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Role and determinants of structural transformation in South Africa

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Role and determinants of structural transformation in South Africa

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Abstract

This study evaluates the contribution of structural transformation to aggregate labor productivity growth over the period 1960-2011 in South Africa, using canonical decomposition approach and assesses the determinants of this structural change with a focus on Chinese competition, trade liberalization and land reform (initiated by government in 1994). The decomposition results suggest that structural transformation was growth enhancing over 1960-1975, 1975-1981, and 1981-1994. While it was growth reducing over 1994-2001 and 2001-2011. Reallocation effect as well within effect varies across sectors. The analysis of determinants using panel data regression at the sector level and structural change indicator as outcome variable reveals that, across all sectors considered, the convergence of structural change is not an unconditional process and total factor productivity (TFP) is negatively correlated with structural change. Furthermore, Chinese competition, trade liberalization and land reform seem to have sector specific effect.

Keywords : Structural transformation, Labor productivity, South Africa.

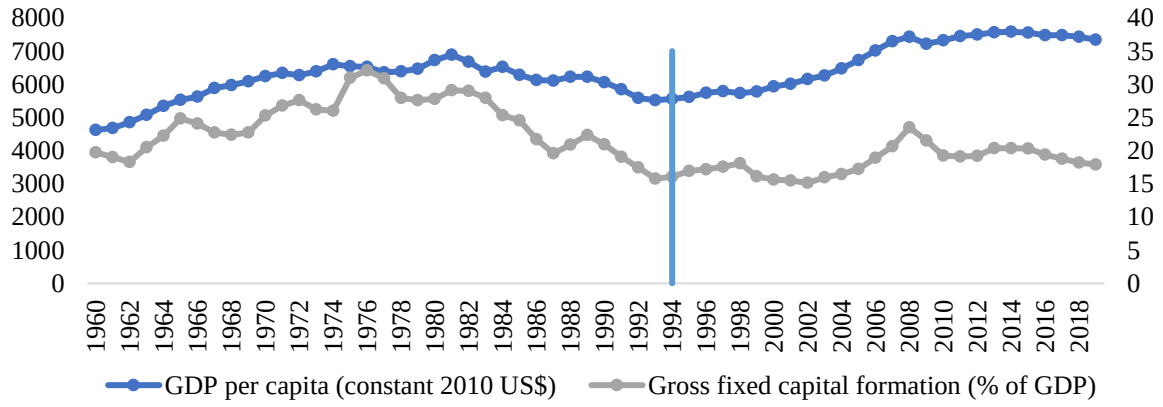
Contents

1. Introduction

What could explain the weak growth dynamic observed in South Africa since the end of the 1980s? What could be behind its relatively lower socioeconomic performance compared to its peers in upper-middle income countries such as Malaysia, Thailand and Turkey? During the decade that followed the end of the Apartheid regime, South Africa experienced a slight economic growth recovery. According to Rodrick (2006), this performance is unfortunately below expectations given the economic rectitude and the political restraint that the country has exhibited. As figure 1 shows, South Africa has recorded an increase in GDP per capita following its democratic transition. The average annual growth rate is estimated at about -1.5% over 1981-1993 compared to around 2% in 1994-2008. Since 2006, GDP per capita was above the peak reached over the period 1960-1993 (around 6895 US dollars in 1981).

South Africa has also seen an increase in the investment as a share of GDP after the end of Apartheid. This ratio fell for example from 29.1% in 1981 to 15.8% in 1993, a drop of about 13.3 percentage points. Over 1994-2019, it shows a slight upward trend from 16.1% to 17.9%, with the highest level recorded in 2008 (23.5%). Since 2009, investment has declined globally as a result of the global financial crisis.

Figure 1: Dynamic of investment and Growth in South Africa (1960-2019).

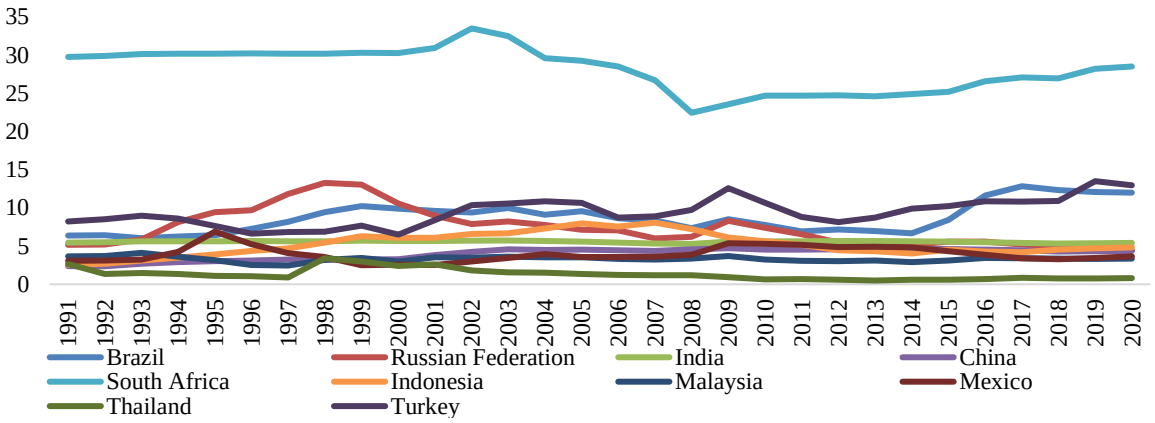


Source: Author's elaboration based on the World Development Indicators (2021).

Despite the positive trend observed from 1994 to 2019, the share of investment relative to GDP remains below the average annual level reached in the aftermath of independence until the 1990s. Furthermore, South Africa's average annual GDP growth rate over this period, estimated at around 2.6%, is lower than the average growth rates of upper middle countries (4.9%) and its peers such as Thailand (3.7%), Turkey (4.5%) and Malaysia (5.2%).

In addition, one of the most worrying aspects of South Africa's relatively poor economic performance is unemployment. Indeed, unemployment rate in South Africa has remained consistently high. Over the last three decades, South Africa has experienced some of the highest unemployment rates in the world (see figure 2 for some international comparisons). Moreover, unemployment seems to have particularly increased over the 8 years following the democratic transition with a peak reached in 2002.

Figure 2 : Dynamic of unemployment rate in South Africa and selected emerging countries (1991-2020).



Source: Same as figure 1.

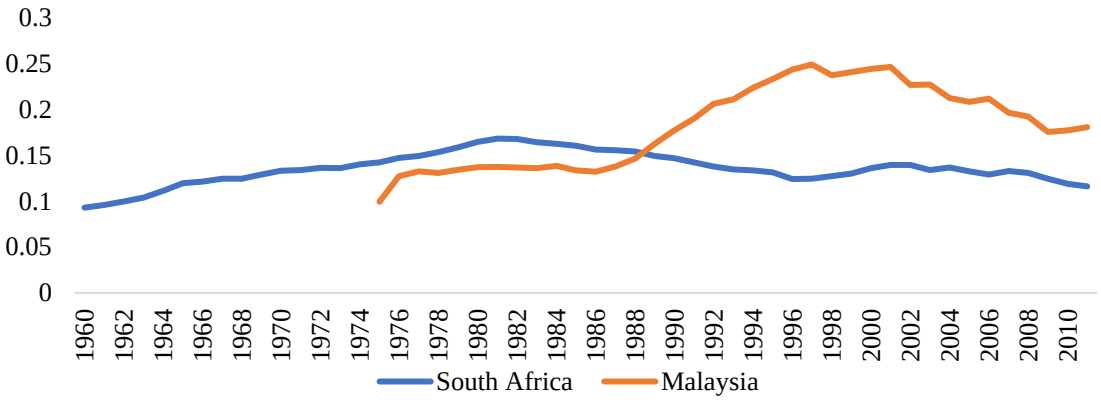
As pointed out by Rodrick (2006), the immediate cause of high level of unemployment observed in South Africa is likely to be the result of a positive differential between prevailing wages and the level of real wages that would clear labor markets at lower levels of unemployment. In fact, various policies implemented by South African's democratic government in order to solve the inequalities generated by Apartheid led to rigidity in wages (Leibbrandt, 2005). Even nowadays, wages are still struggling to adjust to market conditions[1].

Indeed, the root cause of this unemployment is the inability of the South African economy to generate strong growth dynamics and the slow growth is in turn the result of the contraction of the non-mineral tradable goods sector since the early 1990s (Rodrick, 2006). Indeed, the weakness, in particular, of the export-oriented manufacturing sector has deprived South African's growth opportunities that other countries like Malaysia have been able to take advantage of. As an illustration, Rodrick (2006) compares South Africa to Malaysia, a country with which the former had many common characteristics in the 1980s, in term of per capita output, Total factor productivity, human capital and level of dependence on mining (see Table

[1] Labor market rigidity is also associated with the key role of unions (Rodrick, 2006).

1A in appendix). However, while Malaysia has successfully attracted a growing share of its labor force to the manufacturing sector, South Africa has experienced a contraction of its manufacturing sector (see figure 3).

Figure 3: Manufacturing employment (as share of total employment).



Source: Authors' elaboration based on the GGDC 10-sector database.

So, in the 1980s, South Africa has experienced what Rodrick (2006) describes as deindustrialization. The country has undergone a steady reduction in the contribution of the manufacturing sector to overall gross value added and employment since the 1980s (see figure 1A in appendix). Employment in the manufacturing reached its highest level when its share in the GDP was about 16% of GDP with a corresponding per capita income of $6,500 (a level well below the one at which developed economies have started to deindustrialize[2]) in the early 1980s, and then declined. In terms of gross value added, the share of the manufacturing sector as a percentage of GDP peaked at around 24% at almost the same time. Two reasons can justified such a shift in the South African's economic structure that has lead to high unemployment and weak growth performance: First, non-mineral tradable goods (including manufactured goods) in South Africa are labor-intensive and low-skilled relative to services (Rodrick, 2006). Second, the manufacturing sector[3] for emerging economies has historically been considered as the main source of productivity growth (Bell et al., 2018).

This situation raises two important questions regarding the role of structural transformation in South Africa on the one hand, and on the other hand the factors that are likely to explain the pattern of structural change in South Africa.

[2] Industrialization peaked in developed countries such as Britain, Sweden and Italy at income levels of about $14,000, in 1990 dollars (Rodrick, 2016).

[3] Over the period 1960-2011, manufacturing productivity level has typically been higher than average productivity levels, and in some periods higher than the modern service industry in south Africa (UNCTAD, 2018).

The main objective of this study is to investigate structural transformation in South Africa. First, it aims to evaluate the contribution of structural transformation to aggregate productivity growth over the period 1960-2011 relying on two canonical decomposition approaches from Fabricant (1942)[4].

Second, this study seeks to examine the determinants of the pattern of structural transformation experienced by South Africa. There are several studies that address this question but most of them are panel analyses (Martins, 2018; McMillan and Harttgen, 2014; McMillan et al., 2014; Dabla-Norris et al., 2013; McMillan and Rodrik, 2011). To the best of our knowledge, Rodrick's (2006) study is the only one that has so far analyzed the determinants of structural change exclusively in South Africa and at sector level. The author made a regression analysis over the period 1980-2004 across nine one-digit sectors. However, Rodrick (2006) only focused on economic determinants (prices, costs, and productivity). Other factors could also contribute, such as trade and land reforms that South Africa have undergone following the end of the Apartheid. We use Rodrick's sectoral approach with much more recent data (1960-2011) to assess the determinants of structural change in South Africa (based on panel data regression with structural change term as outcome variable); with a focus on Chinese competition, trade liberalization and other sectoral policies such as land reform. In fact, since the China joined the WTO[5] in 2001, bilateral trade with South Africa has intensified (due among others to trade liberalization implemented by south Africa). And some studies such as those conducted by Jenkinsa and Edwards (2015) have suggested that all categories of manufactured exports have lost ground to China. In addition, Lahiff and Li (2012) point out the fact that, due to many factors such as inappropriate project design, lack of necessary support services and shortages of working capital, land reform initiated by the South African government in 1994 led to widespread underutilization of land.

The rest of the paper is structured as follows: Section 2 summarizes the literature on structural transformation. Section 3 provides an overview of South Africa's economic structure. Section 4 presents methodological approaches. In section 5, we present and discuss the results and section 6 concludes.

[4] Cited by De Vries et al (2015).
[5] World Trade Organization.

2. Structural transformation and productivity: A literature review

2.1. Concept of « structural transformation »

There are many uses of "structural transformation" term in economics[6], but in the framework of this study; we deal with structural transformation in development economics[7]. The most significant and prominent changes in the economic structure found in the literature are : *i)* increases in the rates of accumulation (Rostow, Lewis), *ii)* changes in the sectoral composition of economic activity, initially emphasized on the allocation of employment (Fisher, Clark) and later on production and factor use in general (Kuznets, Chenery), iii) changes in the location of economic activities and vi) other aspects related to industrialization such as demographic transition, income distribution (Syrquin, 1988). Institutional changes are also considered as well (Marjanović, 2015). Syrquin (1988) qualifies as "structural transformation" the interrelated process of structural change that appear with economic development. In this perspective, physical and human capital accumulation as well as the changes in the composition of demand, trade, production, and employment are identified as the core of structural transformation, while associated socio-economic processes are considered to be peripheral. It is in this sense that the term structure is used in this study and its scope is limited to those economic aspects (especially production and employment) deemed relevant for the analysis of growth, even though the process of modern economic growth is obviously more encompassing. In addition, we will use structural change and structural transformation indistinctly as is the case in several existing studies (Kuznets, 1973 ;). Indeed, in the development economics field, "structural transformation" is frequently used interchangeably with "structural change" (Nayyer, 2019) and have been defined in various ways by different researchers and economists. However, these two terms are commonly used to describe or explain the transformation in the economic structure that accompany the economic development. This transformation can occur in the composition of production, employment, demand and trade (Doyle, 1997). Matsuyama (2008) provides a more broad definition in which structural change refers to the changes in various aspects of the economy such as "sectoral composition of output and employment, industrial organization, financial system, income and wealth distribution, demography, political institutions, and even the society's value system".

[6] Some of them provide a clear meaning or made clear by the context, while others are imprecise or worse (Syrquin, 1988).
[7] Indeed, according to Syrquin (1988), development economics can be characterized as addressing the issues of structure and growth especially in less developed counties and structure's analysis is carried out though micro and macro approaches.

In the nutshell, the most common use of 'structure" in development economics concerns the relative importance or weight in the economy in terms of production and factors utilization, and industrialization is therefore a key process of structural change (Syrquin, 1988). In the sense that structure refers to the composition of an aggregate, it is also applied to other aggregates that have some impact on the industrialization process such as demand and trade.

