarily drove labour productivity increases. Greater structural change and sector productivity differences negatively impacted labour reallocation.

4.5 Factors Affecting Labour Productivity in BRICS

Labour productivity is influenced by factors like capital stock, technological advancements, infrastructure, policies, and migration. The Cobb-Douglas production function helps estimate productivity by considering these variables. Erumban et al. (2019) used a simplified version of this function with data from multiple sources.

$$lny_{c,t} = \beta_1 + \beta_2 lnk_{c,t} + \beta_3 lnmfg_{c,t} + \beta_4 lninf_{c,t} + \beta_5 lnger_{c,t} + \beta_6 lnurban_{c,t} + \beta_7 lninfra_{c,t} + \varepsilon_{c,t} \quad (1.3)$$

In this equation, y is labour productivity, k is capital stock per labour, mfg is manufacturing's share to total employment, inf is Infant mortality rate, ger is tertiary higher education gross enrollment ratio, $infra$ is infrastructure, and urban is urbanisation. All the variables are converted to the natural logarithm. $\varepsilon_{c,t}$ represents sector-specific shocks to labour productivity of country c at time t.

There is a direct relationship between capital per unit of labour ($k_{c,t}$) and labour productivity ($y_{c,t}$), and an indirect relationship between increased manufacturing employment share ($mfg_{c,t}$) and productivity when labour shifts from less productive sectors. Rivera and Currais (2003) argue that good physical health enhances labour quality and quantity, leading to more productive outcomes. Healthy workers have fewer absences and work more efficiently.

Bloom et al. (2004) suggest that good health enhances work effectiveness and bargaining power. Improved workforce health, indicated by lower infant mortality rates, boosts labour productivity. Nelson and Phelps (1996) show that an educated workforce can adopt modern techniques and conduct R&D, thus enhancing productivity. Gross enrolments in tertiary education (ger) are used as a proxy for labour skills, with higher enrolments indicating increased skills.

The seemingly unrelated regressions (SURE) method is useful when there are fewer countries and more years. Without dynamic specification, autocorrelation issues often arise in time series data, so a lagged dependent variable is used in equation (1.3). Changes in the dependent variable depend on several independent variables from the

previous model. The Arellano-Bond method of moments (Arellano and Bover, 1995; Blundell and Bond, 1998; Bond, 2002) is used for data estimation.

The study used data from the Penn World Table (10.0) on employment and capital stock for capital deepening. It also included variables like infant mortality rate, school enrollment, tertiary education (percent gross), per capita GDP (2015 US$), access to electricity, renewable electricity generation, per capita electricity consumption, and electricity transmission losses. Data on air transport, railways, shipping capacity, telephone and internet subscriptions, and broadband services were sourced from World Development Indicators (WDI) and Global Financial Development (GFD) for the infrastructure index. BRICS Statistics 2020 and WDI provided urban population growth rates, while the Economic Transformation Database offered data on manufacturing share and labour productivity.

Table 1.2 shows that the capital stock coefficient positively relates to labour productivity, with significant coefficients of 1.10 (fixed effects) and 1.73 (random effects). A decrease in the infant mortality rate positively impacts labour productivity. The coefficients β5 and β6 are negative and significant in both estimations. The infrastructure coefficient positively impacts labour productivity, while the correlation between labour productivity and the manufacturing sector share is positive but statistically insignificant. A detailed dataset is given in Annexure 1, 2 and 3.

Table 1.3 shows the dynamic panel model estimation given by the "difference GMM" and "system GMM." The model is also presented with a limited number of instrumental variables in the regression model, as this approach can easily result in an excessive number of instruments and overfitting. Therefore, it is essential to include the appropriate number of instrumental variables to prevent model bias. Lagged labour productivity's coefficient is reported to lie within the 0.59–0.63 region of all

specifications, showing a significantly higher degree of consistency corresponding to the significance levels of five and ten percent. Whereas the capital stock coefficient is statistically insignificant, its value declines considerably as would be expected in a dynamic model.

In the GMM system, the manufacturing share is statistically significant, which contributes to increased labour productivity. On the other hand, in both static and dynamic specifications, there is a negative value of the gross enrolment ratio coefficient, it is statistically insignificant in the dynamic specification, demonstrating that skills have a minimal impact on labour productivity across the panel in all of the BRICS countries. On the other hand, Infrastructure and the infant mortality rate have a significant positive effect on labour productivity. Finally, a coefficient of urbanisation that is positive in a difference GMM and negative in a system GMM.

Table 1. 2: Static Panel Regression Model: dependent variable = ln (labour productivity)

	Fixed Effect Model	Random Effect Model
$lnk_{c,t}$	1.103***	1.733***
	(3.80)	(20.95)
lnmfgc,t	0.0910	-2.005***
	(0.27)	(-7.68)
$lninf_{c,t}$	-1.578***	-1.306***
	(-5.17)	(-7.47)
$lnger_{c,t}$	-0.790***	-0.928***
	(-5.87)	(-9.10)
$lnurban_{c,t}$	-3.759*	-3.754***
	(-2.43)	(-19.24)
infra index	0.0939***	0.0624***
	(4.56)	(3.92)
Constant	14.37**	12.25***
	(3.39)	(6.90)
Observations	68	68
R^2	0.942	0.974

Table 1. 3: Dynamic Panel Regression Model: dependent variable = ln (labour productivity)

	Difference GMM	System GMM
L. $\ln p_{c,t}$	0.633**	0.591*
	(2.78)	(2.28)
$\ln k_{c,t}$	0.0737	1.080
	(0.10)	(1.43)
$\ln mfg_{c,t}$	0.584	0.891***
	(0.62)	(3.56)
$\ln inf_{c,t}$	0.362	0.0649
	(0.28)	(0.32)
$\ln ger_{c,t}$	-0.172	-0.480
	(-0.49)	(-1.60)
$\ln urban_{c,t}$	2.901	-1.500
	(0.99)	(-0.99)
infra index	0.0376	0.0688**
	(1.05)	(2.63)
Constant	--	-5.230*
		(-2.35)
AR (1)	0.36	0.41
AR (2)	0.20	0.14
Test for Sargan	0.84	0.84

t statistics are given in brackets,

* p < 5 percent, ** p < 10 percent, *** p < 1 percent significance level

Note: Results from one-step estimations are used for coefficient estimates, Sargan, and autocorrelation tests. P-values are presented about several post-estimation tests. First-order serial correlation is tested using AR1, whereas second-order serial correlation is tested using AR2. Sargan tests are used to assess the overidentifying constraints for GMM estimators.

