Structural Transformation in Ethiopia's Manufacturing Sector

Worku Gebeyehu,* Getnet Alemu‡ & Kefyalew Endale‡

Abstract

This study assesses the extent of structural transformation within the manufacturing sector by discomposing the source of labour productivity and TFP growth, shares of capital, and employment among other indicators. For the sake of the analysis, the manufacturing sector is classified into three categories: resource-based, low technology, medium and high technology. Labour productivity and TFP growth were estimated using data between 1982/83–2017/18 to assess the reallocation of resources among industrial groups. The findings show that resource-based industries still hold the largest share of output and capital in the manufacturing sector, and remains to be the most productive group. Low technology industries continue to maintain the largest percentage of workers although there has been high rate of growth of workers in medium and high technology industries in recent years. Albeit the prevalence of a slight movement of workers from lower productive to higher productive industrial groups with a given productivity level, there is no evidence of dynamic reallocation or a movement of labour driven by productivity changes across industries. Static comparative advantages or natural resource endowments seem to induce the establishment of most industries in Ethiopia, although these same industries heavily rely on imported inputs. In addition, government policies tend to favour resource-based and low technology industries in the form of, for instance, the provision of working premises and infrastructural facilities such as power through the establishment of industrial parks. Thus, there is a need to improve institutional and policy enablers to address existing binding constraints and strengthen inter-sectoral linkages not only to efficiently tap the available domestic resources, but also pave the way for the growth of medium and high technology industries as a pathway for faster pace of industrialization and economic development.

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1. Introduction

The level and growth of productivity varies across firms in each sector and among sectors in an economy, which causes substantial disparities in the level of development among countries. The industrial sector is a driver of structural transformation and an engine of economic growth (Chenery & Taylor, 1968; Kuznets, 1971). Industries are testing grounds or diffusion centres for innovative ideas and new technological discoveries emanated from, or within, education and research institutions. For instance, Botswana with ample mineral resources, and South Korea

*Institute of Development and Policy Research and Department of Economics, Addis Ababa University: worku.gebeyehu@aau.edu.et. (Corresponding author)
‡Institute of Development and Policy Research, Addis Ababa University.
‡Institute of Development and Policy Research and Department of Economics, Addis Ababa University

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with limited natural resources but access to finance from Western allies, kick-started an 'economic-take off'; and managed to grow into two digits between 1965 and 1980. However, the South Korean economy continued to grow, while Botswana stuck in the middle-income equilibrium after the 1980s. The sustained growth of South Korean economy was largely attributed to the creation of fundamentals for the growth of a knowledge-based export-oriented manufacturing sector, coupled with increased accumulation of capital and efficient use of foreign capital; whereas the main source of growth of the Botswana's economy was mining (EEA, 2015 in UNDP, 2018).

Resource endowments may dictate development paths in the early stages of development (Chenery & Syrquin, 1975 cited in Todaro & Smith, 2015). But in a later stage, countries may need to engage in activities that enhance productivity growth and boost their economic growth. Countries learn from the experiences of previous achievers. It is has been noted that as the "… 'leader-country' moves up the product ladder to more sophisticated industrial production, the late comers can move into the low cost and low skill manufacturing sectors being vacated by the 'lead-country' and 'kick-start' their industrialization process" (Akamatsu, 1962 cited in Cheru, 2015).

Albeit having a long history of handicraft and cottage industries, a conscious and policy-driven industrialization process was sought in Ethiopia as early as 1945 with the launching of the Ten-Year Industrial Development Program (Imperial Government of Ethiopia (IGE), 1945, cited in Worku, 2015). The three different medium-term plans, which were launched between 1957/58 and 1967/68, also gave emphasis to resources-based industries, particularly the agro-processing within the framework of import substitution strategy (IGE, 1957, 1962 & 1968; cited in Worku, 2015). During the period between 1974–1991, industrial investment widened beyond agro-processing, but remained within the realm of socialism that restricted private sector involvement. The restriction on private sector investment was legally uplifted since 1993. The Agricultural Development-Led Industrialization (ADLI) strategy was launched in 1995; while the Industrial Development Strategy was launched in 2004 (Ministry of Information). Subsequent medium-term development plans of the country continued to give emphasis more to labour-intensive resource-based industries.