The rest of this study considers the definition of Breisinger and Diao (2008) for whom structural change refers to an "alteration in the relative importance of economic sectors" more precisely in term of production and employment. Indeed, in the literature, structural change in relation to economic development is defined as the reallocation of resources from low-productivity to higher-productivity activities[8] (UNCTAD, 2016a ;). This is a "classic" pattern of structural change where, as a country or region develops or grows, agricultural sector gradually loses its weight in the economic structure at the expense of the industry[9] and when the per capita income reached a certain level, the weight of industry in turn stops growing while that of services increases (UNCTAD, 2016b). However, it is also possible that the expansion of services may take place even before a sufficiently diversified and dynamic industry is well established, indicating an interruption in the industrialization process. In addition, there are some empirical evidences stating that an opposite pattern of structural transformation (i.e. the shift of resources especially labor from the high productivity to the low productivity activities) in the context of some Africans and Latin Americans countries (McMillan et al., 2014). Indeed, historically, services are generally considered to be more productive than manufacturing activities which, in turn, are more productive than agricultural activities. Nevertheless, this is not always the case, particularly in a context where services are dominated by informal activities. According to African Bank of Development (AfBD, 2016), in many African countries for example, a large portion of the labor force remains trapped in low-productivity informal services activities[10].

2.2. Structural transformation and productivity growth

Growth is examined and explained by two traditions that exist side-by-side in economic literature (Rodrick, 2013). The first one is anchored in development economics and is rooted in the dual economy approach initially formalized by Lewis (1954) and developed later on by

[8] The former are considered activities belonging to the traditional sector (dominated by agriculture) and the latter are classified under the modern sector (largely dominated by manufacturing and services).
[9] It includes in addition of the manufacturing, mining and quarrying, construction and utilities.
[10] It is estimated that as many as nine in ten rural and urban workers have informal jobs (ILO, 2009) and the informal economy labor force accounts for 78 percent of non-agricultural jobs in Africa, 93 percent of new jobs created, and 61 percent of urban jobs (Kessides, 2005).

Ranis and Fei (1961). This approach is built on structural heterogeneity and establishes a clear distinction between traditional sectors (largely dominated by agriculture) and modern sectors (industry and services). It is based on the principle that innovation and productivity growth take place in the modern sectors while the traditional sectors stay technically behind and stagnant. Thus, the growth of the economy as a whole depends on the rate at which resources (mainly labor) can migrate from traditional to modern sectors.

The second tradition is based on macroeconomics and emerges from Solow's (1956) neoclassical growth model. This approach assumes that the different types of economic activities are similar enough in terms of structure to be combined into a representative sector. So, in the neoclassical perspective, growth is shaped by incentives to save, to accumulate physical and human capital, and (in more recent variants that endogenize technological change) to innovate by designing new products and processes (Grossman and Helpman 1991; Aghion and Howitt 1992).

According to Rodrick (2013), these two approaches provide complementary perspectives on economic growth and one way of combining their points of view is to consider neoclassical model as fundamentally focused on the growth path within modern sectors, whereas dual economy model emphasizes the relationships and movements between sectors. Therefore, each approach gives a different reason why growth in less developed countries should be not only feasible, but also easy and fast, which provides a solid argument for the economic convergence. However, although these predictions have not proven accurate, their failure nevertheless informs us about the obstacles that must be overcome for economic development to take place. Based on these two sets of models, McMillan et al. (2017) identify two major development challenges:

- The "structural transformation" challenge: how to make sure that resources shift towards modern economic activities with higher levels of economic productivity.

- The "fundamentals" challenge: how to build up skills and broad institutional capacities required to stimulate sustained productivity growth, not only in a few modern industrial sectors but also across the full range of services sectors and other non-tradable activities.

The increase in the economy-wide productivity level can thus be due to improvements in the within sectoral productivity growth or/and the reallocation in factors of production between sectors, especially from low-productivity to higher-productivity activities (McMillan and Rodrik, 2011). So, the way and the speed at which structural change occurs may be one of the

key factors explaining the differences in economic growth between countries. Indeed, as McMillan et al. (2017) pointed out, structural transformation in principle can play a powerful positive role both in the early phases of development, when there is an "excess supply of labor" in agriculture and informal economic activities, and in the later stages, when capacities have built up and modern services have caught up with and overtaken industrial activities. But neither of these two outcomes is guaranteed because structural change is usually slow and sometimes takes place in the wrong way.

Furthermore, "fundamentals" and "structural transformation" challenge in growth may appear to be a single challenge, too closely interrelated to be isolated. A large part of the development literature is assumed that a policy that is successful on one dimension is also good on the other (Rodrick, 2013). For example, enhancing legal regime and human capital investment should be benefit both for overall productivity and for promoting industrial expansion. Deregulating international trade and industrial restrictions are likely to be good for overall economy and encourage entry into new economic activities. So, what is a desirable policy for growth is not necessarily different depending on whether one considers growth from the point of view of structural transformation or the setting up the fundamentals.

Even though there is significant overlap between the two groups of policies, it is also obvious that the two challenges have somewhat different policy implications (McMillan et al., 2017). Indeed, in practice, it may be much easier for example to directly stimulate industrialization, by subsidizing industry in various ways or by removing specific barriers to it, than to promote it indirectly by making large investments in human capital and institutions and expecting these to lead to incentives for investment in the industry. It is thus possible to rapid structural transformation (in other words, industrialization) without substantial improvements in fundamentals (Rodrick, 2013). As McMillan et al. (2017) mentioned, East Asia is the first example of this strategy. In China for instance, governance and human capital have considerably underperformed compared to the country's manufacturing prowess. In terms of the quality of governance related to corruption[11] for example, China had a relatively low score in 2019 (estimated at -0.32) compared to countries such as India (-0.23), South Africa (0.08), Malaysia (0.25) according to Worldwide Governance Indicators (2020).

[11] It is one of the six dimensions of governance considered in the Worldwide Governance Indicators And reflecting the perception of the degree to which public power is exercised for private interests, including both small and large forms of corruption. Scores range from about -2.5 (weak) to 2.5 (strong) for governance performance.

It is also possible to make significant investments in the fundamentals without getting much benefit in terms of structural transformation (Rodrick, 2013). According to McMillan and Rodrik (2011), Latin America has made significant progress in improving its governance and macroeconomic fundamentals since the early 1990s, but structural changes in the region have tended to reduce growth. Jobs have shifted from manufacturing and some other modern sectors have to low-productivity services and informal activities. Rodrick (2013) summarizes these possibilities in a 2×2 table (see Table 1) that provides a typology of growth patterns and outcomes.

As shown in Table 1, On the one side, structural transformation alone can lead to a fast growth, but if it is not supported by fundamentals, growth becomes depleted and is episodic (quadrant 2). On the other side, the building up of fundamentals, which entails high-cost, time-intensive and supplementary investments in the economy as a whole, leads to sustained but slow growth only if it is not supported by structural changes (quadrant 3). Definitely, sustained growth and convergence are a combination of both processes (quadrant 4). Indeed, in the ideal world, structural change will ultimately take its course and industrialization will attain its limits. Henceforth, growth is likely to be driven by the sustained accumulation of the fundamentals highlighted by the neoclassical theory of growth. The well-known long-term success stories, including Britain, Germany and the United States, all passed through these phases. It is also true for more recent successes, like Japan, Taiwan, South Korea and China. And if there are doubts about China's economic future, it is because much of the country's institutional transformation, particularly with regard to political institutions, has still to be done (McMillan et al., 2017).

Table 1: A typology of growth patterns and outcomes

		Structural transformation	
		Slow	Rapid
Investment in Fundamentals	Low	(1) No growth	(2) Epesodic growth
	High	(3) Slow growth	(4) Rapid, sustained growth

Source: Rodrick (2013).

This typology offers some clarifications of one confusing aspects of cross-national data: human capital and quality of institutions are strongly linked to income levels. But, there is little

evidence that improvements in institutions and human capital are robust indicators of economic growth (Rodrick, 2013). It suggests that this is not a contradiction, because on the one hand only countries that regularly improve their basic capabilities ultimately become rich. And on the other hand, investing in the fundamentals is not the fastest or easiest way to do so, at least in the early stages of development. At the beginning, it is rapid industrialization that feeds growth, which entails policies that may differ significantly from traditional fundamentals. Countries that exclusively focus on building broad-based capabilities are generally gratified by moderate growth, and thus may be turned away from these policies.

We will apply this typology to an interpretation of South African experience. It can be suggested that South Africa has generally undergone, at best, episodic growth-promoting structural change, moving back and forth between quadrants (1) and (2), although it can be argued that it has recently tended to try to move into quadrant (3). Indeed, as mentioned above, South Africa experienced until the late 1980s an expansion of its industrial sector (including manufacturing), and since 1988 the country has experienced a phenomenon of deindustrialization with an increase in the weight of the service sector in the economic structure (in terms of value added and employment) where productivity was roughly equal to that of the manufacturing sector (McMillan and Rodrick, 2014), but with on average low labor intensity and high skill levels (Rodrick, 2006). In addition, even though public spending on education has for several years now accounted for more than 18% of government spending (World Bank, 2021) and the country is performing relatively well in terms of infrastructure, many constraints still exist, particularly those related to the regulation of the labor market, an inadequately educated workforce. Indeed, the World Economic Forum's recent Global Competitiveness Report (Schwab, 2019) reveals that South Africa has persistently exhibited a lack of flexibility in the labor market, for example, regarding wage determination (which is limited), hiring and firing regulations (it is difficult, for example, to hire foreign workers). By contrast, it has developed one of the most advanced transport infrastructures with, for instance the "Logistics performance index: Quality of trade and transport-related infrastructure"[12] which is much above standard (World Bank, 2021).

The contribution of structural change in economy-wide productivity using a unifying framework[13] was largely addressed empirically in the existing literature. But due to the lack of consistent data, most of them mainly focused in the developed countries. However, more

[12] It is logistics professionals' perception of country's quality of trade and transport related infrastructure (e.g. ports, railroads, roads, information technology) ranking from 1 (very low) to 5 (very high) and South Africa score above 3 since 2007.
[13] This analytical framework considers that the increase in overall productivity results from what Rodrick (2013) calls "fundamentals" and the structural transformation.

recently, some studies are carried out in the context of emerging and developing countries (Timmer and De Vries, 2009; McMillan and Rodrik, 2011; McMillan et al., 2014; De Vries et al., 2015; McMillan et al., 2017; Haile, 2018; UNCTAD, 2018). Furthermore, it is not intended to provide an exhaustive review of these studies, but rather to present some of them which have examined the issue especially in South Africa.

McMillan and Rodrick (2011) for example use panel data of 38[14] countries (including South Africa) over the period 1990-2005 to show that structural change has led to growth reducing in Africa. In fact, aggregate labor productivity increased by 0.8 percentage points per year in Africa over this period and, while the contribution of sectoral productivity was estimated at 2.13 percentage points per year on average, structural transformation reduced Africa's growth by 1.3 percentage points. Using the same sample of countries and with data covering the same time period (i.e., 1990-2005), McMillan et al. (2014) structured their analysis into two time periods: 1990-1999 and 2000 and onward[15] in order to learn more about Africa's results. The authors show that, from 2000 to 2005, structural change contributed positively to Africa's overall growth. And in the weighted sample[16] where aggregate labor productivity growth was approximately 3 percentage points per year on average, structural change accounted for almost half of that growth. Over 1990-1999, structural change impeded economy-wide productivity in Africa. Indeed, in the unweighted sample, overall labor productivity growth was negative and largely the result of structural change. But, after 2000, structural change contributed about 0.4 percentage points in the unweighted sample and roughly 1.4 percentage points to labor productivity growth in the weighted sample. The findings of a study conducted by UNCTAD (2018) on 5 Southern African countries (including South Africa) suggest that, the structural change effect was responsible for 45 percent of the overall labor productivity gains between 1991-2010. It should be mentioned that these three studies used a two-component (within and between) decomposition approach.

Instead, applying a three-component decomposition approach (within, between-static and between-dynamic components) on a sample of 11 African countries and over 1960-2010, De Vries et al (2015) structured their analysis into three time periods: 1960-1975; 1975-1990;

[14] The panel includes twenty-nine emerging and developing countries for Africa, Latin America and Caribbean, Asia and nine high-income countries.
[15] The latter period corresponds to what many have called the "miracle of African growth" and a surge in world commodity prices (McMillan et al., 2014).
[16] Sample includes Ethiopia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, South Africa, and Zambia.

1999-2000; 2000-2010. The results of this analysis for South Africa are summarized in Table 2 below.

Table 2 : Decomposition results of overall productivity change in South Africa from 1960-2010.

Periods	Contribution (percentage points)			Overall productivity change in %
	Within	Between-static	Between-dynamic	
1960-1975	2.1	1.3	0.6	4.0
1975-1990	-1.0	1.3	-0.3	-0.1
1990-2000	0.8	0.5	-1.2	0.1
2000-2010	2.7	0.1	0.0	2.8

Source: De Vries et al (2015).

As shown in Table 3, overall labor productivity in South Africa varies across time periods as well as the contribution of various productivity effects. However, we can observe that structural change (which here includes between-static and between-dynamic components) contributed negatively to the shift in overall productivity in South Africa over the period 1990-2000 as was the case on average in Africa based on the McMillan et al. (2014) findings.

2.3. Determinants of structural transformation: candidate factors in south Africa's context.

In this section, we present a brief overview of the recent literature on the determinants of structural transformation. Dabla-Norris et al., (2013) highlighted that structural transformation is not a mechanical process. The extent and speed of sectoral changes reflect the capacity and willingness of capital and labor to relocate towards sectors, in particular with higher productivity. And this process is strongly affected on the one hand by the fundamentals (such as natural ressources endowment, demographic structure in term of age, education and skill) and on the other hand by policy and institutional environment.

In several recent theoretical studies, structural transformation is explained by elements that result jointly from two broad economic mechanisms (which drive the observed shift of economic activity across sectors) according to Dabla-Norris et al. (2013).

The former is based on one group of multi-sectoral general equilibrium models which emphasize on preferences or "demand factors", with income effects as the driving force behind the structural transformation process (Echevarria, 1997, 2000; Kongsamut et al., 2001). The sectoral movements are driven by differences in the income elasticity of demand for the different goods. Echevarria (1997) build for example three-sector dynamic general equilibrium

model based on Solow model of sustained growth with multiple consumption goods and non-homothetic preference to examine the interrelationship between sectoral composition and growth.