Source: Authors Estimation based on BRICS Statistics 2020, ETD (2021), Global Financial Development, Penn World Table (10.0), UNCTAD and World Development Indicators.

5. Conclusion

The study uses econometric models to identify key factors boosting labour productivity. McMillan et al. (2014) decomposition techniques measure sectoral labour productivity, helping to understand structural changes in BRICS countries. New structural economists like Lin (2011) emphasize the importance of structural change for economic growth. Asia is experiencing growth and structural change, unlike Latin America and Africa. Bosworth & Collins (2007) and McMillan & Rodrik (2011) focus on broad economic sectors in developing countries, which may limit their relevance for total productivity growth. Sector-level analyses could reveal distinct growth patterns.

The study examines trends in structural change and productivity in BRICS economies since 1990 using updated sector-level data. It found significant structural changes in China and India, while Russia, Brazil, and South Africa showed minimal structural change.

The study highlights significant labour productivity differences between agriculture and industrial sectors in developing countries. It examines the shift of labour to high-value, high-skilled sectors. Industries contributing more to GDP are seen as more productive and growth-driving. Since 1990, labour productivity has increased in Brazil and South Africa due to sectoral productivity gains and structural shifts. However, from 1990-2010, Russia, China, and India saw reduced productivity growth due to strong negative 'Within effects.'

Service sector employment in low-productivity industries like communication, construction, transport, and retail trade increased in Brazil, China, and South Africa. In Russia, employment is concentrated in less productive retail trade and slow-growing social personal services. In India, many jobs are in retail and construction. Structural changes boost overall labour productivity by moving labour to high-productivity sectors. However, dynamic structural change, or labour transfer to expanding industries, is limited. Surplus labour often shifts from agriculture to construction, which absorbs unskilled labour but offers lower earning potential than factory work. Unproductive agricultural workers easily transition to low-skilled construction jobs (Erumban et al., 2019).

Econometric models show that factors like decreased infant mortality, well-developed infrastructure, a higher capital-to-labour ratio, and increased manufacturing share positively impact labour productivity. However, enrollment ratio and urbanization rate negatively impact productivity in India, indicating a lack of skilled labour (McKinsey,

2012). Education and vocational training can drive structural changes, boosting employability and productivity. Reducing administrative restrictions promotes growth-enhancing structural change. Investments in health and education, especially at the tertiary level, enable labour mobility. Technological advancements' benefits can be more equitably distributed with better education and structural changes.

Policymakers should not become complacent. Barriers to international trade in services need to be lowered to grow productive service sectors. Policies must align with the skills needed in tradable service subsectors like financial and business services. In low-productivity nations, a holistic approach is needed to boost human capital, infrastructure, and the business environment. The loss of manufacturing jobs can significantly impact regions that were manufacturing centers. Policies should support reskilling displaced workers and reduce relocation costs. Policymakers must also consider the high costs of sectoral reallocation for some workers and strengthen safety nets and targeted redistribution policies.

The study has some limitations, offering directions for future research. It uses the Economic Transformation Database (ETD) to analyse gross value added and employment percentages across 12 sectors from 1990 to 2018, grouped into five categories: Agriculture & Mining, Manufacturing, Construction, Public Utilities, and Services (low-skilled and high-skilled). Constant prices data (real GDP) were used to understand economic growth. Baumol's model suggests that as per capita income rises, employment in agriculture decreases, while employment in industrial and service sectors increases. The study applies McMillan and Rodrik's methodology to illustrate structural change in BRICS economies, examining changes in employment share and relative productivity level through pace, intensity, and consistency.

Firpo and Pieri (2017) reveal that partial productivity analyses can be misleading with large productivity differences across sectors. High productivity growth in a sector can negatively impact overall economic performance if that sector's employment share decreases. Displaced workers in developing economies may end up in lower-productivity sectors, affecting overall growth. The study captures changes in intersectoral efficiency and within-industry productivity improvements.

References:

Acemoglu, D., & Guerrieri, V. (2008). Capital deepening and nonbalanced economic growth. *Journal of Political Economy*, *116*(3), 467–498. https://doi.org/10.1086/589523

Adegboye, A., Adegboye, & Abidemi. (2020). Macroeconomic policies and sustainable employment yields in sub-Saharan Africa. *African Development Review*, *32*(4), 515–527. https://doi.org/10.1111/1467-8268.12457

African Development Bank. (2018). *African Economic Outlook 2018*. African Development Bank Group. Available at: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/African_Economic_Outlook_2018_-_EN.pdf

Ajilore, T., & Yinusa, O. (2011). An analysis of employment intensity of sectoral output growth in Botswana. *Southern African Business Review*, *15*(2).

Andersen, B., & Corley, M. (2003). The Theoretical, Conceptual and Empirical Impact of the Service Economy: A Critical Review. *WIDER Working Paper Series*. https://ideas.repec.org/p/unu/wpaper/dp2003-22.html

Araujo, E., Galete, R., & Caldarelli, C. E. (2023). Structural change, labour market and employment in Brazil after the 2017 labour market reform. *Panoeconomicus*, *70*(4), 627–645. https://doi.org/10.2298/PAN2304627A

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29–51. https://econpapers.repec.org/RePEc:eee:econom:v:68:y:1995:i:1:p:29-51

Baily, M. N., Bartelsman, E. J., & Haltiwanger, J. C. (1996). Labour productivity: Structural change and cyclical dynamics. *Review of Economics and Statistics*, *83*, 420–433.