The Growth and Transformation Plan II (2015/16–2019/20) gave due consideration for structural transformation of the economy towards industrial sector by increasing the share of manufacturing in GDP from 5.2 percent in 2015/16 to 8.0 percent in 2019/20; both by increasing the number of firms and improving their capacity utilization and productivity. The plan envisaged to consolidate enablers such as the expansion of power generation, constructing industrial parks, and reducing transaction or logistic costs of trade. Besides labour-intensive and agro-processing industries, emphasis has also been given to light and heavy metallic, engineering, chemical, non-metallic, and pharmaceutical industries (National Planning Commission, 2016). A new economic policy—Home Grown Economic Policy—was launched in 2019.

In general, various measures have been taken with the aim of expanding the manufacturing sector during last 60–70 years. However, there has not been a noticeable change in the structure of the economy. The share of the manufacturing sector to GDP rose from 1.6 percent between 1961–1964 to 3.4 percent between 1970–1974; 5.3 percent between 1985–1989 (Worku, 2015); and stuck at 5.2 percent in 2015/16 (National Planning Commission, 2016); and 6.5 percent in 2019/20 (National Bank of Ethiopia, 2020/21).

Existing natural and human resource endowments often guide entrepreneurs where to channel their resources. Structural transformation is vital not only among broad economic sectors, but also within a given sector towards sub-sectors that ensure a more productive use of resources. Accordingly, structural transformation is driven by the reallocation of labour from low-productivity to high-productivity activities that include identifying and exploiting dynamic comparative advantages for a higher pace of industrialization as evidenced in many East Asian countries, including South Korea.[1] In view of this, assessing whether there has been some kind of structural transformation within the manufacturing sector, or whether there is a relative labour share reallocation away from resource-based industries to light, medium and large technology groups, is an imperative in the case of Ethiopia.

Some research works have been done on this issue in the case of Ethiopia. For instance, Kidanemariam, Gebreeyesus and Ohno (2019) estimated productivity and assessed the movement of labour among the International Standard Industrial Classification (ISIC) three digit industries. Using firm level, Shiferaw (2005), Shiferaw and Bedi (2013) and Shiferaw (2016) in Manyazewal and Shiferaw (2019), assessed whether there has been reallocation of labour among industrial groups. These studies brought inconclusive evidences, and did not give focus on the strategic importance of different industrial groups based on their resource and technology orientation.

The depth of industrialization of a country is gauged by the extent to which it has moved from resource-based to medium and high-tech industries. Hence, examining the trend of structural transformation of the manufacturing sector from resource-based to other more complex technology groups provides insights on how to reorient the composition of industries for faster pace of industrialization and economic development. To our knowledge, no empirical study has been conducted—at least in the context of Ethiopia—based on a systematic classification of industries by technology groups.

Thus, the main objective of this paper is to assess the extent of structural transformation among the different technological groups as classified by Lall (2001) within the Ethiopian manufacturing industries. The study uses a combination of methods based on secondary data collected from the Central Statistical Agency (CSA) for large- and medium-scale industries.

[1]South Korea transited from being one of the poorest countries with a GNP per capita income of US$82 in 1961, to US$25,977 in 2013 (World Bank, 2014 in Page & Tarp, 2017). This was achieved by, among other things, setting and implementing development plans that were subsequently revised based on the growth potentials of the country. For instance, the Second Development Plan gave emphasis to export-oriented light manufacturing industries such as textiles, clothing and footwear; and the 3rd development plan attempted to strike a balance between light and heavy industries (EPB, 1978; IMF, 1979 in Page and Tarp, 2017).