The latter is related to a group of models which focus on relative price effects or "supply factors" to explaining the long-term patterns of sectoral resource reallocation. According to Acemoglu and Guerrieri (2008), relative price shifts and sectoral changes are driven by different capital intensity. They can also be induced by different rates of productivity growth across sectors (Ngai and Pissarides, 2007; Duarte and Restuccia, 2010). Buera and Kaboski (2012a, 2012b) develop models that focus on the role of human capital or skill intensity in services, and scale up technologies as a complementary mechanism to explain industry and service growth paths during the development process. In line with the data, these theoretical models suggest an increase in the skill level, the skill premium and the relative price of services that is associated with the skill premium. It has also been shown that openness to trade and the resulting differential productivity growth rates across sectors have important implications for structural transformation (Matsuyama, 2008).

Lee and Wolpin (2006) build for example a two-sector model that measures the costs related to the sectoral reallocation of labor and evaluates the relative importance of changes in labor demand (e.g., driven by sectoral productivity and relative price changes) and labor supply factors (e.g., education level, demographic changes and fertility) for structural transformation. The authors found that, demand-side factors (i.e. technological change, shifts in product and capital prices) are driving the growth of the services sector. In addition, Lee and Wolpin (2006) also have established significant mobility costs and estimated that output in both sectors would have been two times higher than its current level if these mobility costs had been zero.

Sen (2016) highlighted that two broad sets of determinants of labor demand and supply have been identified in the literature. The first is related to government failures that hinder the functioning of factor and product markets. The second deals with market failures such as problems of coordination in investment and technology acquisition and learning externalities that drive private returns below social returns, resulting in underinvestment in areas of potential dynamic comparative advantage (McMillan and Rodrik 2014). Government failures can impede both the demand for labor in high-productivity sectors and the supply of labor in low-productivity sectors. According to Dabla-Norris et al. (2013), policies that constrain growth in high-productivity sectors, such as product and labor market regulations, can have a negative

impact on labor demand in high-productivity sectors. Also, policies that influence the movement of labor from low-productivity to high-productivity sectors, such as land reforms and migration policies, will have an impact on the supply of labor in low-productivity sectors.

As noted earlier, South Africa has persistently experimented with restrictive labor regulations in terms, for example, of real wage rigidity, hiring and firing regulations. This lack of labor market flexibility, with Chinese competition in the market for non-mineral tradable goods (including manufactured goods), is seen as one of the main reasons for the restriction of manufacturing production and employment contribution in South Africa. Indeed, the results of a study carried out by Jenkinsa and Edwards (2015) to analyze the impact of Chinese competition on South Africa's exports of manufacture products to its major markets in sub-Saharan Africa, Europe and the United States over the period 1997-2010, suggest that all types of manufactured exports have lost ground to China (with a strongest impact on low-tech products).

South Africa has also undergone several changes in trade policy. Before 1970s, the country has adopted an explicit industrial policy based on import substitution. Consequently, domestic industry was protected by several measures among others quantitative restrictions, high tariff barriers and country has suffered from a huge anti-export bias. In the early of 1970, South Africa was initiated trade liberalization and one of the first signs of this liberalization was the introduction of export subsidies as an initiative to offset the anti-export bias of import protection and in the side of imports, quantitative restrictions were replaced by equivalent tariffs and other duties (Caasim et al, 2004). While these signs of trade liberalization were observed, it was really in the 1990s that a more substantial and sustained process of liberalization began. And the World Trade Organization (WTO), in particular, was symbolically important in terms of consolidating South Africa's tariff phase-down agenda. Accordingly, starting with the removal of quantitative restrictions, the process has moved towards liberalizing imports through tariff reductions. In addition, the 1990s was marked by the end of the international sanctions (including trade sanctions) assigned to South Africa due to the Apartheid regime.

As South Africa integrates into the global economy through trade liberalization, there are emerging concerns about the impact on employment, output as well as economic growth (Edwards, 2001) and several channels have been found in the literature. Some scholars identified final domestic demand, exports and imports as a main source of change in employment as well as in output in South Africa (Edwards, 2001). So, through these sources,

domestic trade policy can affect the economic structure in term of employment and output and the effect depend largely on the level of competitiveness which in turn is related to some country specific factors including flexibility of labor, labor skill and transport logistic.

Through export expansion and import penetration, trade liberalization can affect respectively positively and negatively the level and the structure of output and employment. Usually, the sectors which are produce the tradable goods and services that are directly affected.

Furthermore, South Africa has set out a multidimensional program of land reform designed to redress imbalance in land holding and secure the land rights of historically disadvantage people (Fedderke, 2012). One of the objectives of these land reform has been efficiency in term of improved land use. But they lead to widespread underutilization of land due to many factors such as inappropriate project design, lack of necessary support services and shortages of working capital (Lahiff and Li, 2012). This is likely to explain changes in the structure of employment and production of the agricultural sector.

In terms of the empirical literature, there are several recent studies that have been conducted on the determinants of structural change and most of them are panel analyses (Martins, 2018 ; McMillan and Harttgen, 2014; McMillan et al., 2014 ; Dabla-Norris et al., 2013 ; McMillan and Rodrik , 2011). A summary of some of these studies is presented in Table 3.

Overall, these studies used regression analysis to analyze the determinants of structural change, although Dabla-Norris et al. (2013) also used quantile[17] analysis to investigate heterogeneity across countries. However, they do not cover the same time period or research area and also use different indicators to measure structural change. Martins (2018) McMillan et al. (2014) and McMillan and Rodrik (2011) have used labor reallocation or between-sector productivity effect as a proxy for structural transformation. Whereas, McMillan and Harttgen, 2014 used labor share in agriculture sector and Dabla-Norris et al. (2013) used real value added share in agriculture, manufacturing, and services sectors.

[17] Quantile regression relates a set of predictors variables to specific percentiles (or "quantiles") of dependent variable. Unlike the OLS regression, it sets no assumptions on the distribution of the target (dependent) variable and tends to resist the influence of outliers.

Table 3: A summary of some empirical studies on the determinants of structural transformation.

Authors	Research area and time period	Indicators of structural change	Methodology Approaches	General findings
Martins (2018)	169 countries over the world (1991-2013)	Structural change term (between-component contribution in %)	Regression analysis through fixed-effects estimator	The pattern of structural change can be significantly shaped by physical and human capital.
McMillan and Harttgen (2014)	19 African countries (2000 -2010)	Labor share in agriculture sector	Regression analysis	The substantial decline in the share of labor engaged in agriculture (which can be attributed to much of the recent growth and poverty reduction in Africa) has been most rapid in countries where the initial share of labor engaged in agriculture is highest and where increases in commodity prices have been accompanied by better governance.
McMillan et al. (2014); McMillan and Rodrik (2011)	38 countries over the world 1990–2005	structural change term (between-component contribution in %)	Regression analysis	Initial structural gaps (measured by agriculture's employment share at the beginning of the period 1990) have played a huge role in the ability of growth-enhancing structural change to occur. There is a very strong and negative association between a country's dependence on primary products and the degree to which structural change contributes to growth. The undervaluation of a country's currency promotes structural changes that are favorable to growth, while employment rigidity inhibits them.
Dabla-Norris et al. (2013)	169 countries over the world 1970-2010	Real value-added share in agriculture, manufacturing, and services sectors	Pooled OLS estimation and Quantile Regression	Country characteristics such as real GDP per capita, population size and demographic structure can explain a large proportion of the cross-country variation in sector share. And policy and institutional variables, such as product market reforms, openness to trade, human and physical capital can be also accounted for the variation in sectoral shares across countries

Source: Author elaboration.

Furthermore, their general finding highlighted that the pace and speed of structural change are shaped by many factors including initial structural gaps (captures by initial agriculture's employment share[18]), human and physical capital, policy, and institutional variables, such as product market reforms, openness to trade, real income level, population size and demographic structure.

To the best of our knowledge, Rodrick's (2006) study is the only one that has so far analyzed the determinants of structural change inclusively in South Africa. The author made a regression analysis over the period 1980-2004 across nine one-digit sectors. He found that output and employment in each sector of the economy respond to some factors including prices, costs and productivity. The results of his analysis suggest that the pattern of South African manufacturing is well explained by standard economic determinants. Relative Prices (captured value-added price index to GDP deflator ratio), labor costs (measure by skill-adjusted real remuneration levels[19]), and total factor productivity (obtained as a Solow residual using growth accounting approach) are the key factors that drive manufacturing output and employment. In terms of value added, manufacturing does not differ significantly from other sectors; a fall in its relative prices reduces the output of manufacturing by almost the same amount as other sectors on average. However, for employment, there are strong differences. Total employment and unskilled employment are considerably more sensitive to changes in relative prices in manufacturing than elsewhere. Skill upgrading and labor costs are not significantly associated with changes in value added, while they have powerful effects on employment. Both skill upgrading and skill-adjusted labor costs have a negative effects on employment, with the effect of skill upgrading being notably strong on unskilled employment. Furthermore, an increase in TFP (total factor productivity) effects output and employment in different way. It stimulates output and reduce employment.

[18] The intuition is that due to the large productivity gaps between agriculture and other sectors of the economy, countries with a high agriculture's employment share tend to have (at least in principle) more space to benefit from job reallocation. And as these gaps close, the scope for reallocation benefits is shrinking (Martins, 2018).

[19] In fact, Rodrick (2006) decomposed the changes in real remuneration by sector into the two components : a first component that represents the skill-adjusted wage, qualified as "wage-push component" and through which he assesses the role played by wage pressure . And a second component that is due solely to changes in skill composition of the workforce (qualified as "skill upgrading" or "skill-biased technological change" component)

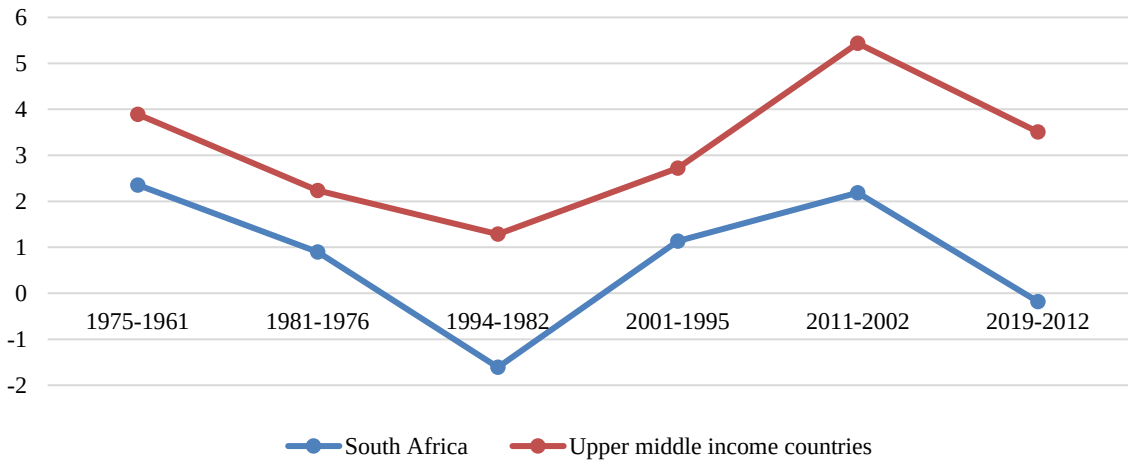
3. Structural transformation in South Africa: data descriptive analysis

In this section, we present an overview of trends underlying South African's economic structure. By examining the level, change, and composition of output, employment as well as labor productivity, we seek to provide insights on the nature and pace of structural change in South Africa. Nevertheless, we start by presenting an overview of the South African economy since independence. For this purpose, we mainly use data from World Bank (World Development Indicators) to document the main stylized facts from 1960 onwards.

3.1. Global overview of South Africa's socio-economic performance

During 1961 - 2019, South African's growth performance has been lower than the average of upper middle countries (see Figure 4). The pre-democratic transition is globally characterized by a downward trend of GDP per capita growth rate. The South Africa's annual average growth rate of GDP per capita was estimated at around 2.4% between 1975 and 1961, compared to 0.9% over 1994-1982. And as Figure 4 shows, over 1982-1994, the performance gap between South Africa and the average upper middle income country is relatively larger than in previous periods (i.e. 1975-1961 and 1981-1976). Indeed, over this period, South African's annual average growth rate of GDP per capita was about -1.6% relative to 1.3% as average of the upper middle income countries, which represents a difference of about 2.9 points of percentage compared to 1.5 and 1.3 points of percentage respectively in 1975-1961 and 1981-1976.

Figure 4 : Dynamic of GDP per capita growth (constant 2010US$) in South Africa over 1961-2019.



Source: World Development Indicators (2021).

However, South Africa's GDP per capita growth rate showed a positive trend between 1994 and 2011, reaching about 1.1 % and 2.2% respectively in 2001-1995 and 2002 - 2011. This recovery process may be explained by a remarkable transformation that South Africa has undergone since its democratic transition in 1994. South Africa's striking transformation at this period, including fundamental political and economic freedoms. In fact, before 1994, political and economic power was concentrated in the hands of the white minority and even though the Apartheid regime had started to unravel in the 1980s, the majority of blacks remained deprived of basic freedoms.

Considering the depth of racial and income disparities that prevailed, it would not have been unusual to anticipate, as Rodrick (2006) noted, a cycle of redistribution and macroeconomic populism after democratization that would have been detrimental to the economy and turned the country into a sham democracy. Instead, democratically elected governments headed by the African National Congress (ANC) have been successfully established political stability with a peaceful and racially balanced regime. Economic policy has been handled with the same exemplary manner[20]. It would have been expected that such a transformation would lead to a booming South African economy operating at or near full employment. However, the level of unemployment in South Africa is still very substantial and is one of the highest levels recorded in the world. As the figures in Table 4 show, unemployment has been estimated at about 28.2 % in 2019 that is far above the average level for upper-middle-income countries (6 %) and its group of emerging countries such as Malaysia (3.3 %), Mexico (3.4 %), Indonesia (4.7 %) and Brazil (12.1 %).