Ball, L., Furceri, D., Leigh, D., & Loungani, P. (2019). Does One Law Fit All? Cross-Country Evidence on Okun's Law. *Open Economies Review*, *30*(5), 841–874. https://doi.org/10.1007/s11079-019-09549-3

Baumol, W. J. (1967). Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis. *The American Economic Review*, *57*(3), 415–426. http://www.jstor.org/stable/1812111

Beeson, P. E., & Bryan, M. F. (1986). The emerging service economy. *Economic Commentary*, *Jun*. https://ideas.repec.org/a/fip/fedcec/y1986ijun15.html

Beletskaya. (2022). BRICS labour markets: Competing with the largest economy. *BRICS Journal of Economics*, *3*(2), 75–96. https://doi.org/10.3897/brics-econ.3.e85970

Bell, J., Goga, S., Mondliwa, P., & Roberts, S. (2018). Structural Transformation in South Africa: Moving Towards a Smart, Open Economy for All. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3269732

Bhadury, S., Narayanan, A., & Pratap, B. (2021). Structural transformation of jobs from manufacturing to services: Will it work for India? Margin?The Journal of Applied Economic Research, 15(1), 22?49. *Sage Publications*. https://doi.org/10.1177/0973801020976608

Bhalla, G. S. (2008). Globalization and employment trends in India. *The Indian Journal of Labour Economics*, *51*(1), 1–23.

Bhorat, H., & Rooney, C. (2017). State of Manufacturing in South Africa. In *Development Policy Research Unit* (Issue March). DPRU, University of Cape Town.

Bloom, D. E., Canning, D., & Sevilla, J. (2004). The effect of health on economic growth: A production function approach. *World Development*, *32*(1), 1–13. https://doi.org/10.1016/j.worlddev.2003.07.002

Blundell, R., & Bond, S. (2000). GMM Estimation with persistent panel data: an application to production functions. *Econometric Reviews*, *19*(3), 321–340. https://doi.org/10.1080/07474930008800475

Boltho, A., & Glyn, A. (1995). Can macroeconomic policies raise employment? *International Labour Review*, *134*(4–5), 451.

Bonelli, R. (2004). Economic Growth and productiviy change in Brazil. *World Bank's Brazil Investment Climate Assessment (ICA)*, *1975*, 1–35. https://hdl.handle.net/10986/20783

Bosworth, B., & Collins, S. M. (2007). Accounting for growth: Comparing China and India (NBER Working Papers, Issue 12943). National Bureau of Economic Research, Inc. https://econpapers.repec.org/RePEc:nbr:nberwo:12943

Brandt, L., Litwack, J., Mileva, E., Wang, L., Zhang, Y., & Zhao, L. (2020). China's Productivity Slowdown and Future Growth Potential. https://doi.org/10.1596/1813-9450-9298

Buera, F. J., Kaboski, J. P., & Rogerson, R. (2015). Skill biased structural change (NBER Working Paper No. *21165). National Bureau of Economic Research*.

Buera, F. J., & Kaboski, J. P. (2012). The Rise of the Service Economy. *American Economic Review*, *102*(6), 2540–2569. https://doi.org/10.1257/aer.102.6.2540

Bulman, D., & Kraay, A. (2011). Growth in China 1978-2008: Factor Accumulation, Factor Reallocation, and improvements in Productivity. *World Bank, Washington, DC.*

Caselli, F., & Coleman II, W. J. (2001). The U.S. Structural Transformation and Regional Convergence: A Reinterpretation. *Journal of Political Economy*, *109*(3), 584–616. https://doi.org/10.1086/321015

Cattaneo, N. (2011). Services Trade Liberalisation and the Role of the Services Sector in South African Development. In *SAIIA Occasional Paper* (Johannesburg: Economic Diplomacy Programme, Issue 94).

Chakravarty, K. C. (2013). Environmental & social sustainability: Key issues & concerns. Yes Bank–GIZ–UNEP Sustainability Series event on Environment and Social Risk Management, Mumbai, April.

Chandrasekhar, C. P. (2016). Macroeconomic policy, employment and decent work in India. 205. http://www.ilo.int/wcmsp5/groups/public/ed_emp/documents/publication/wcms_542029.pdf

Chenery, H. B., & Syrquin, M. (1975). *Patterns of development 1950-70*. Oxford University Press.

Chenery, H. B., & Taylor, L. (1968). Development Patterns: Among Countries and Over Time. *The Review of Economics and Statistics*, *50*(4), 391. https://doi.org/10.2307/1926806

Chenery, H. B. (1960). Patterns of Industrial Growth. *The American Economic Review*, *50*(4), 624–654. http://www.jstor.org/stable/1812463

Chheda, K., & Patnaik, A. (2015). State-level analysis of employment in the construction sector of India. *ISFIRE Working Paper-11*. http://iire.in/ojs/index.php Issue - June 2015.

Clark, C. (1951). *The conditions of economic progress* (No. 04; HC55, C5 1951.)

Cuadrado, J. R., & Rio, C. D. (1989). Structural change and evolution of the services sector in the OECD. *Service Industries Journal*, *9*(3), 439–468.