2. Literature Review

Both the balanced theory of Nurkes (1953) and unbalanced theory of Hirschman (1958) implicitly suggest the need for some form of structural transformation for countries whose economies are stuck in a primary sector and move towards industrialization. According to Nurkes (1953), investment in one sector (such as agriculture) without accompanying investments in other sectors (such as industry) is not rewarding because of insufficient demand. Thus, synchronized and coordinated investments in different sectors of the economy create backward and forward linkages and externalities that provide a remedy for inadequate markets in terms of increasing demand and incomes in less developed countries (Rosenstein-Rodham, 1943). Hirschman (1958), on the other end, argued for the use of limited resources on certain selected areas rather than scatter them in a wide range of activities, for instance, through import-substitution strategy to facilitate structural transformation towards the industrial sector, which is the engine of economic development. The industry sector provides a wider room for increasing returns, enhancing linkages and productivity within itself and beyond. Virtually all cases of high, rapid, and sustained economic growth in modern economic development have been associated with industrialization, particularly the growth in manufacturing production (Szirmai 2009). In a similar tone, Kaldor (1966, 1967) found a positive and statistically significant relationship between industrialization and economic development.

Thus, structural transformation and the development of competitive manufacturing activities is a necessary condition for sustained economic growth. The gain from international trade is associated with higher dynamic efficiency that is to be tapped by changing towards industrial branches that use, among other things, more skilled labour and the growth of high-value and skill-intensive manufacturing export products (Dijkstra, 2000). In other words, sustained and rapid industrialization requires a shift from low-productivity and primary activities to those that use modern technologies, create new skills, generate beneficial spill-over effects on other sectors, and change the trade structure towards more complex, technology-based activities (Lall, 2003). The proposition of using comparative advantage for the mutual benefits of trading partner countries had been dominant for years until it was proved otherwise among the East Asian countries. Cheap unskilled labour or raw material resources may be a necessary condition, but these do not guarantee sustainable industrial growth. Even simple labour-intensive activities such as clothing, footwear or food processing require sophisticated capabilities if they are to face global competition. Thus, a strong local capability is the one that determines competitive success (ibid.).

The level of industrialization of countries is not only measured by the share of the industrial or the manufacturing sector to GDP, but also in terms of the composition of manufacturing output by technology use (Weiss, 2002). Technology-intensive industries offer better opportunities for further learning and application of new scientific knowledge and skills and growth, whose products tend to be income elastic, create new demand, and substitute older products (Lall, 2001). The transition from low technology-intensive to technologically complex may entail scarification of the short-term benefit of the resource-based (RB) comparative advantage. The transition is a result of a cumulative process of learning, agglomeration, and interaction of firms; supported by enabling government policies (Redding, 1999; Lall, 2001). Based on technological complexity and resource use, Lall (2001) divided industrial activities into four main technological groups: resource-based (RB), low technology (LT), medium technologies (MT), and high technology (HT).

RB products tend to be simple and labour-intensive, and their competitive advantage heavily relies on the availability of natural resources in the local market. LT industries require stable technologies with relatively simple skill requirements. Labour cost is a major element of the total cost in the competitiveness of these industries, with low-scale economies and barriers to entry. The demand for the products of LT industries grows slowly because of their income inelastic nature. MT industries require skill and scale-intensive technologies with moderately high levels of R&D, and lengthy learning periods. They are a nucleus for matured industrialization. HT industries use advanced and fast-changing technologies, with high R&D investments with prime emphasis on product design. The most advanced technologies require sophisticated technology infrastructures; high levels of specialized technical skills and close interactions between firms; and between firms and universities or research institutions (ibid., 2001).

Table 1: Industrial Classification by Resource-base and Technology Intensity

Industrial Classification	Products
Resource-based manufacturers	
Agro/forest-based industries	Meat, fruits, vegetable oil, wood products, etc.
Other resource-based industries	Cement, glass, cut gems, petroleum, rubber products
Low technology manufacturers	
Fashion cluster	Textile fabrics, clothing, headgear, footwear, leather products
Other low technology	Simple metal parts/structures, furniture, jewellery, plastic products and toys
Medium technology manufacturers	
Automotive products	Vehicles and parts, motorcycles and parts, engines, machinery and equipment
Medium technology process industries.	Synthetic fibres, chemicals, and paints, fertilizers, plastics, iron, pipes/tubes
Medium technology engineering industries.	Engines, motors, industrial machinery, pumps, switchgear, ships and watches
High technology manufacturers	
Electronics and electrical products	Office/data processing/telecommunications equipment, TVs, transistors, turbines, power, generating equipment
Other technology	Pharmaceuticals, aerospace, optimal/measuring instruments, cameras, etc.