In general, South Africa's performance is poor compared to its peer group of emerging market countries. While overall, in upper-middle-income countries (and in several emerging economies), value added in industry (especially manufacturing) has driven GDP growth over the period 1994-2019, it is striking that for South Africa the opposite is observed. As Brazil, South Africa has recorded a pattern with industry and manufacturing growing significantly slower than GDP. This contrasts with countries like Malaysia, Thailand and Turkey, regarding the manufacture. This may be due to the premature deindustrialization of the South African economy, which in turn may explain its weak growth dynamics. Industry growth rates have historically been closely linked to GDP growth rates, and within industry, manufacturing has

[20] South Africa turning into one of the emerging markets with the lowest risk spreads and has implemented innovative and costly social transfer programs to address long-standing disparities within a framework of prudent fiscal and monetary policies that have kept inflation and public debt low (Rodrick, 2006).

played a critical role (UNCTAD, 2016b). A robust and deep domestic manufacturing base has been the core of economic development success, as it helps create virtuous and cumulative connections with other sectors of the economy, stimulates technological progress, and has the greatest potential for productivity gains. As manufacturing develops, primary production generally tends to become more efficient due to the increased use of capital and technology that lead not only to productivity gains in manufacturing, but also to the development of other subsectors in an economy. And at a certain level of per capita income, services sector can emerge to complement manufacturing activities and can even become dominant in the economy.

Although South Africa had an investment growth rate of about 4% over the period 1994-2019, one of the highest rates among the selected emerging economies behind India (7.8 %), Turkey (5.7%) and Indonesia (4.4%). It represented only 17.9% of GDP compared to an average of 30.7% in upper middle income countries, 21% in Russia, 22.9% in Malaysia, 25.9% in Turkey, 32.3% in Indonesia. Adequate investment (particularly in priority sectors) is fundamental to achieving structural transformation. It helps reinforce the virtuous circle of rapid productivity growth, more and better-paid jobs, higher household incomes, and expanded markets (both domestic and foreign), which in turn lead to higher levels of investment and thus help stimulate further productivity (UNCTAD, 2016b).

In 2019, exports of goods and services which account for about 29.8% of GDP in South Africa, a proportion higher than the average for upper middle-income countries (32.7%) but lower than that reached in Malaysia (65.2%), Thailand (59.8%), Mexico (38.8%) and Turkey (32.7%). Regarding manufacturing exports, South Africa's manufactured exports account for 43% of merchandise exports, compared to higher ratios in countries such as China (93.1%), Mexico (80%) and Malaysia (70.1%). However, South Africa had the lowest level of high-tech exports (% of manufactured exports) in 2019 (estimated at about 5.5% of GDP) and the lowest growth rate in exports of goods and services (i.e. 2.7%) among the selected emerging economies over the period 1994-2019. This poor performance of South Africa can be indirectly linked to globalization. According to Jenkins and Edwards (2015), South Africa has been losing competitiveness (especially in the manufacturing sector) due to Chinese competition in South Africa's main export markets as well as in the domestic market, particularly since China joined the World Trade Organization (WTO) in 2001.For example, they found South Africa's competitiveness losses of about 24.2 percentage points in Mozambique, 10 percentage points in Malawi and 9.4 percentage points in Zambia over the period 2001-2010.

The financial market appears to be more developed in South Africa in terms of the market capitalization of domestic listed firms, which is about 300.6 percent of GDP in 2019, compared to 110.8 percent in Malaysia, 104.7 percent in Thailand, and 60.1 percent in the upper-middle-income countries. While in terms of domestic credit to the private sector by banks (% of GDP), South Africa's ratio (66.7%) was lower than the average ratio of upper-middle-income countries (121%) and the ratios of countries such as China (165.4%), Malaysia (120.8%), Thailand (111.8%).

Table 4: South Africa's socio-economic Performance compared to some selected emerging economies.

Indicators	BRICS*					Other emerging countries					Upper Middle Income
	Brazil	Russia	India	China	South Africa	Malaysia	Mexico	Indonesia	Thainland	Turkey	
GDP growth 1994-2019 (%)	2.2	2.5	6.3	8.7	2.5	4.8	2.1	4.3	3.3	4.6	4.8
GDP per capita growth 1994-2019 (%)	1.1	2.6	4.8	8.0	1.1	3.0	0.8	3.0	2.6	3.1	3.9
Industry value added (including contruction)											
% of GDP in 2019	17.9	32.2	24.8	39.0	26.0	37.4	30.9	38.9	33.4	27.2	32.3
Growth 1994-2019 (%)	1.2	2.3	6.2	9.3	1.2	3.8	1.2	3.8	3.0	5.2	4.9
Manufacturing value added											
% of GDP in 2019	9.4	13.1	13.6	27.1	11.8	21.4	17.3	19.7	25.3	18.3	19.3
Growth 1994-2019** (%)	0.4	1.8	6.7	-	1.9	5.1	2.0	4.7	3.4	5.0	-
Exports of goods and services											
% of GDP in 2019	14.3	28.3	18.4	18.4	29.8	65.2	38.8	18.4	59.8	32.7	24.6
Growth 1994-2019 (%)	4.3	4.5	10.7	-	2.7	4.5	5.7	4.4	5.4	7.2	-
Manufactures exports (% of merchandise exports)	31.5	19.6		93.1	43.0	70.1	80.0	45.8	73.0	78.2	67.5
High-technology exports (% of manufactured exports)	13.3	13.0	10.3	30.8	5.5	51.8	20.4	7.6	23.6	3.0	23.4
Imports of goods and services											
% of GDP in 2019	14.6	20.8	21.1	17.4	29.3	57.7	39.1	18.9	50.6	29.9	23.3
Growth 1994-2019 (%)	4.7	5.9	9.4	-	4.3	4.6	5.1	3.9	4.3	6.7	-
Manufactures imports (% of merchandise imports)	75.4	82.0	50.2	59.9	63.4	67.9	76.9	68.0	68.6	58.1	66.4
Market capitalization of listed domestic companies % of GDP in 2019	64.5	-	76.0	59.6	300.6	110.8	32.6	46.8	104.7	24.3	60.1
Domestic credit to private sector by banks (% of GDP) in 2019	63.9	52.5	50.2	165.4	66.7	120.8	28.5	32.5	111.3	61.8	121
Grosss Fixed Formation											
% of GDP in 2019	15.3	21.0	29.9	42.6	17.9	22.9	20.7	32.3	22.6	25.9	30.7
Growth 1994-2019 (%)	1.7	2.7	7.8	-	4.0	3.2	1.4	4.4	0.5	5.7	4.3
Unemployment rate 2019	12.1	4.6	5.3	4.3	28.2	3.3	3.4	4.7	0.7	13.5	6.0

Note: *BRICS (Brazil, Russia, India, China, South Africa). ** For Russia, growth was computed over 2002-2019 due to availability of data. Growth rates are all calculated as compound annual average growth rates.

Source: World Bank, World Development Indicators (2021).

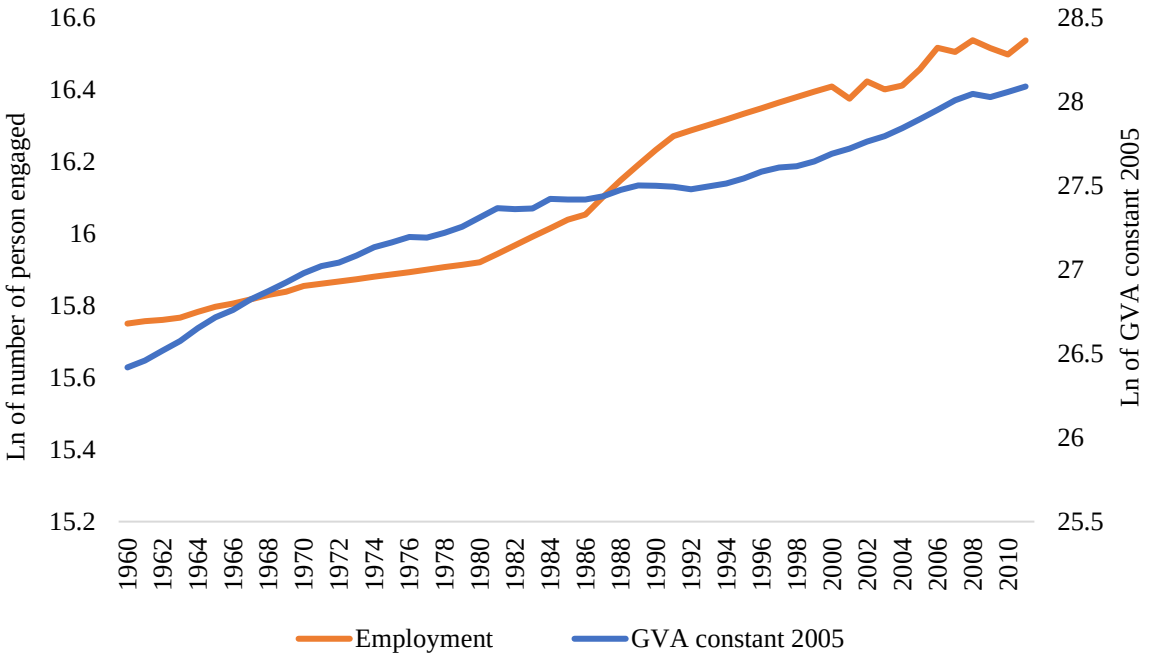
3.2. Dynamic of employment, output and labor productivity

The data presented in this section come from Groningen Growth and Development Centre (GGDC) 10-Sector Database over 1960-2011. GGDC 10-Sector Database provides data on the value added and employment (the number of people employed) across 10 economic activities based on the International Standard Industrial Classification (ISIC rev. 3.1). Table 2A (in appendix) provides more details on the classification of the nine main economic activities we considered, as well as their short names. It should be mentioned that a ninth category of activity that we have qualified as 'other' is a residual value (difference between the total value of the added value as well as the employment and the sum of the values of the eight activities initially selected).

Over the period 1960-2011, South Africa has broadly experienced an upward trend in aggregate employment and output (gross value added) with limited fluctuations, as depicted in Figure 5. These aggregated insights dissimulate significant differences in the evolution of these two indicators by sector. However, rather than showing the dynamics of these indicators by sector of activity, it is more interesting to present the trend of the sectoral share. Most notably, the more disaggregated insights (i.e. by main economic activity) reveals that the structural change experienced by the country has reduced its dependence on natural resources, both agricultural and extractive (see Figure 6). Over this period, the share of mining and quarrying value added declined from 27.6% to 6.3%, while share of agricultural employment decreased from 48.8% to 16.8%.

The shrinking of the primary sector has mainly benefited the services. Financial and business services have experienced an increase of more than tenfold in their share of employment and almost fivefold in their value added during this period. The share of employment of activities classified as "Trade, restaurants and hotels" as well as the share of value added of "Transport, storage and communication" has almost doubled. However, as we mentioned earlier, South Africa has experienced in the 1980s a steadily decline in the contribution of manufacturing to GDP as well as to employment in favor of services. Indeed, as shown in Figure 6, manufacturing employment share initially increased from 9.3% in 1960 to 16.8% in 1981, but it has contracted since then and falling to 11.6% in 2011. Similarly, manufacturing value added, which peaked at 24.5 percent in 1981 and fell to 18.3 in 2011.

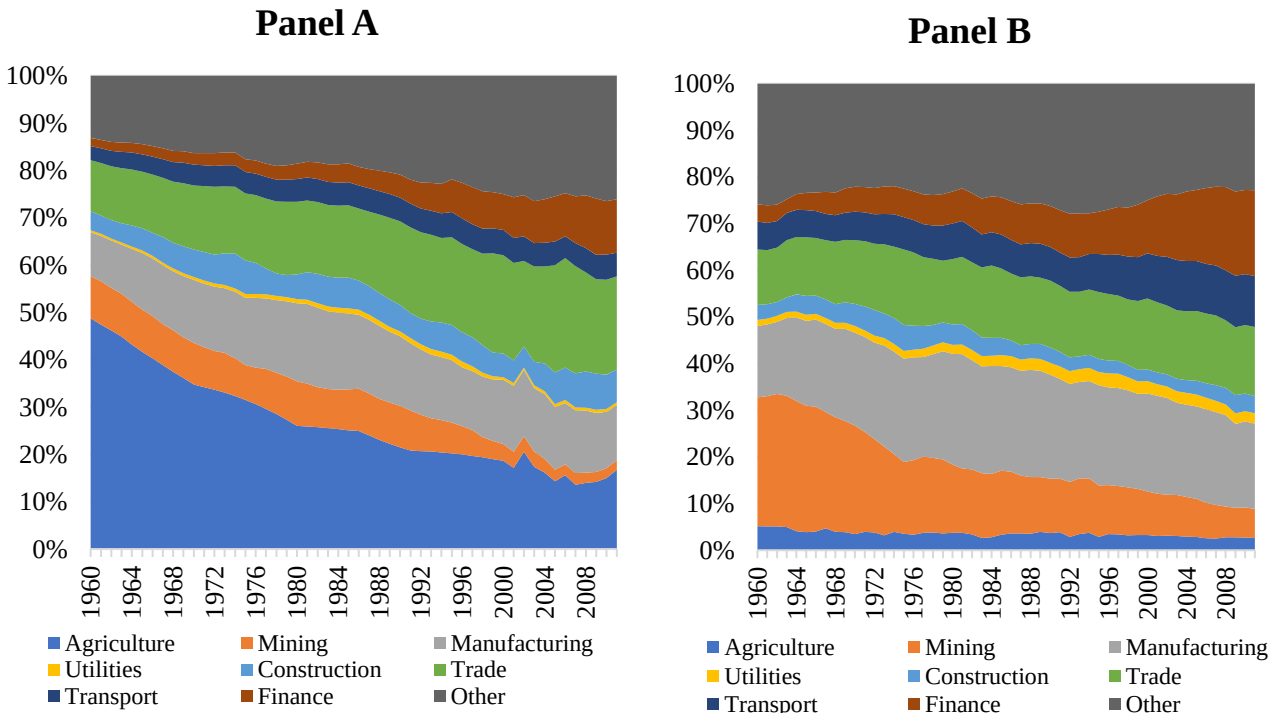
Figure 5: Trend of aggregate employment, value added from 1960-2011.



Note: Other includes the activities classified in the "government services" and "Community, social and personal services".

Source: GGDC 10-sectors Database.

Figure 6: Employment (panel A) and value added (panel B) shares by sectors over 1960-2011.