Dasgupta, S., & Singh, A. (2006). *Manufacturing, Services and Premature Deindustrialization in Developing Countries: A Kaldorian Analysis* (RP2006-49; WIDER Working Paper Series).

de Vries, G. J., Erumban, A. A., Timmer, M. P., Voskoboynikov, I., & Wu, H. X. (2012). Deconstructing the BRICs: Structural transformation and aggregate productivity growth. *Journal of Comparative Economics*, *40*(2), 211–227. https://doi.org/10.1016/j.jce.2012.02.004

Dieppe, A. (Ed.). (2020). *Global productivity: Trends, drivers, and policies*. World Bank. https://doi.org/10.1596/978-1-4648-1550-3

Döpke, J. (2001). The "employment intensity" of growth in Europe. In *Kiel Working Paper* (Vol. 120, Issue No. 1021). https://econpapers.repec.org/RePEc:zbw:ifwkwp:1021

Doskeyeva, G. Z., Baitalassova, K. A., Omarkhan, D. N., Bekova, R. Z., & Rakhimbekova, A. E. (2019). Assessment of the current state of employment in the regions of Kazakhstan. *Academy of Strategic Management Journal*, *18*(6), 1–5.

Dougherty, S. M., Herd, R., Chalaux, T., & Erumban, A. A. (2008). India's growth pattern and obstacles to higher growth. (OECD Economics Department Working Papers; Vol. 623). OECD.

Erumban, A. A., Das, D. K., Aggarwal, S., & Das, P. C. (2019). Structural change and economic growth in India. *Structural Change and Economic Dynamics*, *51*, 186–202. https://doi.org/10.1016/j.strueco.2019.07.006

Fang, L., & Herrendorf, B. (2021). High-skilled services and development in China. *Journal of Development Economics*, *151*. https://doi.org/10.1016/j.jdeveco.2021.102671

Firpo, S., & Pieri, R. (2017). Structural change, productivity growth, and trade policy in Brazil. In M. S. McMillan, D. Rodrik, & C. Sepúlveda (Eds.), *Structural change, fundamentals, and growth: A framework and case studies* (pp. 151-182). International Food Policy Research Institute (IFPRI).

Fisher, A. G. B. (1939). PRODUCTION, PRIMARY, SECONDARY AND TERTIARY. *The Economic Record*, *15*(1), 24–38. https://econpapers.repec.org/RePEc:bla:ecorec:v:15:y:1939:i:1:p:24-38

Fofana, N. (2001). Employment and Economic Growth in the Côte d'Ivoire: An Analysis of Structural Determinants. *African Development Review*, *13*(1), 98–113. https://econpapers.repec.org/RePEc:adb:adbadr:813

Fourastié, J. (1949). *The great hope of the 20th century: Technical progress, economic progress, social progress*. Presses Universitaires de France.

Fuchs, V. (1968). *The service economy*. New York: National Bureau of Economic Research.

Fuchs, V. R. (1980). Economic growth and the rise of service employment. In *Quarterly Journal of Economics* (NBER Working Papers, Vol. 118, Issue 2). National Bureau of Economic Research, Inc. https://econpapers.repec.org/RePEc:nbr:nberwo:0486

Furceri, D., Crivelli, E., & Toujas-Bernate, J. (2012). Can Policies Affect Employment Intensity of Growth? A Cross-Country Analysis. In *IMF Working Papers* (Vol. 12, Issue 218). A cross-country analysis. International Monetary Fund. https://doi.org/10.5089/9781475505689.001

Gala, P., Camargo, J., Magacho, G., & Rocha, I. (2018). Sophisticated jobs matter for economic complexity: An empirical analysis based on input-output matrices and employment data. *Structural Change and Economic Dynamics*, *45*(C), 1–8. https://econpapers.repec.org/RePEc:eee:streco:v:45:y:2018:i:c:p:1-8

Gemmell, N. (1982). Economic development and structural change: The role of the service sector. *The Journal of Development Studies*, *19*(1), 37–66. https://doi.org/10.1080/00220388208421849

Ghazali, M., & Mouelhi, R. (2018). The employment intensity of growth: Evidence from Tunisia. *Journal of Economic Development*, *43*(3), 85–117. https://doi.org/10.35866/caujed.2018.43.3.004

Ghose, A. K., & Kumar, A. (2021). India's Deepening Employment Crisis in the Time of Rapid Economic Growth. *The Indian Journal of Labour Economics*, *64*(2), 247–279. https://econpapers.repec.org/RePEc:spr:ijlaec:v:64:y:2021:i:2:d:10.1007_s41027-021-00314-0

Goldar, B. (2000). Employment Growth in Organised Manufacturing in India. *Economic and Political Weekly*, *35*(14), 1191–1195. http://www.jstor.org/stable/4409114

Goldar, K. B., Das, D. K., Aggarwal, S. C., Erumban, A. A., & Das, P. C. (2022). *India productivity report*. Retrieved August, from www.econdse.org

Gruss, B., & Novta, N. (2018, April 9). *The Decline in Manufacturing Jobs: Not Necessarily a Cause for Concern*. IMFBlog.

Haider, A., Jabeen, S., Rankaduwa, W., & Shaheen, F. (2023). The Nexus between Employment and Economic Growth: A Cross-Country Analysis. *Sustainability (Switzerland)*, *15*(15). https://doi.org/10.3390/su151511955

Helble, M., Trinh, L. Q., & Le, T. T. (2019). Sectoral and Skill Contributions to Labour Productivity in Asia. In *SSRN Electronic Journal*. Asian Development Bank Institute. https://doi.org/10.2139/ssrn.3374794

Herrendorf, B., & Schoellman, T. (2015). Why is measured productivity so low in agriculture? *Review of Economic Dynamics*, *18*(4), 1003–1022. https://doi.org/https://doi.org/10.1016/j.red.2014.10.006

Hodge, D. (2009). Growth, employment and unemployment in South Africa. *South African Journal of Economics*, *77*(4), 488–504. https://doi.org/10.1111/j.1813-6982.2009.01226.x

Imbs, J. (2013). The Premature Deindustrialization of South Africa. In J. E. Stiglitz, J. L. Yifu, & E. Patel (Eds.), *The Industrial Policy Revolution II* (pp. 529–540). Palgrave Macmillan UK. https://doi.org/10.1057/9781137335234_20

ILO. (2016). *Key Indicators of the Labour Market (KILM)*, Ninth edition, Geneva.