Source: Lall (2001)

The assessment of structural transformation, among others, is often based on the measurement of labour and total factor productivity, and gauging the extent of the reallocation of labour share among industrial groups driven by productivity changes. In the empirical front, various studies have been done in different parts of the globe. In the former eight East European socialist countries, productivity growth in manufacturing output was largely attributed by the within component in fabricated metals, machinery, and food and beverages. Reallocation of labour was small except in few MHT industries (motor vehicles, electrical machinery, and radio and television), in which the entry of new productive firms contributed the most to TFP growth (Alam et al., 2008).

UNIDO and UNU (2012a) found a gradual shift of industrial activities in Brazil, Russia, India, China and South Africa from labour-intensive to capital and higher skill intensive manufacturing in the last few decades. The structure of China and Indian exports shifted from labour-intensive and low-tech products (such as food, beverages and textiles) to capital intensive and MHT products (metal products, machinery and electrical equipment in China, and chemicals in India). Similar changes, but less drastic, have taken place in Brazil and South Africa, where transport equipment, machinery and electrical equipment made up the bulk of exports. The manufacturing of exports in the Russian Federation remained concentrated in capital intensive goods.

Africa, as a continent, has accounted for a low share in global manufacturing output. The share of RB exports was as much as 52 percent in 2000 and 49 percent in 2008. This magnitude of Africa exceeded significantly from Latin America (34 percent) and East Asia and Pacific (13 percent) in 2008. However, the slight decline in RB and LT manufacturing (the later dropped from 23 percent in 2000 to 20 percent in 2008) was taken over by MHT industries; whose share in value-added raised from 23 percent in 2000 to 29 percent in 2008 (UNIDO & UNU, 2012b). Cadot et al. (2015) found no reallocation of labour to industries with high productivity growth in the manufacturing sector of Sub-Saharan Africa (SSA) between 1960 and 2010. Neither the productivity of LT industries picked up because of high labour costs and the lack of appropriate skills. In some cases, such as in Ethiopia and Mauritius, there has been a premature de-industrialization.

In the case of Ethiopia, using firm level large- and medium-scale manufacturing industries data for the period 1996–2002, Shiferaw (2005) found TFP growth to be driven by factor reallocation as result of driving out inefficient firms and improving the performance of incumbent firms. Shiferaw and Bedi (2013) and Shiferaw (2016) (in Manyazewal and Shiferaw, 2019) found different outcomes. Larger firms, having higher initial investment, show superior performance because of being better positioned to take advantage of the incentives pledged in investment and financial sector policies. The number of firms has grown markedly. However, most of them are small because of unfavourable conditions for growth. Neither has this situation led to a tangible exit rate, nor the reallocation of labour from low to high productive firms. Instead, the average firm size tends to decline.

Jones et al. (2018) used data for the period between 2000 and 2010 and measured TFP based on values and quantities, which provided different results for the two methods. They argued that physical productivity measure is a better indicator to examine firm dynamics when local producers have some degree of market-power. Both methods revealed that the reallocation of resources from less productive areas or firms into productive areas or firms was the main cause for the growth of TFP at the sectoral level. In general, the above studies brought not only inconclusive findings but also they have limitations in scope. They simply focussed only on assessing whether there has been reallocation of labour driven by productivity differentials among industries based on ISIC, not among different technology groups of industries. This paper aims to redress this shortcoming.