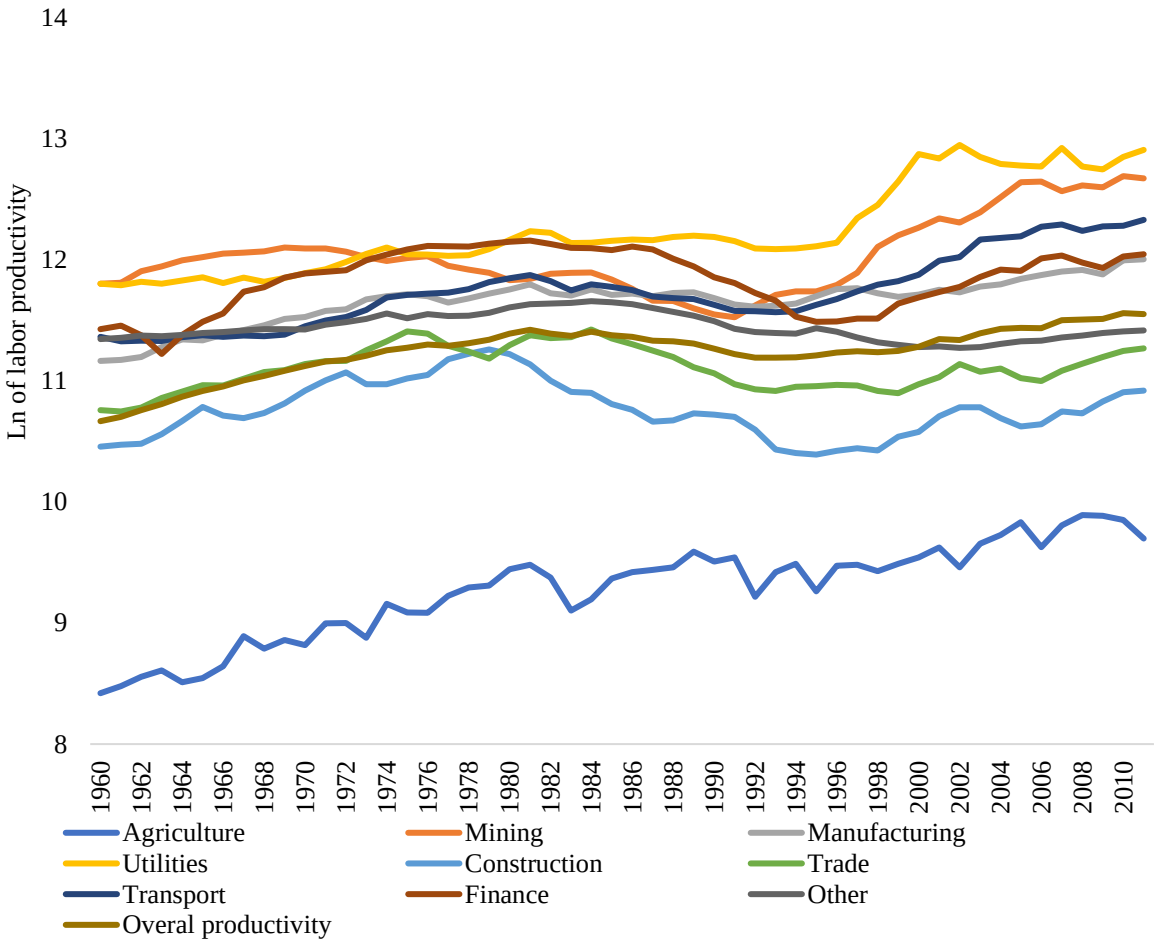


Sources: Same as figure 5.

The dynamic of average labor productivity (overall and across sectors) is depicted in Figure 7. Globally, aggregate productivity is relatively stable compared to the average productivity across sectors. However, its trend highlighted three main episodes: two expansionary periods and one phase of decline.

The trend observed over the first expansionary period (i.e., 1960-1981) is the result of a combined increase in productivity at the sectoral level. Globally, during this period, sectoral labor productivity increased . In the second period (1995-2011), average labor productivity growth in the South African economy was driven mainly by increases in specific sectors. Most notably, over 1996-2011, the average productivity of the activities classified in category "utilities" experienced a strong positive trend with a limited fluctuation. Transport, storage and communication sector also showed upward trend productivity from 1994-2011. After a contraction recorded between 1969 and 1991, the average productivity of the mining sector benefited from an increase in productivity from the 1990s.

Figure 7: Trend of labor productivity over 1960-2011.



Source: Same as figure 6.

The reduction in overall average productivity over the 1981-1995 period is largely due to the decline in all sectors in general, and especially in utilities, construction, and mining and quarrying, Finance, insurance, real estate and business services.

In summary, labor productivity in modern services sector is growing globally, outperforming the manufacturing industry. Labor productivity in manufacturing has generally been above average productivity levels and sometimes, above that of the modern services. And over the period 1960-2011, average labor productivity of sectors such as agriculture, construction, trade, restaurants and hotels was broadly lower than the average productivity of the worldwide economy.

4. Methodology

4.1. Structural change and aggregate productivity: A decomposition approach

To measure the contribution to aggregate productivity growth of the reallocation of workers across sectors, we use the canonical decomposition derived from Fabricant (1942) and commonly used in the literature. It decomposes the overall productivity change into a "within" and a "between" components. The within component measures productivity growth within sectors, while the between component captures the productivity effect of the redistribution of labor across different sectors. Indeed, many studies have used this this decomposition, it is for instance the case of Haltiwanger (1997) and Foster et al. (2001) who used it to examine the contribution of the plant productivity growth and reallocation of activity across plants to overall productivity growth in the US manufacturing sector. Furthermore, this approach has been used more recently in several studies including McMillan and Rodrick (2011), McMillan et al. (2014), McMillan et al. (2017), and UNCTAD (2018) to explore the contribution of these two effects to the economy-wide productivity growth in many countries of the world in general and in Africa in particular.

As noted by McMillan et al. (2017), this approach does not seek to deal with the issue of causality, but rather to present a set of facts in the hope that it will help policy makers to better understand their economies and allow future studies to develop better theories of growth and structural change. In addition, there is no doubt that the study of productivity at the sectoral level automatically hides the inherent heterogeneity of productivity within sectors. However, focusing solely on heterogeneity within a particular sector ignores the economic implications of sector-specific productivity changes. As an illustration, McMillan et al. (2017) point out that many studies have

shown that increased import competition has forced manufacturing industries around the world to become more efficient by rationalizing their operations. Typically, the least competitive firms have left manufacturing, while the remaining firms have shed their "excess labor". Furthermore, the question left without an answer by these studies concerns the fate of the workers thus displaced. Indeed, in economies that do not have large inter-sectoral productivity gaps or persistent high unemployment, labor displacement would not have significant implications for economy-wide productivity. However in many contexts, particularly in developing economies, the possibility cannot be excluded that displaced workers may end up in even less productive activities (services, informality). Indeed, this seems to have occurred typically in Latin America. An important advantage of the comprehensive approach to the economy adopted in this volume is that the authors are able to capture changes in the efficiency of intersectoral allocation, as well as improvements in intra-industry productivity. Thus, an important advantage of the economy-wide approach is that it captures changes in the efficiency of intersectoral allocation, as well as intra-industry productivity improvements.

In this framework, overall productivity (which refers just as a reminder to the total labor productivity in the perspective of our study for recalling) is given by

$$P_t = \sum_{i=1}^{n} \varphi_{i,t} P_{i,t} \qquad (1)$$

where P_t is total labor productivity in year t. $\varphi_{i,t}$ denotes the share of total labor employed in sector i at time t, $P_{i,t}$ refers to labor productivity in sector i at time t and $i = 1,..., 9$.

Then, the change in total productivity between t and $t-k$ (ΔP_t) is decomposed as follow:

$$\Delta P_t = \sum_{i=1}^{n} \varphi_{i,t-k} \Delta P_{i,t} + \sum_{i=1}^{n} P_{i,t} \Delta \varphi_{i,t} \qquad (2)$$

where P_t and $P_{i,t}$ denote economy-wide and sectorial labor productivity levels respectively. $\varphi_{i,t}$ refers to the proportion of employment in sector i at time t and Δ operator refers to the change in employment or productivity between t and $t-k$.

The first term on the right-side is “within sector” component which captures the contribution of productivity change within the sector to overall productivity change. It is also called “intra-effect”. “Within component” is the weighted sum of productivity change within individual sector, where the weights are each sector’s share of employment at the beginning of the period (i.e. $t-k$). When the weighted labor productivity change in sector is positive, this term will be positive. The second term is “between” component and also known as the “structural-change” component or “shift effect”. It captures how much of aggregate productivity growth

can be attribute to reallocation of workers across sectors. It is basically the inner product of productivity level (at the end of the time period, i.e. t) with the shift in employment proportions across sectors. This term will be positive and thus structural change will increase overall productivity when the shifts in employment shares are positively correlated with productivity level. So, the implication of this decomposition is that overall productivity growth can be reached in one of two ways. It provides clarification on how partial analyses of productivity performance within individual sector can be spurious when there are significant gaps in labor productivity ($P_{i,t}$) between economic activities (McMillan et al., 2017). Indeed, a high rate of productivity growth within an industry can have rather ambiguous consequences for aggregate productivity if the industry's proportion of employment declines rather increases. If for instance, the dislocated workers move into low-productivity activities, overall productivity will suffer and could even become negative.

However, some scholars as Timmer and De Vries (2009), De Vries et al. (2015) highlight that the between component in equation (2) is a static measure of the reallocation effect because it is solely dependent on differences in productivity levels across sectors, not on differences in productivity growth. Indeed, according to De Vries et al. (2015), this distinction is useful to the extent that expanding sectors may initially have high levels of productivity, but if additional workers cannot be employed efficiently, the marginal productivity of those additional workers will be low, resulting in a decline in productivity growth rates. This negative correlation could occur when, for example, a large proportion of new jobs are in low-tech and/or small-scale informal activities. An alternative decomposition method that explicitly considers the possibility that expanding sectors may have low rates of productivity growth is therefore suggested. Importantly, this approach introduces a third term in the decomposition and can be written as follows:

$$\Delta P_t = \sum_{i=1}^{n} \varphi_{i,t-k} \Delta P_{i,t} + \sum_{i=1}^{n} P_{i,t-k} \Delta \varphi_{i,t} + \sum_{i=1}^{n} \Delta \varphi_{i,t} \Delta P_{i,t} \qquad (3)$$

where on the right-hand side, the first term denotes within component (within-sector productivity changes), the second term is between component (between-sector productivity changes or between-static-effect) and the third term captures the joint effect of changes in sector productivity levels and employment (cross-sector productivity changes or between-dynamic-effect). This third component is positive if workers move to sectors with positive productivity growth and vice versa.

This second decomposition with, on the one hand, the static component and, on the other hand, the dynamic component of the structural change is confusing for two reasons according to McMillan et al. (2017). First, by definition, structural change is a dynamic process. And second, the third term by itself is difficult to interpret when, for example, decreases in the share of employment are accompanied by increases in productivity. Indeed, the term becomes negative, appearing to act as a brake on productivity, when in fact it could be seen as a positive development in sectors such as agriculture. Therefore, McMillan et al. (2017) combines the second and third terms in what they called "structural change" term. However, De Vries et al. (2015) claim that the analysis looks quite different depending on the approach adopted. They found, for example, that between 1960 and 2010, aggregate labor productivity growth in the 11 African countries (unweighted average) was 1.4 percentage per year. According to the first decomposition (i.e., equation 2), the within effect is positive at 0.8 percentage points and the external effect accounts for about 0.6 percentage points of growth. Based on the second decomposition (i.e., equation 3), the within effect is the same as before. Moreover, the between-static-effect suggests that labor has shifted to sectors with above-average productivity, which accounts for 1.5 percentage points. Furthermore, this approach shows that the sectors that have expanded have exhibited lower productivity growth than the overall average for the economy. This translates into a negative between-dynamic-effect of -0.8 percentage points.

Thus, in our analysis, we use both approaches. First, we decompose overall labor productivity growth among “within” and “between” productivity effects. Second, we disaggregate “between” productivity effect in “static” and “dynamic” components.

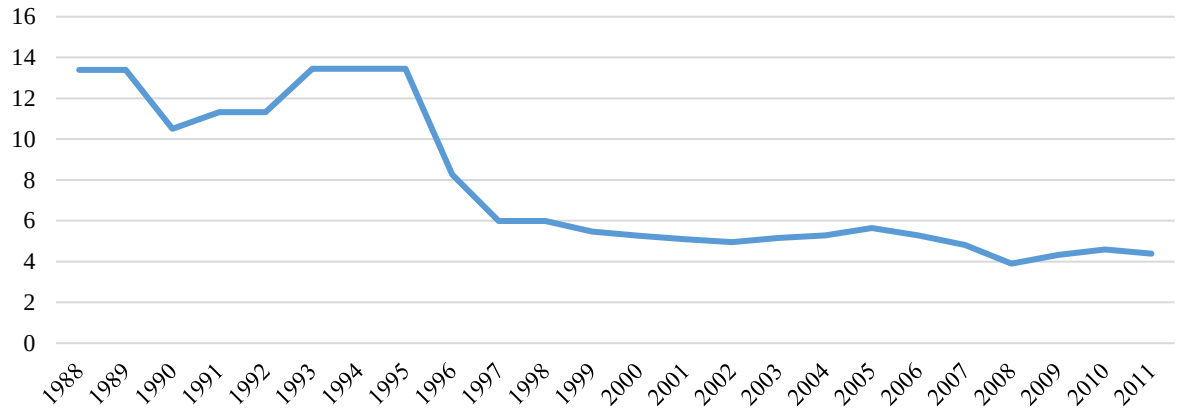
4.2. Explaining the pattern of structural transformation in south Africa

In this section, we present an econometric analysis of the factors that can explain the pattern of structural transformation in South Africa. We use as in Rodrick (2006), panel data regression analysis across sectors over 1960-2011. We mainly pay attention to some external shocks, sectoral and worldwide reforms experienced by South Africa including trade reform that took place in the 1990s, land reform initiated at the end of the Apartheid regime (i.e. 1994) and competitiveness issue due to more trade openness and especially China’s entry to WTO. Structural change term (derived from the labor productivity decomposition and described in the previous section) is used as outcome variable.

Trade reform, which was undertaken in the 1990s, featured a progressive reduction in tariffs and other restrictive measures because of South African's entry to WTO. This reform led to changes in some sectoral policies, particularly those related to the promotion of

industrialization. Indeed, one objective of the application of tariffs was protection of local companies considered young enough to face the international competition. And being more open international trade is likely to have mixed effect on structural change pattern through several mechanisms. On the one hand, we have opportunities to expand output and employment in some sectors due to the influx of foreign investment; the possibility of importing inputs and technologies required for production; and the expansion of demand due to both the possibility of selling abroad and an increase in domestic demand resulting from the increase in income. Improvement in output may also due to more efficient use of labor and capital to cope with foreign competition. On the other hand, more trade openness may lead to the reduction in output and employment as a result of the contraction of activities in sectors that are unable to compete both on the national and international markets. It may also reduce employment opportunities (especially in unskilled labor) due to a reorientation towards more capital-intensive activities in order to face competition. Figure 8 depicts a negative trend in the simple mean tariff rate applied to all products over the 1988-2011. A substantial decline was recorded two years after South Africa joined the WTO, i.e. in 1994. The tariff rate dropped from 13.45 percent to 8.27 percent, a decrease of 5.18 percentage points.