ILO. (2018). *ILO Trends Econometric Models, 2018*.

International Labour Office. (2023). *World Employment and Social Outlook: Trends 2023*. Geneva. Retrieved November 6, 2022.

International Labour Office. (2023). *Building sustainable enterprises through productivity ecosystems for Decent Work in the BRICS countries*. 1st Meeting of the Employment Working Group

International Trade Centre. (2022). *BRICS Trade in Services Report 2022*. 78.

Islam, I., Nazara, Suahasil., & International Labour Office. Area Office, Jakarta. (2000). *Estimating employment elasticity for the Indonesian economy : technical note on the Indonesian labour market*. International Labour Office.

Jorgenson, D. W., & Timmer, M. P. (2011). Structural change in advanced nations: A new set of stylised facts. *Scandinavian Journal of Economics*, *113*(1), 1–29. https://doi.org/10.1111/j.1467-9442.2010.01637.x

Kannan, K. P., & Raveendran, G. (2009). Growth sans employment: A quarter century of jobless growth in India?s organised manufacturing. *Economic and Political Weekly*, 80–91.

Kapelyushnikov, R., Kuznetsov, A., & Kuznetsova, O. (2012). The role of the informal sector, flexible working time and pay in the Russian labour market model. *Post-Communist Economies*, *24*(2), 177–190. https://doi.org/10.1080/14631377.2012.675154

Kapsos, S. (2006). The Employment Intensity of Growth: Trends and Macroeconomic Determinants. In J. Felipe & R. Hasan (Eds.), *Labour Markets in Asia* (pp. 143–201). Palgrave Macmillan UK. https://doi.org/10.1057/9780230627383_4

Katouzian, M. A. (1970). The development of the service sector: A new approach. *Oxford Economic Papers*, *22*(3), 362–382. https://doi.org/10.1093/oxfordjournals.oep.a041171

Khan, A. R. (2001). Employment policies for poverty reduction, Issues in Employment and Poverty Discussion Paper No. *1. International Labour Office (Geneva).*

Khor, N., et al. (2016). China's looming human capital crisis: Upper secondary educational attainment rates and the middle-income trap. *China Quarterly, 905*. https://doi.org/10.1017/S0305741016001119

Klintsov, V., Shvakman, I., & Solzhenitsyn, Y. (2009, September 1). How Russia could be more productive. *McKinsey Quarterly*. https://www.mckinsey.com/featured-insights/europe/how-russia-could-be-more-productive

Kochhar, K., Kumar, U., Rajan, R., Subramanian, A., & Tokatlidis, I. (2006). India's pattern of development: What happened, what follows? *Journal of Monetary Economics*, *53*(5), 981–1019. https://doi.org/10.1016/j.jmoneco.2006.05.007

Kothe S. (2012). Inter-sectoral shifts in employment and employment elasticity in service sector in India. *International Journal of Development Studies and Research*, 1(1), 159–167.

Kuznets, S. S., & Murphy, J. T. (1966). *Modern economic growth: Rate, structure, and spread* (Vol. 2). Yale University Press New Haven.

Lamba, R., & Subramanian, A. (2020). Dynamism with Incommensurate Development: The Distinctive Indian Model. *Journal of Economic Perspectives*, *34*(1), 3–30. https://doi.org/10.1257/jep.34.1.3

Leif, V. N. (2018). Globalization and deindustrialization in advanced countries. *Structural Change and Economic Dynamics*, *45*, 49–63.

Leshoro, T. L. A. (2014). Empirical analysis of employment elasticity of growth in Botswana. *Mediterranean Journal of Social Sciences*, *5*(2), 171–179. https://doi.org/10.5901/mjss.2014.v5n2p171

LEWIS, W. A. (1954). Economic Development with Unlimited Supplies of Labour. *The Manchester School*, *22*(2), 139–191. https://doi.org/10.1111/j.1467-9957.1954.tb00021.x

Lin, J. Y. (2011). New Structural Economics: A Framework for Rethinking Development1. *The World Bank Research Observer*, *26*(2), 193–221. https://doi.org/10.1093/wbro/lkr007

Mahadea, D., & Simson, R. (2010). The challenge of low employment economic growth in South Africa: 1994 -2008. *South African Journal of Economic and Management Sciences*, *13*(4), 391–406. https://doi.org/10.4102/sajems.v13i4.92

Mazumdar, D., & Sarkar, S. (2007). Growth of employment and earnings in tertiary sector, 1983-2000. *Economic and Political Weekly*, *42*(11), 973–981.

McKinsey & Company. (2012). *India's urban awakening: Building inclusive cities, sustaining economic growth*. McKinsey Global Institute. https://www.mckinsey.com/featured-insights/urbanization/urban-awakening-in-india

McMillan, M., Rodrik, D., & Verduzco-Gallo, Í. (2014). Globalization, Structural Change, and Productivity Growth, with an Update on Africa. In *World Development* (Vol. 63). https://doi.org/10.1016/j.worlddev.2013.10.012

McMillan, M. S., Rodrik, D., & Sepúlveda, C. (2017). Structural Change, Fundamentals, and Growth: A Framework and Case Studies. In *Structural Change, Fundamentals, and Growth: A Framework and Case Studies*. https://doi.org/10.1596/978-0-8962-9214-7

McMillan, M., & Harttgen, K. (2014). *What is driving the "African Growth Miracle"?* (Issue 20077). https://doi.org/10.3386/w20077

McMillan, M. S., & Rodrik, D. (2011). Globalization, structural change, and productivity growth (NBER Working Paper No. *17143). National Bureau of Economic Research*. https://doi.org/10.3386/w17143

Mishra, S., & Sureh, A. K. (2014). Estimating Employment Elasticity of Growth for the Indian Economy. In *Rbi Working Paper Series* (Issue June).

Mitra, A. (2016). Productivity growth in India: Determinants and policy initiatives based on the existing literature. *UNESCAPE Working Paper*, *19*, 174–183.