3. Methodological Framework

3.1 Classification of Manufacturing Industries by Technology Groups

To assess the tendency of structural transformation of the Ethiopian manufacturing industry by technological group, ISIC 3 industries are regrouped as per the Lall (2001) classification, as indicated in section 2. Regrouping industries classified in ISIC 3 in the context of Lall (2001) classification has its own difficulties. The problems become severe when we consider the Ethiopian context. For instance, rubber is classified in the RB industry according to Lall (2001). In the Ethiopian case, rubber is exclusively import-dependent. Pharmaceuticals are classified under HT in Lall (2001). In the case of Ethiopia, almost all pharmaceutical manufacturers bring all ingredients from abroad; and then mix and pack them without involving tangible R&D activities for invention and innovation of new products. Considering the relative simplicity of their technologies, both industries are grouped under LT in this paper. Similarly, the assembling of TVs, mobile phones and similar items are labelled as HT in Lall (2001), but the Central Statistical Agency reports do not explicitly show in which types of industries these products are being produced. Thus, the medium technology and high technology industrial groups are combined together as medium and high technology (MHT) manufacturers.

3.2 Measures of Structural Transformation

3.2.1 Input and Output Shares

A very simple statistical indicator of structural transformation is to calculate and assess the share of each subsector from the total manufacturing output or input use. Accordingly, we use the share and change in shares of each industrial group from the gross value of production (GVP), value added at factor cost (VAFC), the number of persons engaged, and the net fixed assets of the manufacturing industry over time. Gauging the extent to which the industrial sector use locally available resources, and also adding more value in the production process are also straight forward signals of structural transformation and industrialization. Thus, the ratio of VAFC to GVP and import intensity, or the share of imported inputs to total intermediate inputs of the industrial group under reference, are used to assess the tendency for structural transformation within the sector.

3.2.2 Partial and Total Productivity Measures

The above indicators do not show whether the changes are driven by economic gains or the dynamics behind observed changes in shares, if any. Hailtiwanger

(1997); and Foster, Haltiwanger and Krizan (2001) suggested a better measure as they tried to explore the contributions of the reallocation of inputs across plants to overall productivity growth in the US manufacturing sector. A similar method was used, for instance, by Shiferaw (2005) to assess the sources of overall productivity growth of manufacturing firms in the case of Ethiopia. With the same logic, this method is used in many studies to assess the existence of economic-wide, and within sector, structural transformation. This method can be applied in both the context of labour and total factor productivity cases.

(a) Labour productivity

Labour productivity (LP_t), the ratio of value added at factor cost ($VAFC_{it}$), divided by the number of workers (L_{it}), is given by:

$$LP_{it} = VAFC_{it}/L_{it} \qquad (1)$$

Labour productivity growth (LPG) arises either from additional investment on capital or capital depending on more efficient use of available resources on the one hand, or TFP on the other. Using a simple Cobb-Douglas production function specification of two inputs—labour (L) and capital (K), and constant returns to scale—LPG can be decomposed into:

$$LPG_t = \underbrace{TFPg_t}_{(a)} + \underbrace{\beta(K_t^g - L_t^g)}_{(b)} \qquad (2)$$

Where, TFP_g, K^g, L^g and β are *TFP*, capital and labour growth and the parameter, capturing the percentage share of the contribution of capital to value-added, or one minus the share of wages and salaries from value-added. Often, the component of labour productivity growth is the source of improved competitiveness and economic growth.

Based on equation (2), the Hailtiwanger (1997) and Foster, Haltiwanger and Krizan (2001) labour productivity decomposition is given as:

$$LP_t = \sum_{i=1}^{n} s_{i,t}\,, lp_{i,t} \qquad (3)$$

where LP_t is total labour productivity in year *t*, $s_{i,t}$ denotes the proportion of total labour employed in sector *i* at time *t*; and $lp_{i,t}$ is labour productivity of sector *i* at time *t*; where *i* = 1,2,3 and *t* runs from 1982 to 2017.

The change in overall labour productivity between *t* and *t-k,* denoted as ΔLPt, can be written as:

$$\Delta LP_t = \underbrace{\sum_{i=1}^{n} s_{i,t}\,\Delta lp_{i,t}}_{(i)} + \underbrace{\sum_{i=1}^{n} lp_{i,t}\,\Delta s_{i,t}}_{(ii)} + \underbrace{\sum_{i=1}^{n} \Delta s_{it}\,.\,\Delta lp_{i,t}}_{(iii)} \qquad (4)$$

In the right-hand side of equation (4), *(i)* captures intra- or within sector productivity change between *t* and *t-k*; *(ii)* captures static reallocation or a movement of workers from one sector to another with given productivity level; and *(iii)* measures dynamic reallocation or the effect of the simultaneous change in within productivity and workers' share to the overall productivity. Also, *(ii)* and *(iii)* indicate the existence of structural transformation or movements of workers from one sector to another.