Figure 8 : Trend of the simple mean tariff rate (in %) applied to all products over the 1988-2011.



Source: World development indicators (2021).

The potential effects of land reform experienced by South Africa are equally mixed. In fact, as we mentioned previously, one of the objectives of these land reform was improved land use. But, due to many factors such as inappropriate project design, lack of necessary support services and shortages of working capital (Lahiff and Li, 2012), they lead to widespread underutilization of land. So, these land reforms may lead to a reduction in production and employment due to inefficient use of land by the new. However, with respect to employment, it is also possible to

expect that agrarian reform will not substantially lead to a contraction in the number of people engaged in the agricultural sector due to the high capital intensity in this sector (in particular, regarding intensive agriculture which contribute to a large share of agricultural value added and employment). It is worth mentioning that land reform was initiated in 1994 and became much more effective in the late 1990s and early 2000s, with a total of 1.4 million hectares redistributed to 130,000 beneficiaries between 1994 and 2002 (equivalent of about 10.2 percent of South African arable land in 2002 and 41.2 percent of the total land redistributed between 1994-2011)[21].

Regarding the competitiveness issue, several studies (Edwards, 2001; 2015) point out that South Africa has suffered a loss of competitiveness as a result of more trade openness and especially China's entry into the WTO in 2001 combined with the real wage rigidity of the South African labor market. Loss of competitiveness would lead to a decline or slowdown in the evolution of production and employment through the contraction of less competitive sectors, which in turn could lead to a reduction in national demand due to lower incomes or unemployment of individuals in the sectors that have contracted. Since the China joined the WTO, bilateral trade with South Africa and China has grown dramatically. In 2011, China was the main South Africa's pattern in term of imports and exports. With a share of 14.2 percent in 2010 (up from 8.9 percent in 2000), China was the main source of South Africa's imports, ahead of Germany (11.3 percent), the USA (7.4 percent) and Japan (5.2 percent)[22]. China was also the main destination for South African exports in 2010 with a share of 11% in 2010 compared to 3.1 percent in 2000. South Africa's trade with China is dominated by manufactured goods (in the broad sense), which in 2010 represented 97 percent of exports and 85% percent of imports. However, South African exports are largely dominated by raw materials, whereas imports from China are mainly consumer products and increasingly capital goods[23].

In our analysis, trade tariffs are used as indicator that allow us to capture trade reform. The effect of land reform is analyzed by introducing year dummies in the specification. And Chinese competition is only analyzed at the level of the South African domestic market and is measured by the level of penetration of Chinese imports. Import penetration is captured by M/D, with M and D denotes imports and domestic demand, respectively.

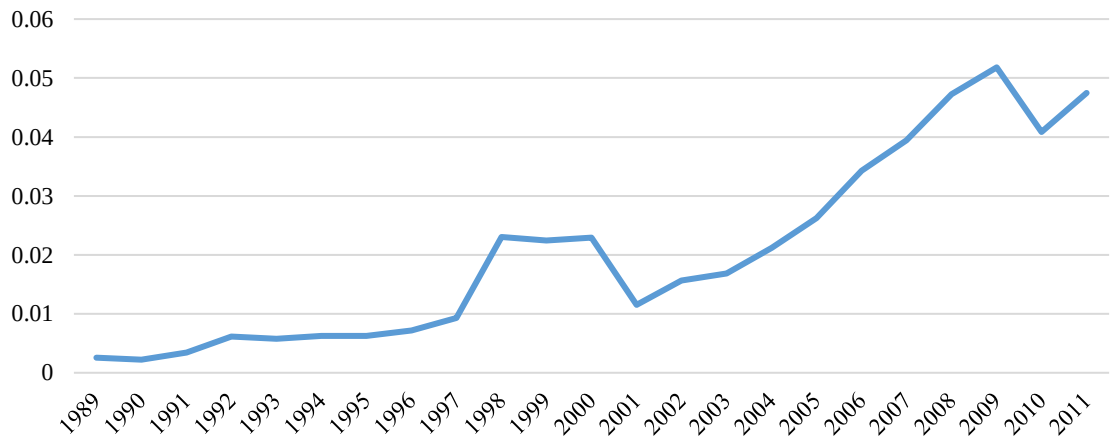
[21] See Lahiff and Li (2012) and Jacobs et al (2003) for more details.
[22] These statistics were calculated from the Research and Expertise on the World Economy database (in short CEPII in French version).
[23] See Edwards and Jenkins (2015) for more details.

$$D = Y + M - X \qquad (4)$$

where Y is gross output and X is exports.

Figure 9 shows the trend of Chinese import penetration over 1989-2011, with a positive trend from 2001 to 2011, although there is a decrease between 2009 and 2010.

Figure 9 : Trend of Chinese import penetration (1989-2011).



Source : Authors' calculations based on Research and Expertise on the World Economy database (CEPII).

As other determinants, we consider "within" effect or component as a proxy of TFP and sectoral earnings as proxy of labor cost. Reallocation or "between" effect is used to capture structural change.

Thus, the following empirical specification will be tested:

$$STC_{s,t} = \alpha_0 + \varphi STC_{s,t-1} + \alpha_1 Dri_t + \alpha_2 Sect_j + \alpha_3 Dri_t \times Sect_j + \beta' X_{j,t} + \rho_t + \epsilon_{j,t} \qquad (4)$$

Where *STC* stands for structural change (in logs) of sector j in time t, *Dri* stands for drivers of interest assessed in this study including Chinese competition, trade liberalization/reform and land reform. *Sect* stands for sector fixed effects (dummies variables). $X_{j,t}$ is the set of determinants that change across sectors and over time (TFP). ρ_t stands for the time fixed effect. ϵ stands for error term.

5. Empirical findings

In this section, we provide in two steps the results of our analysis. First, we present and discuss the contribution of structural transformation to aggregate labor productivity growth. Second,

we discuss the factors that drive the shift in the sectoral structure of South African output and employment

5.1. Structural transformation and overall labor productivity growth

We have divided our study period (i.e. 1960-2011) into non-overlapping five periods: 1960-1975, 1975-1981, 1981-1994, 1994-2001, 2001-2011. This subdivision was motivated on the one hand by the country's economic performance and on the other hand by events likely to explain this performance, notably the end of apartheid in 1994 and China's to WTO in 2001.

The period 1960-1975 is approximately the "golden age of growth" in South Africa as in most African countries (De Vries et al., 2015). The average annual real GDP per capita growth rate over this period was estimated at about 2.4% compared to 0.9%, -1.6%, 1.1% and 2.2% recorded over the other four periods respectively. This outcome is driven by, among others, the rise in commodity's price, especially gold[24] in the case of South Africa.

Our results suggest that, during 1960-1975, labor productivity in South Africa has grown by an average of about 4.14 % per year. Over this period, within sector component contributed approximately 2.74 percentage points. This substantial within effect is the result of the increase in productivity in all sectors considered (see Figure 7). This effect has been driven in large part by following sectors: manufacturing (0.70 percentage point [pp]), Wholesale and retail trade, hotels and restaurants (0.60 pp), mining and quarrying (0.44 pp), Transport, storage, and communication (0.39 pp). It means that over this period, labor productivity on average experienced an improvement. This may be explained by physical capital-labor ratio deepening, improved technology and efficiency (enhanced skill, more suitable management practices). On average, all sectors considered experienced positive growth in total real fixed capital stock, with growth rates ranging from 2.7% (agriculture) to 13.1% (construction)[25]. This increase in physical capital was high relative to the growth of hired workers. Some sectors such as agriculture and mining even recorded a contraction in the number of workers, with a negative growth rate estimated at around 1.97% and 0.31% respectively.

[24] Gold mining accounted for about 10.1 percent of gross national product in 1960 (Pillay, 1981) and the nominal price of the mineral rose from $36.50 in 1960 to $186.77 in 1974 per troy ounce (World Gold Council, 2021).
[25] See Prinsloo and Smith (1997) for more details.

Table 5 : Decomposition of overall labor productivity growth (1960-2011)

Period	Overall productivity growth (%)	Contribution of (Percentage points)		Between component (Percentage points)	
		Within component	Between component	Static contribution	Dynamic contribution
1960-1975	4.14	2.74	1.40	1.38	0.02
1975-1981	2.50	0.97	1.53	1.61	-0.08
1981-1994	-1.71	-2.09	0.38	0.46	-0.08
1994-2001	2.21	2.52	-0.31	-0.06	-0.25
2001-2011	2.12	2.51	-0.38	-0.15	-0.23

Source: Author's calculations based on GGDC 10-sectors Database.

During the period 1960-1975, structural transformation was "productivity-enhancing" following the two decomposition approaches. As Table 5 shows, structural change contributed positively (by 1.4 pp) to overall labor productivity growth, but this contribution is relatively smaller than within sector effect. Based on three components decomposition approach, static reallocation gain was quite high (1.38 pp) in comparison to the dynamic gain (0.02 pp). This reflects the fact that, over this period, workers moved to activities with productivity above the average leading for those sectors to positive productivity growth. In section 3.2, we discussed for instance that workers moved over this period from agricultural sector to manufacturing. As far as agricultural sector is considered, labor productivity in manufacturing was much higher and did not decline compared to the average productivity in the whole economy (see figure 7). Like agriculture, the share of mining in the overall employment has shrinked at the expense of manufacturing (see Figure 6). Accordingly, these two sectors have experienced a static loss.

Static contribution at the aggregate level has been drawn upwards notably by manufacturing (0.52 pp), Government services, Community, social and personal services or "other" (0.47 pp) and Wholesale and retail trade, hotels, and restaurants respectively by 0.22 pp. Meanwhile, dynamic contribution was largely attributed to manufacturing (0.02 pp) and Wholesale and retail trade, hotels and restaurants (0.01 pp) sectors.

The substantial contribution of the manufacturing to the structural change component as well as to the within component over 1960-1975 reflects a striking growth of the manufacturing during this period. This might well be due to active import substitution policies pursued by the

government of South Africa to stimulate domestic manufacturing[26] and state investment in key sectors as utilities (electricity) and transport. Indeed, South Africa, as many countries in sub-Saharan Africa, is richly endowed with natural resources. Schneider (2000) point out the fact that for most of these countries, the profits generated by primary commodity exports were generally repatriated by foreign firms or captured by domestic elites. However, South Africa has been able to keep a large part of the profits from gold and diamond mining in its territory. This has been made possible by, among others, the implementation of import substitution policies (e.g., through the application of import tariffs) that have led, for example, mine owners to invest their own funds in certain local manufacturing companies, especially those closely related to mining, such as dynamite, chemicals, protective clothing and metallurgy. In addition, the state developed other sectors that they considered essential but not profitable, such as railroads and electricity[27].

Overall, during the 1960-1975 period, structural change experienced by south Africa was growth enhancing and contributed for a substantial part of labor productivity growth, in line with the finding of De Vries et al. (2015). And at sectoral level, the manufacturing sector stands out with a major contribution to reallocation effect as well as within component.

As indicated above, South African's economic growth slowed down during the period 1975-1981 compared to the period 1960-1975. Over 1975-1981, labor productivity growth was estimated at approximately 2.5% on average per year. Structural transformation has made a substantial contribution to overall labor productivity growth (roughly 1.53 pp) relative to within effect (0.97 pp). Regarding the within effect, the main sectors considered have contributed positively to the labor productivity growth, excluding mining and quarrying (-0.45 pp), Wholesale and retail trade as well as hotels and restaurants (-0.09 pp). This negative contribution reflects a decline trend of labor productivity for both sectors over this period (see figure 6). The drop in mining and quarrying productivity has been draw by the striking of labor productivity in gold and uranium mining. This subsector dominated mining and quarrying sector[28], and during this period it experienced a negative growth of labor productivity, around 4.6 percent (Fedderke and Pirouz, 2002). This may be explained by the fact that, the higher gold price led to more economic use of available reserves which in turn led to a decline in

[26] The manufacturing was more protected sector with nominal protection rate (unweighted mean) in order of 30 percent compared to 15 percent for agriculture and 3 percent for mining (Belli and al, 1993).
[27] South Africa state formed for example the Electric Supply Commission (Escom) to supply the mines with cheap electricity (Schneider, 2000).
[28] Gold and uranium mining accounted for about 80.9 percent of total mining output in 1970 and 46.5 percent in 1997.

output per worker in terms of kilograms. According to Fedderke and Pirouz (2002), another explanation can be found in the nature of the underground gold mining itself. Indeed, the increasing difficulty of extracting gold ore may have led to a decrease in labor productivity due to the constraints imposed by the mining tasks to be performed. And in this case, the explanation for the decline in labor use, according to the authors, lies in the technological requirements.

Reallocation effect was globally positive at sectoral level except for construction (- 0.17 pp) and agriculture (-0.12 pp). Over this period, static contribution was positive (gain) and substantial (about 1.61 pp), while dynamic contribution was negative (loss) and relatively small (-0.08 pp). At sectoral level, construction and agriculture are also the two sectors which experienced static losses with contribution to overall labor productivity estimated at around -0.11 and - 0.16 pp, respectively.

In sum, during 1975-1981, overall labor productivity experienced a positive growth and structural transformation's contribution was substantial compared to within effect. At the sectoral level, mining and quarrying was the sector that has contributed most negatively regarding the within component. Despite the decline in labor productivity in the mining and quarrying sector, it remained well above the average productivity recorded in the South African economy (see figure 7). This reflects the positive reallocation effect of this sector, which along with manufacturing are the sectors that have driven up the structural change contribution to overall labor productivity.

South Africa shifted from a slowdown in growth during the period 1975-1981 to an negative average annual growth rate of real GDP per capita over the period 1981-1994. There was also a contraction in the overall labor productivity during this period. The average growth rate per year of labor productivity was around -1.71%. This striking has been drawn by within component which contributed for about -2.09 points of percentage. At sectoral level, all sectors considered experienced a drop in productivity, excluding agriculture (see Figure 7). This may be explained by the reduction in the level of investment as a result of the crisis which in turn may have led to a decline in capital-labor ratio. Indeed, over 1981-1994, the growth of the total real fixed capital stock in most of the sectors considered has slowed down (with rates well below the rates recorded in the two previous periods, i,e. 1960-1975 and 1975-1981). And some sectors such as agriculture and construction experienced a negative growth rate, estimated at about 2.02 percent and 1.57 percent respectively.