Mkhize, N. I. (2019). The Sectoral Employment Intensity of Growth in South Africa. *Southern African Business Review*, *23*, 1–24. https://doi.org/10.25159/1998-8125/4343

Muendler, M.-A. (2004). Estimating production functions when productivity change is endogenous. CESifo Working Paper, No. *1143. Center for Economic Studies and Ifo Institute (CESifo), Munich*.

Nabar, M., & Yan, K. (2013). Sector-level productivity, structural change, and rebalancing in China. IMF Working Paper No. *13/240. International Monetary Fund*. https://www.imf.org/external/pubs/ft/wp/2013/wp13240.pdf

Nagaraj, R. (2000). Organised Manufacturing Employment. *Economic and Political Weekly*, *35*(38), 3445–3448. http://www.jstor.org/stable/4409751

Nelson, R. R., & Phelps, E. S. (1966). Investment in humans, technological diffusion, and economic growth. *The American Economic Review*, *56*(1/2), 69–75. http://www.jstor.org/stable/1821269

Nassif, A., Morandi, L., Araújo, E., & Feijó, C. (2020). Structural change and productivity growth in Brazil: Where do we stand? *Brazilian Journal of Political Economy*, *40*(2), 243–263. https://doi.org/10.1590/0101-31572020-3089

Naude, W., Szirmai, A., & Haraguchi, N. (Eds.). (2015). *Structural change and industrial development in the BRICS*. Oxford University Press.

OECD. (2007). *Employment Outlook*.

OECD. (2019). *Employment Outlook 2019 - The Future of Work*. OECD Publishing, Paris.

Padalino, S., & Vivarelli, M. (1997). The employment intensity of economic growth in the G-7 countries. *International Labour Review*, *136*(2), 191-213.

Papola, T. S., & Sahu, P. P. (2012). *Growth and structure of employment in India*. Institute for Studies in Industrial Development, New Delhi.

Pattanaik, F., & Nayak, N. C. (2015). Employment intensity of service sector in India: Trend and determinants. *International Conference on Business and Economics, 1(August), 62-66*.

Perugini, C. (2009). Employment intensity of growth in Italy: A note using regional data. *Regional and Sectoral Economic Studies*, *9*(1), 59–105.

Pianta, M., Evangelista, R., & Perani, G. (1996). The dynamics of innovation and employment: An international comparison. *STI Review*, *18*(18), 67–93.

Rangarajan, C., Kaul, I., & Seema, S. (2007). Revisiting Employment and Growth. *ICRA Bulletin-Money & Finance*, 57–68. http://www.eac.gov.in/aboutus/chspe/art_revisit.pdf

Rev, I., Ann, Y., Sex, E., & Mf, S. (2011). Employment by economic activity. *World Development*, *2011*(October), 238–266.

Rincon-Aznar, A., Castaneda-Navarrete, J., & Lopez-Gomez, C. (n.d.). Productivity and structural change: Cross-country evidence. *Seventh World KLEMS International Conference 2022*.

Rivera, B., & Currais, L. (2003). The effect of health investment on growth: A causality analysis. *International Advances in Economic Research*, *9*(4), 312–323. https://doi.org/10.1007/BF02296180

Rodrik, D. (2016). Premature deindustrialization. *Journal of Economic Growth*, *21*(1), 1–33. https://doi.org/10.1007/s10887-015-9122-3

Roy, S. (2008). Structural Change in Employment in India since 1980s: How Lewisian Is It? *Social Scientist*, *36*(11), 47–68.

Sawtelle, B. (2007). Analyzing the link between real GDP and employment: An industry sector approach: Employment responsiveness to long-term real GDP expansion differs markedly across US industry sectors. *Business Economics*, *42*, 46–54.

Sodipe, Oluyomi. A., & Ogunrinola, Oluranti. I. (2011). Employment and Economic Growth Nexus in Nigeria. *International Journal of Business and Social Science*, *2*(11), 232–240.

Timmer, M. P., Inklaar, R., O'Mahony, M., & Ark, B. van. (2010). *Economic growth in Europe: A comparative industry perspective*. Cambridge University Press. http://ideas.repec.org/a/sls/ipmsls/v21y20111.html

Timmer, M., de Vries, G. J., & de Vries, K. (2015). Patterns of structural change in developing countries. *Routledge Handbook of Industry and Development*, July, 65–83. https://doi.org/10.4324/9780203387061

Timmer, M. P., & Voskoboynikov, I. B. (2016). Is mining fuelling long-run growth in Russia? Industry productivity growth trends in 1995-2012. In *The World Economy: Growth or Stagnation?* https://doi.org/10.1017/9781316534502.008

Upender, M. (2006). Output Elasticity Of Employment In The Indian Economy: An Empirical Note. *Applied Econometrics and International Development*, *6*(1), 197–206.

van Neuss, L. (2019). The drivers of structural change. *Journal of Economic Surveys*, *33*, 309–349. https://doi.org/10.1111/joes.12266

Voskoboynikov, I. B. (2020). Structural change, expanding informality and labour productivity growth in Russia. *Review of Income and Wealth*, *66*(2), 394–417. https://doi.org/10.1111/roiw.12417

Vu, K. M. (2017). Structural change and economic growth: Empirical evidence and policy insights from Asian economies. *Structural Change and Economic Dynamics*, *41*. https://doi.org/10.1016/j.strueco.2017.04.002

Wolfe, M. (1955). The concept of economic sectors. *The Quarterly Journal of Economics*, *69*(3), 402–420. https://doi.org/10.2307/1885848

Yogo, U. T. (2008). Croissance et emploi en Afrique subsaharienne: Evidence theorique et faits empiriques [Growth and employment in Sub-Saharan Africa: Theoretical evidence and empirical facts] (No. *10474). University Library of Munich, Germany*.