The methodology suggested by Timer et al. (2015), as also used in Rodrik et al (2016), decomposes the change in overall productivity using the base year and terminal period values as shown below:

$$\Delta LP = \underbrace{\sum_{i=1}^{n}(LP_i^T - LP_i^0)S_i^0}_{(i)} + \underbrace{\sum_{i=1}^{n}LP_i^0(S_i^T - S_i^0)}_{(ii)} + \underbrace{\sum_{i=1}^{n}(LP_i^T - LP_i^0)(S_i^T - S_i^0)}_{(iii)} \quad (5)$$

where T and O refer to terminal and baseline periods; and (i), (ii) and (iii) capture the three different sources of LP growth as (5) above. This method can also be extended to the total factor productivity for robustness case.

3.3 Estimation Methods for TFP

Assume the production technology of medium- and large-scale industries of Ethiopia is characterized by a log linear Cobb-Douglas production function of the form:

$$y_{it} = a_{it} + \beta_1 w_{it} + \beta_2 k_{it} + \beta_3 m_{it} + \eta_{it} \quad (6)$$

where y_{it}, w_{it}, k_{it} and m_{it} are log values of gross value of production, wages and salaries, raw materials and intermediate inputs in million Birr, and η_{it} is the error term.

TFP is extracted as the difference between actual gross value of production figure and the predicted output level, which represent a_{it}. OLS gives biased and inconsistent estimates of coefficients for equation (6) as inputs are not exogenous regressors. Marshak and Andrews (1944) recognized for the first time that firms or industries know their human, technological, and managerial capabilities and predict their likely productivity at time t+1. This prior knowledge of estimated productivity in turn affects the amount of inputs to be deployed at time t. To address the problem, fixed effect models and dynamic model specifications such as the first difference GMM of Arellano and Bond (1991), and system GMM of Blundell and Bond (2000), are used in both firm and industry level data sets.[2] Among these variants, GMM would have provided a robust estimate.

However, according to Roodman (2009: 128):

> If T is large, dynamic panel bias becomes insignificant, and a more straightforward fixed-effects estimator works. Meanwhile, the number of instruments in difference and system GMM tends to explode with T. If N is small, the cluster-robust standard errors and the Arellano-Bond autocorrelation test may be unreliable.

[2] Since the use of fixed effects models (Mundlak, 1961; Hoch, 1962), different methods have been used to resolve the endogeneity problem in production specifications. Semi-parametric approaches of Pakes and Olley (1996), Levinsohn and Petrin (2003) and Ackerberg, Caves and Fraser (2004), and the use of instrumental variables in Wooldridge (2009) to control for input endogeneity and selection bias are the notable ones applied on firm-level data.

On the other hand, fixed effect and random effect models are two competing estimators that could capture the influences of group effects on coefficient estimates. The Hauseman test is often conducted to identify the more robust estimator between the two. However, using *Monte Carlo* experiments, Clarck and Linzer (2015) demonstrated that the Hausman test may not be a necessary and sufficient condition to decide between the two models. In other words, the nature of the data and the purpose of a research are likely to inform the choice for the relevant model.

> If an experiment involves hundreds of individuals who are considered a random sample from some larger population, then random effects are more appropriate. Conversely, a fixed-effects specification would be more appropriate if we want to assess differences between specific individuals (Pesaran, 2015: 653).

In our case, we have observed the likely fixed effects emanating from industrial technology groups, which we intend to compare with each other. Thus, we decided to choose fixed effects models, which we know are not arbitrarily or randomly selected. Thus, fixed effects and GMM models are to be compared, and the better estimator be chosen.