The within productivity loss during this period is mostly attributed to Government services, Community, social and personal services or "other" (-0.47 pp) , Wholesale and retail trade, hotels and restaurants (-0.45 pp), Finance, insurance, real estate and business services (-0.40 pp), manufacturing (-0.27 pp). Despite the decline in labor productivity in the three sectors mainly responsible for within productivity loss over the period 1981-1994, it remained above the aggregate average productivity. This translates into a positive reallocation effect of these three sectors, which have contributed for about 0.46, 0.19 and 0.41 pp to overall productivity growth respectively (see Figure 11). However, manufacturing and mining are two sectors which mainly drawn down structural change effect, with -0.39 and -0.25 pp as contribution. This reflects the fact that, these two sectors (which were the mainstay of the South African economy at that time) have been the most affected by the crisis. Indeed, the fall in the price of gold during this period is part of the causes of the crisis (Jones and Inggs, 1994). And as noted above, the deployment of the manufacturing sector has been largely based on the mining sector.

Overall, structural change has made a positive contribution (0.38 pp) while within effect made negative contribution over 1981-1994 (-2.09 pp). With respect to three components decomposition approach, static effect (with a contribution of about 0.46 pp) shifts upwards the contribution of structural change. Dynamic component has contributed negatively (-0.08 pp).

During period 1994-2001, there is a recovery in economic activities and labor productivity has grown positively by about 2.21 percent on average. Within component positively contribute to the overall growth in labor productivity and its contribution is estimated at approximately 2.52 percentage points (pp). This substantial contribution has been drawn by all sectors considered, excluding Government services, Community, social and personal services or "other" which recorded a negative contribution (-0.38 pp). Within sector productivity gain over this period is mainly attributed to mining and quarrying (0.95 pp), Transport, storage, and communication (0.55 pp), manufacturing (0.36 pp).

However, South Africa exhibited growth reducing structural transformation over 1994-2001. It contributed for about -0.31 pp to overall labor productivity growth. This negative contribution was mostly driven by mining and quarrying, which accounted for about -0.99 point of percentage of structural change effect. This sector has seen its share in overall employment shrink at the expense of services sectors (see Figure 6). Overall, South African‘s economy experienced static and dynamic losses estimated at about 0.06 and 0.25 pp of overall labor productivity growth.

As in the period 1994-2001, South Africa exhibited growth reducing structural change over 2001-2011. Overall labor productivity experienced a positive growth on average (about 2.12%). And while within component contributed positively to aggregate labor productivity improvement (around 2.51 pp), structural change made a negative contribution (-0.38 pp). The within sector contribution has been drawn by all sectors, mostly manufacturing (0.50 pp) and Finance, insurance, real estate and business services (0.48 pp). Growth reducing structural change is mainly attribute to manufacturing (-0.37 pp), mining and quarrying (-0.34 ppp). However, some sectors positive structural change effect. This reflects the decline in the share of employment of these two sectors, which have seen their share fall in favor of the services sector. Regarding the services sector, Finance, insurance, real estate and business services (0.45 pp) and Government services, Community, social and personal services or "other" (0.44 pp) are two sectors which mainly drawn upwards structural change contribution. Like in the 2001-1994, South Africa exhibited static and dynamic losses estimated at approximately 0.15 and 0.23 pp of overall labor productivity growth (see figures 12 and 13).

Figure 10 : Within contribution at the sectoral level.

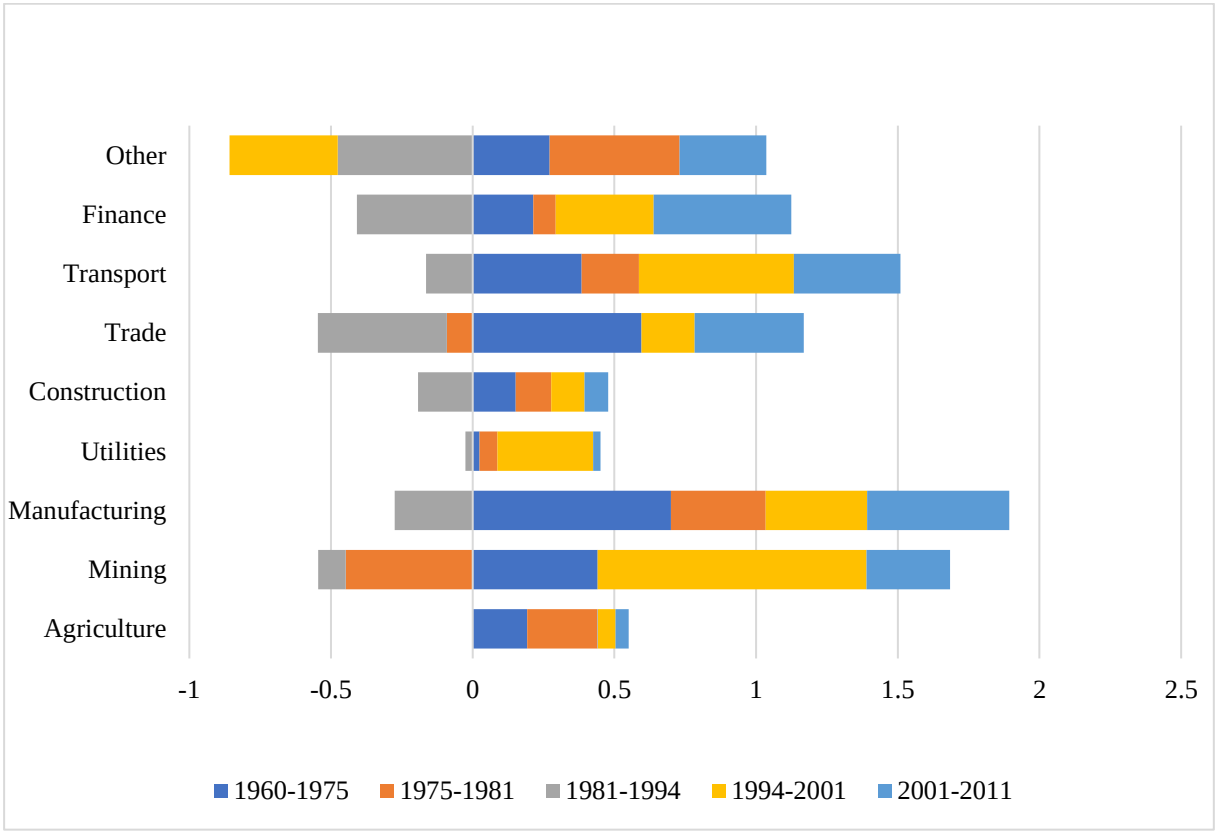


Figure 11 : Between contribution at the sectoral level.

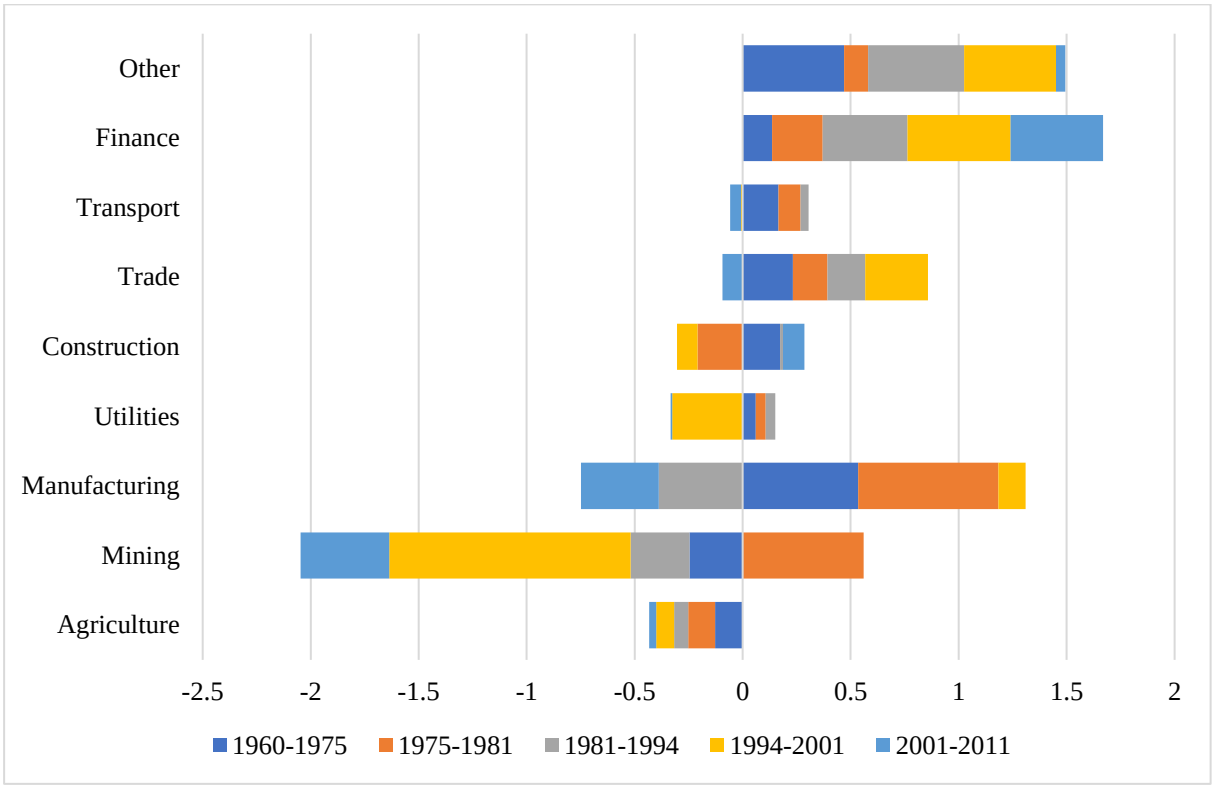


Figure 12 : Between static contribution at sectoral level.

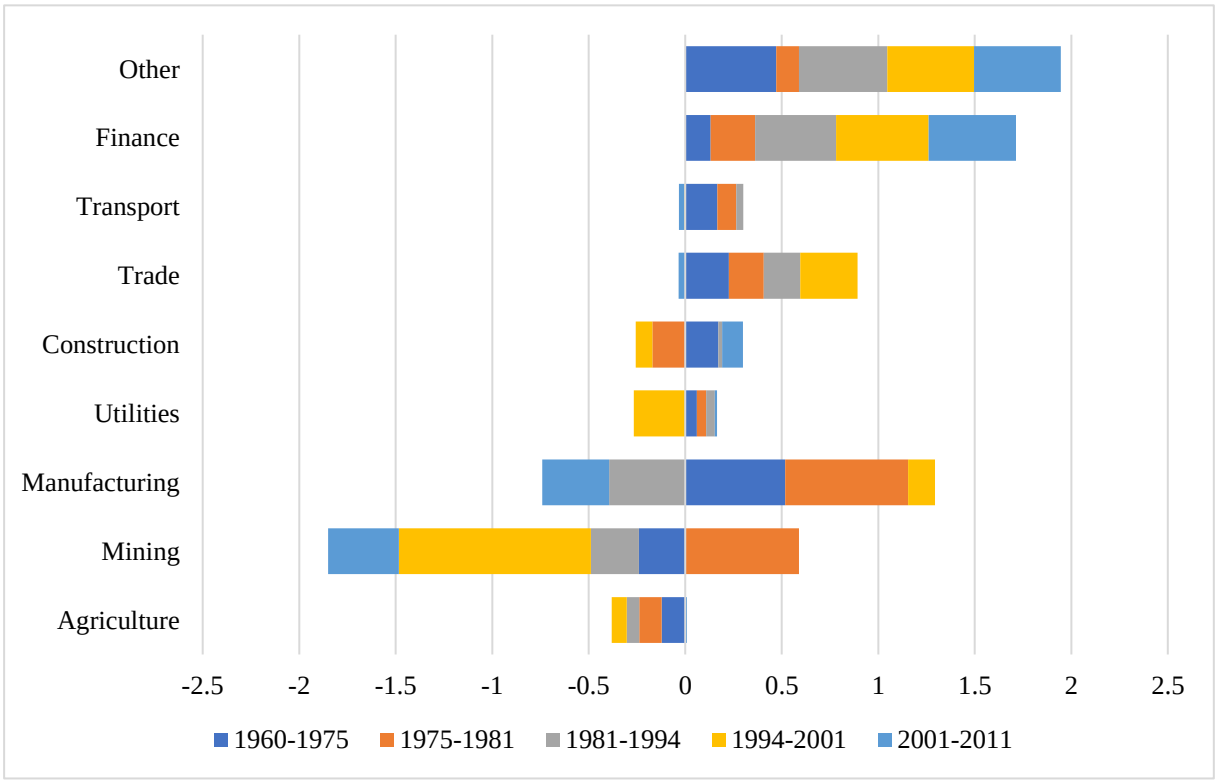
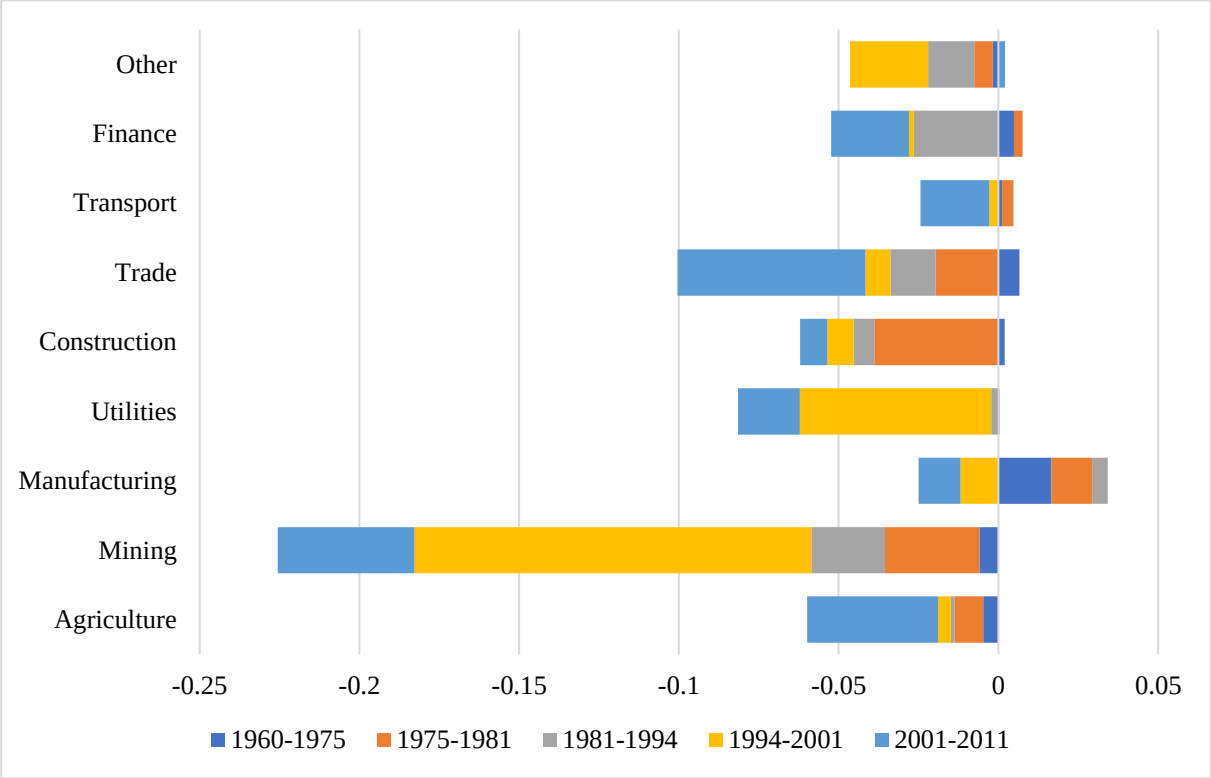


Figure 13: Between dynamic contribution at sectoral level.