Zhunussova, A., & Dulambayeva, R. (2019). The state policy of service sector development in the republic of Kazakhstan. *Journal of Eastern European and Central Asian Research*, *6*(1), 56–66. https://doi.org/10.15549/jeecar.v6i1.255

Annexure 1: Labour Productivity of BRICS Countries measured in natural log

Year	Brazil	China	India	Russia	South Africa
1990	3.95	2.48	4.45		5.09
1991	3.95	2.55	4.44		5.05
1992	3.93	2.66	4.47		5.02
1993	3.89	2.76	4.50		5.01
1994	3.91	2.85	4.54		5.02
1995	3.92	2.94	4.59	2.96	5.03
1996	3.94	3.01	4.66	3.28	5.05
1997	3.95	3.08	4.68	3.45	5.06
1998	3.96	3.13	4.73	3.53	5.02
1999	3.92	3.19	4.78	4.08	5.03
2000	3.93	3.25	4.79	4.46	5.06
2001	3.94	3.31	4.82	4.66	5.12
2002	3.93	3.39	4.82	4.85	5.16
2003	3.93	3.47	4.87	5.02	5.24
2004	3.93	3.55	4.90	5.25	5.27
2005	3.93	3.65	4.97	5.46	5.33
2006	3.94	3.77	5.04	5.67	5.24
2007	3.99	3.90	5.11	5.87	5.28
2008	4.01	3.98	5.15	6.07	5.28
2009	4.01	4.05	5.22	6.07	5.28
2010	4.04	4.16	5.29	6.22	5.33
2011	4.05	4.25	5.34	6.40	5.32
2012	4.06	4.32	5.39	6.53	5.33
2013	4.07	4.38	5.42	6.61	5.34
2014	4.05	4.43	5.48	6.69	5.35
2015	4.02	4.48	5.56	6.79	5.32
2016	4.01	4.54	5.64	6.83	5.31
2017	4.02	4.60	5.69		5.31
2018	4.02	4.67	5.74		5.30

Source: Authors Calculations based on Economic Transformation Database (2021)

Annexure 2: Measure of Variation

Variables		Mean	Std. Dev.	Min Value	Max Value	Observations
ln (labour productivity)	overall	4.842	0.863	3.250	6.830	N = 85
	between		0.844	3.934	5.850	n = 5
	within		0.410	3.452	5.822	T = 17
ln (capital deepening)	overall	11.467	0.808	9.840	12.550	N = 85
	between		0.845	10.523	12.488	n = 5
	within		0.273	10.649	12.299	T = 17
ln (manufacturing share)	overall	2.584	0.208	2.230	3.070	N = 85
	between		0.213	2.434	2.947	n = 5
	within		0.081	2.339	2.779	T = 17
ln (infant mortality rate)	overall	3.095	0.669	1.810	4.200	N = 85
	between		0.671	2.260	3.879	n = 5
	within		0.288	2.415	3.785	T = 17
ln (gross enrolment ratio)	overall	3.349	0.669	2.030	4.390	N = 71
	between		0.605	2.744	4.282	n = 5
	within		0.350	2.302	4.142	T bar = 14.2
ln(urbanization)	overall	4.016	0.373	3.320	4.450	N = 85
	between		0.407	3.409	4.427	n = 5
	within		0.072	3.767	4.227	T = 17
Infrastructure index	overall	0.117	3.204	-2.789	12.178	N = 79
	between		3.058	-2.107	5.453	n = 5
	within		1.642	-4.445	6.842	T bar = 15.8

Note: N stands for the nos. of observations; n for the nos. of countries; T for the nos. of years

Source: Authors Estimation based on BRICS Statistics 2020, ETD (2021), Global Financial Development, Penn World Table (10.0), UNCTAD and World Development Indicators.

Annexure 3: Dataset for Estimation of Panel Regression Model of BRICS countries

Country	Year	lnlabour productivity	$lnk_{c,t}$	$lnmfg_{c,t}$	$lninf_{c,t}$	$lnger_{c,t}$	$lnurban_{c,t}$	infra index
Brazil	2000	3.93	11.82	2.46	3.41		4.40	-2.09618
Brazil	2001	3.94	11.84	2.44	3.35	2.90	4.40	-2.02796
Brazil	2002	3.93	11.81	2.43	3.29	3.03	4.41	-1.98912
Brazil	2003	3.93	11.81	2.45	3.22	3.14	4.41	-1.95056
Brazil	2004	3.93	11.78	2.48	3.16	3.20	4.41	-1.88316
Brazil	2005	3.93	11.76	2.52	3.09	3.26	4.42	-1.8513
Brazil	2006	3.94	11.75	2.49	3.03		4.42	-1.60831
Brazil	2007	3.99	11.77	2.52	2.97	3.43	4.42	-1.35872
Brazil	2008	4.01	11.78	2.54	2.91	3.57	4.43	-1.16334
Brazil	2009	4.01	11.80	2.51	2.86	3.61	4.43	-1.27513
Brazil	2010	4.04	11.80	2.47	2.82		4.43	-1.10278
Brazil	2011	4.05	11.81	2.42	2.77	3.77	4.44	-0.93147
Brazil	2012	4.06	11.83	2.47	2.73	3.81	4.44	-0.74205
Brazil	2013	4.07	11.85	2.43	2.70	3.85	4.45	-0.69496
Brazil	2014	4.05	11.86	2.47	2.68	3.92	4.45	-0.43909
Brazil	2015	4.02	11.88	2.43	2.65	3.94	4.45	-0.32758
Brazil	2016	4.01	11.90	2.34	2.71	3.93	4.45	-0.4867
Russia	2000	3.25	9.84	2.82	3.40	2.03	3.58	
Russia	2001	3.31	9.93	2.80	3.33	2.28	3.61	-2.09638
Russia	2002	3.39	10.02	2.79	3.24	2.54	3.65	-1.94294
Russia	2003	3.47	10.12	2.79	3.15	2.74	3.68	-1.84335
Russia	2004	3.55	10.22	2.84	3.06	2.87	3.72	-1.79173
Russia	2005	3.65	10.33	2.91	2.97	2.95	3.75	-1.74012
Russia	2006	3.77	10.43	2.96	2.87	3.01	3.78	-1.05166
Russia	2007	3.90	10.53	2.99	2.79	3.02	3.81	-0.49386
Russia	2008	3.98	10.64	2.98	2.69	3.03	3.84	-0.67588
Russia	2009	4.05	10.76	2.98	2.61	3.11	3.87	-0.97851
Russia	2010	4.16	10.88	3.00	2.53	3.19	3.90	-0.9327
Russia	2011	4.25	10.99	3.01	2.44	3.24	3.92	-0.83021
Russia	2012	4.32	11.10	3.01	2.36	3.36	3.95	-0.92564
Russia	2013	4.38	11.20	3.04	2.28	3.48	3.97	-0.94004
Russia	2014	4.43	11.30	3.06	2.20	3.75	3.99	-0.81499
Russia	2015	4.48	11.40	3.07	2.12	3.83	4.02	-0.86467
Russia	2016	4.54	11.49	3.05	2.03	3.87	4.04	-0.71187
India	2000	4.79	10.09	2.38	4.20	2.25	3.32	
India	2001	4.82	10.13	2.39	4.17	2.27	3.33	-2.04798
India	2002	4.82	10.16	2.40	4.13	2.32	3.34	-2.05747
India	2003	4.87	10.19	2.41	4.09	2.36	3.35	-1.91947
India	2004	4.90	10.22	2.42	4.06	2.39	3.36	-1.59425
India	2005	4.97	10.29	2.42	4.02	2.37	3.38	-1.22696
India	2006	5.04	10.36	2.43	3.98	2.44	3.39	-0.98782
India	2007	5.11	10.44	2.43	3.94	2.57	3.40	-0.71717

Continued .....

.

Country	Year	lnlabour productivity	$lnk_{c,t}$	$lnmfg_{c,t}$	$lninf_{c,t}$	$lnger_{c,t}$	$lnurban_{c,t}$	infra index
India	2008	5.15	10.51	2.44	3.90	2.71	3.41	-0.14685
India	2009	5.22	10.58	2.44	3.85	2.77	3.42	-0.12862
India	2010	5.29	10.65	2.45	3.81	2.88	3.43	0.139747
India	2011	5.34	10.72	2.45	3.76	3.13	3.44	0.197546
India	2012	5.39	10.81	2.46	3.71	3.19	3.45	0.051934
India	2013	5.42	10.84	2.46	3.66	3.17	3.47	0.404857
India	2014	5.48	10.90	2.46	3.61	3.24	3.48	0.566985
India	2015	5.56	10.97	2.47	3.55	3.29	3.49	0.68193
India	2016	5.64	11.03	2.47	3.50	3.29	3.50	0.829102
China	2000	4.46	12.55	2.72	2.74	4.02	4.30	
China	2001	4.66	12.53	2.71	2.69	4.12	4.30	0.890264
China	2002	4.85	12.52	2.69	2.62	4.20	4.30	1.101866
China	2003	5.02	12.50	2.67	2.56	4.26	4.30	1.501585
China	2004	5.25	12.49	2.66	2.48	4.26	4.30	2.16984
China	2005	5.46	12.47	2.64	2.41	4.28	4.30	2.452779
China	2006	5.67	12.46	2.63	2.33	4.29	4.30	3.275625
China	2007	5.87	12.45	2.63	2.26	4.30	4.30	4.595723
China	2008	6.07	12.45	2.60	2.20	4.32	4.30	4.738218
China	2009	6.07	12.48	2.53	2.15	4.32	4.30	5.664042
China	2010	6.22	12.48	2.55	2.12		4.30	6.506648
China	2011	6.40	12.47	2.55	2.09	4.33	4.30	6.893999
China	2012	6.53	12.47	2.55	2.07	4.33	4.30	7.080037
China	2013	6.61	12.48	2.54	2.03	4.35	4.30	8.209538
China	2014	6.69	12.50	2.51	1.97	4.36	4.30	9.066083
China	2015	6.79	12.49	2.52	1.89	4.38	4.30	12.17814
China	2016	6.83	12.50	2.52	1.81	4.39	4.31	10.91611
South Africa	2000	5.06	11.77	2.54	3.86		4.04	
South Africa	2001	5.12	11.82	2.56	3.87		4.05	-2.43348
South Africa	2002	5.16	11.78	2.57	3.87		4.06	
South Africa	2003	5.24	11.82	2.58	3.88		4.07	
South Africa	2004	5.27	11.83	2.62	3.90		4.08	-2.78883
South Africa	2005	5.33	11.86	2.67	3.90		4.09	-2.52668
South Africa	2006	5.24	11.76	2.55	3.89		4.10	-2.27727
South Africa	2007	5.28	11.79	2.56	3.84		4.10	-2.11867
South Africa	2008	5.28	11.80	2.53	3.76		4.11	-2.22112
South Africa	2009	5.28	11.85	2.48	3.65		4.12	-2.54763
South Africa	2010	5.33	11.90	2.44	3.54	2.91	4.13	-2.09431
South Africa	2011	5.32	11.88	2.42	3.47	2.98	4.14	-1.81165
South Africa	2012	5.33	11.91	2.38	3.43	2.95	4.15	-1.85179
South Africa	2013	5.34	11.92	2.35	3.40	2.99	4.16	-1.83169
South Africa	2014	5.35	11.94	2.32	3.38	2.99	4.16	-1.82946
South Africa	2015	5.32	11.92	2.28	3.35	3.10	4.17	-1.75348

Source: Authors Estimation based on BRICS Statistics 2020, ETD (2021), Global Financial Development, Penn World Table (10.0), UNCTAD and World Development Indicators.