In conclusion of this section, the decomposition results of labor productivity growth during the five-period considered from 1960-2011 suggest that structural transformation was growth enhancing over 1960-1975, 1975-1981, and 1981-1994. While it was growth reducing over 1994-2001 and 2001-2011. Reallocation effect as well within effect varies across sectors.

5.2. Determinants of structural transformation

In this section, we present the results of panel data regressions at sector level aimed at highlighting the key drivers of the pattern of structural change in South Africa (Table 6). We regress the structural change term at the sectoral level over the period 1960-2011 (the second term in equation (2), annualized in percent) on a set of plausible explanatory variables with a focus on Chinese competition, Trade liberalization and Land reform. It is worth notice that our equation of interest is a parsimonious reduced form in which we try to control of unobserved heterogeneity with a bunch of fixed effects. Moreover, from this analysis, we claim no causal inference, but rather guess some structural correlation between those drivers and the pattern of structural change in South Africa. Five specifications are defined for each of the potential

candidates factors likely to explain the structural change pattern observed in South Africa that we have identified. These include Chinese competition, tariffs, trade reform that took place in the 1990s, land reform initiated at the end of the Apartheid regime (i.e. 1994). Regarding the land reform, we also evaluate its effect of effectiveness of the reform from 2002, when about 10.2 percent of South African arable was redistributed (refers to land reform 2 in Table 6).

We begin by examining the persistence of structural change by using the lagged value of one period (in this case the year) of structural change term. Although this variable enters the regression with a positive coefficient, it is not statistically significant whatever the specification (row 1 of dependent variables). This implies that the convergence of structural change is not an unconditional process. Starting with a large contribution of structural change to overall labor productivity growth can increase the potential for structural change-induced growth, but the mechanism is clearly not automatic.

We also considered as explanatory variables the within term at sectoral level, derived from labor productivity growth decomposition that we use as a proxy of total factor productivity (TFP). This indicator enters the regression with a negative coefficient and is highly significant (row 2 of dependent variables). Not surprisingly, there is a very strong and negative association between structural change and within terms. This can be explained by the fact that, most of the time, sectors that experience a contraction in employment (number of people engaged in our study) are likely to benefit, all other things being equal, from an improvement in average productivity. Our results are in line with the findings of Rodrick (2006) which suggest that TFP is negatively associated with employment.

As far as Chinese competition is concerned, we use import penetration at aggregate level as a proxy. Our results (column 1) suggest that there are sector specific effects. Among the selected sectors, only four are significantly likely to be affected by Chinese competition. Three could be negatively affected (Manufacturing, Utilities and Government services, Community, social and personal services or “other”) and one positively (Finance, insurance, real estate and business services). Manufacturing sector appears to be the most negatively i.e. 6.7% lower than the sector of reference (Agriculture). This is in line with the findings by Jenkinsa and Edwards (2015) which suggest that South African manufactured products have lost ground to China over the period 1997-2010. This may be explained by the labor cost differential in favor of China and the fact that Chinese imports into South Africa are largely dominated by manufacturing products.

Our results also suggest that, trade liberalization through lower import tariffs could lead to growth enhancing structural change in manufacturing, construction, finance and government services (other) sectors (column 2). In fact, the coefficient of interaction between tariff rate and categorical variable associated with this sector is statistically negative. This may be explained by the fact that, free trade has intensified activities in these sectors, particularly in labor-intensive activities. The insignificant coefficients associated with both agricultural and mining sectors could be justified by the fact that, trade in these sectors is largely dominated by primary products for which South Africa is price taker.

The trade reform took place in the 1990s as well as land reform (whether the reference period is 1994 or 2002) seems to have negatively affected the structural term of mining, manufacturing, utilities, trade sector, and "other" sectors (column 3, 4 and 5). While the effect seems positive for the finance sector and non-significant for agriculture and transport sectors.

Overall, our regression results suggest that, across all sectors considered, the convergence of structural change is not an unconditional process and within term used as a proxy of TFP is negatively correlated with structural change component. Furthermore, Chinese competition, trade liberalization and land reform seem to have sector specific effect. Manufacturing sector appears to be the most significantly affected by Chinese competition. In general, a positive impact of trade liberalization seems to have been seen on the structural change term, however. Finally, land reform as well as the other plausible drivers (including Chinese competition, trade liberalization) seem to have non-significant effect on structural change term in agricultural sector.

Table 6 : Determinants of the scope of the structural change term.

Dependent variable : STRUCTURAL CHANGE TERM (logs)					
	(1)	(2)	(3)	(4)	(5)
	Chinese competition	Tariff	Trade Liberalization	Land Reform 2	Land Reform
L. Structural Change.	0.113	0.003	0.118	0.138	0.150
	(1.27)	(0.04)	(1.38)	(1.45)	(1.72)
TFP(within component)	-0.449**	-0.604**	-0.393**	-0.404**	-0.398**
	(-3.57)	(-4.61)	(-3.76)	(-3.80)	(-3.65)
Chinese competition	-0.0203				
	(-0.68)				
Tariff		0.0005			
		(0.66)			
Trade Liberalization			-0.001		
			(-1.71)		
Land Reform 2				0.002	
				(1.84)	
Land Reform					-0.003
					(-1.45)
Mining x Driver	-0.027	-0.0002	-0.004***	-0.003***	-0.001***
	(-1.82)	(-1.11)	(-12.48)	(-11.13)	(-9.47)
Manufacturing x Driver	-0.067***	-0.004***	-0.005***	-0.003***	-0.005***
	(-12.88)	(-9.99)	(-11.22)	(-12.40)	(-20.61)
Utilities x Driver	-0.039***	0.002***	-0.001***	-0.001***	-0.0005***
	(-12.17)	(19.25)	(-11.42)	(-15.95)	(-10.78)
Construction x Driver	0.014	-0.0005*	-0.0004***	-0.0002	0.0005*
	(1.44)	(-2.36)	(-7.38)	(-1.71)	(2.48)
Trade x Driver	-0.032	-0.0004	-0.0014***	-0.0007**	-0.002***
	(-1.95)	(-0.41)	(-22.92)	(-4.70)	(-8.98)
Transport x Driver	0.0002	-0.0005	-0.0001	0.0002	-0.0006*
	(0.02)	(-1.23)	(-0.46)	(0.52)	(-2.36)
Finance x Driver	0.076**	-0.005**	0.0027***	0.0029**	0.0023*
	(3.37)	(-3.56)	(5.53)	(4.54)	(2.69)
Other x Driver	-0.030**	-0.002*	-0.002***	-0.0018***	-0.0020***
	(-3.74)	(-3.11)	(-9.07)	(-11.20)	(-6.66)
Constant	0.0009	-0.0003	0.0012*	0.0014*	0.0015
	(2.21)	(-0.18)	(2.33)	(2.43)	(2.30)
N	369	216	450	450	450
Sectoral fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
adjusted R^2	0.423	0.550	0.419	0.407	0.408

Note: t statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6. Concluding remarks

This study investigates the role and the determinant of structural transformation in South Africa. Specially using data from Groningen Growth and Development Centre (GGDC) 10-Sector Database over 1960-2011 to evaluate the contribution of structural transformation to aggregate productivity growth based canonical decomposition derived from Fabricant (1942). Using the reallocation effect or component at sectoral level as a proxy of structural change, we assess the determinants of the pattern of structural change observed in south Africa. Our results revealed on the one hand that, over the five-period considered from 1960-2011, structural transformation was growth enhancing over 1960-1975, 1975-1981, and 1981-1994 while it was growth reducing over 1994-2001 and 2001-2011. This reflects the fact that, over the first three periods, workers moved from low-productivity to high productivity activities. During these periods, workers moved more mainly from the agricultural sector and to some extent from the mining sector to the booming manufacturing sector (with a labor productivity largely above the average of the economy as a whole). The expansion of manufacturing sector is explained by, among others, the rise in commodities price (especially gold), which combined with the implementation of import substitution policies led for example to mine owners to invest their own funds in certain local manufacturing enterprises, particularly those closely related to mining, such as dynamite, chemicals, protective clothing, and metallurgy. During the two-last period (i.e. 1994-2001 and 2001-2011), South African's economy has been largely dominated by the services sector and workers have migrated to sectors such as construction, trade and government, whose productivity on average has been lower than that of the manufacturing sector and the economy as a whole. On the other hand, the results of panel data regression at the sectoral level (with structural change component as a outcome variable) suggest that, across all sector considered, the convergence of structural change is not an unconditional process and within term used as a proxy of TFP is negatively correlated with structural change component. Furthermore, Chinese competition, trade liberalization and land reform seem to have sector specific effect. Manufacturing sector appears to be the most affected by Chinese competition. However, in general, trade liberalization seems to have had a positive impact on the term structural change. Finally, land reform seems to have non-significant effect on structural change term in agriculture sector.

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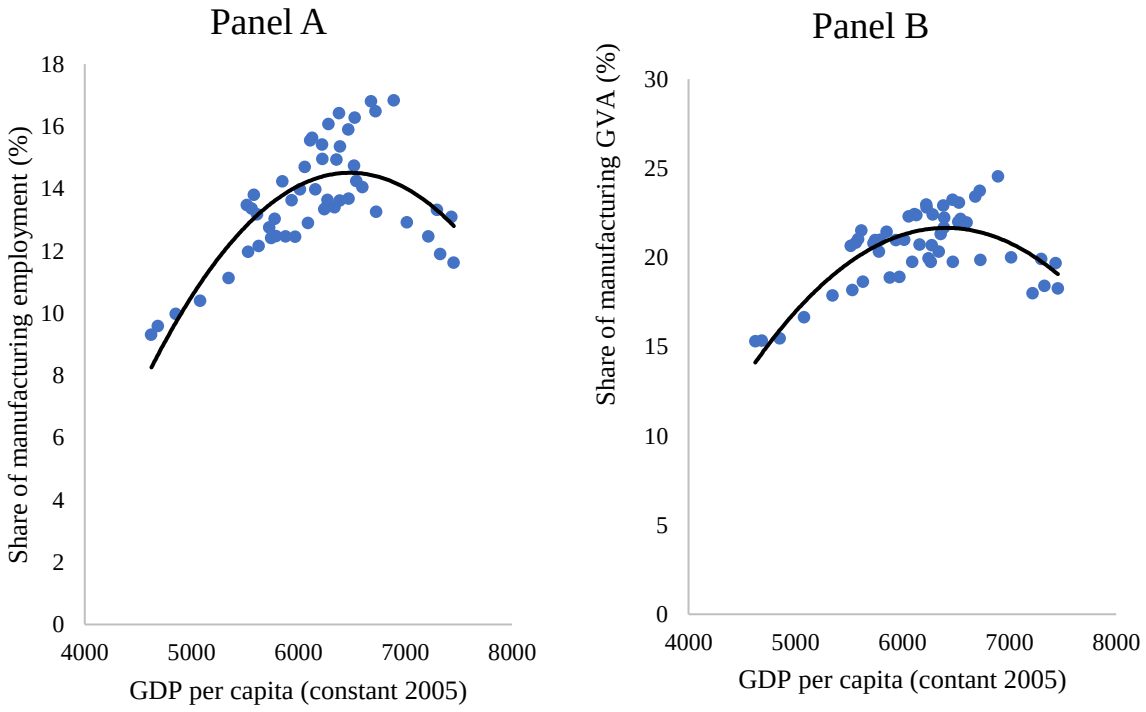
Appendix

Table 1A: A snapshot of economic structures of south Africa and Malaysia in 1988 (US=1).

	Y/L	(K/Y)[a]	H/L	A	Mining share of GDP
South Africa	0.25	0.956	0.568	0.46	0.111
Malaysia	0.267	1.004	0.592	0.45	0.103

Notes: Y/L , K/L and H/L refer to output per worker , physical capital intensity and human capital per worker, respectively. A is productivity level calculated as a residual and a=α/(1-α), where α refers to output elasticity of capital in the simplest Cobb-Douglas production function.
Source: Hall and Jones (1999)[29].

Figure 1A : South African's premature deindustrialization process (1960–2011).



Source: GGDC 10-sectors Database.

[29] Cited by Rodrick (2006).

Table 2A: GGDC 10-sectors data description.

GGDC 10 sectors		Aggregation for our analysis	
Main economic activities (sectors)	**ISIC rev. 3.1 code**	**Short Names**	**ISIC rev. 3.1 code**
Agriculture, hunting, forestry and fishing	A, B	Agriculture	A, B
Mining and quarrying	C	Mining	C
Manufacturing	D	Other	D
Electricity, gas and water supply	E	Utilities	E
Construction	F	Other	F
Wholesale and retail trade, hotels and restaurants	G, H	Trade	G, H
Transport, storage, and communication	I	Transport	I
Finance, insurance, real estate and business services	J, K	Finance	J, K
Government services	L, N	Other	L, N, O, P
Community, social and personal services	O, P		

Source: GGDC 10-sectors Database.