Based on (6) above, the fixed effects model is specified as:

$$y_{it} = a_{it} + \beta_1 l_{it} + \beta_2 k_{it} + \beta_3 m_{it} + v_i + \varepsilon_{it} \qquad (7)$$

where v_i and ε_{it} are the industrial group-specific error term and the usual stochastic error term.

The dynamic panel data model, a version of GMM, is specified based on (7) and StataCorp (2019):

$$y_{it} = \sum_{j=1}^{p} \alpha_j\, y_{it-j} + x_{it}\beta_1 + w_{it}\beta_2 + v_i + \varepsilon_{it} \qquad (8)$$

where y is the same as before, α_j is the parameters to be estimated, β_1 and β_2 are vectors of parameters to be estimated, x_{it} is a vector of exogenously determined inputs, w_{it} is a vector of predetermined covariates, and v_i and ε_{it} are defined as before.

Given that the parameter estimates specified in (7) and (8) appear in the same way, TFP is calculated as:

$$TFP = anti\, ln(\, y_{it} - \hat{\beta}_1 l_{it} - \hat{\beta}_2 k_{it} - \hat{\beta}_3 m_{it}) \qquad (9)$$

The growth rate of TFP is decomposed into its different components as indicated in (9).

$$\Delta TFP = \underbrace{\sum_{i=1}^{n}(TFP_i^T - TFP_i^0)S_i^0}_{(i)} + \underbrace{\sum_{i=1}^{n} TFP_i^0(S_i^T - S_i^0)}_{(ii)} + \underbrace{\sum_{i=1}^{n}(TFP_i^T - TFP_i^0)(S_i^T - S_i^0)}_{(iii)} \qquad (10)$$

where *(i), (ii)* and *(iii)* are similar as equation (5); T and O are defined as terminal and base years, respectively.

3.4 Data Source

The study uses data collected from surveys of large- and medium-scale industries annually conducted by the Central Statitical Agency of Ethiopia. Large and medium industries are those manufacturing enterprises that engage ten (10) persons or more; and use power-driven machinery for production. The data contains, among other things, gross value of production, value added at factor cost, number of persons engaged, imports of intermediate inputs, wages and salaries and the value of fixed assets. The data covers the period between 1982/83–2017/18.

4. Empirical Findings

4.1 The State of the Ethiopian Manufacturing Industry

The Ethiopian industrial sector is in its infant stage. Ethiopia has been suffering from trade deficits for many years primarily because of its huge reliance on primary goods for exports and poor performance of the manufacturing sector.[3] This is consistent with the argument that lower-income elasticity of demand for raw or less processed goods of the developing world—or 'the periphery'—faces a secular deterioration of terms of trade as against highly processed industrial goods of the developed world—or the centre (Amin, 1976). Thus, Ethiopia needs not only to move away from agriculture dominance, but also diversify the industrial sector itself. If structural transformation is needed towards the industrial sector, what kind of structural transformation is required, is an empirical issue given the current economic situation of the country. Despite previous experience of other countries, Ethiopia may not have to follow a stereotype approach because of "… the advantage of being a later comer."

Although the advent of industrialization initiative is traced back to the beginning of the 20th century, a conscious effort to bolster the industrialization process was initiated in Ethiopia in the 1940s with the launching of the Ten-Year Industrial Development Program in 1945, which attracted foreign investors mainly from the US and the UK. The first two consecutive medium-term development plans—(1957/8–1961/62) and (1963/4–1967/8)—intended to stimulate agro-processing industries. The third (1968/69–1974/75) promoted domestic resources-based exports (IGE, 1957, 1962, and 1968 in Worku, 2015).[4]

The government nationalized medium and large-size firms in 1975. The establishment and expansion of such types of firms was fully controlled and managed by the government until 1993. During this period, private sector entry into the manufacturing sector was restricted only to small-scale food processing, grain milling and oil seeds pressing (Proclamation, 26/1975). Not only that, the marginal profit tax rate, which was imposed on businesses went up to 89% (Proclamation, 124/1977), which had a discouraging effect on private sector investment.

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[3]For instance, in 2016/17, merchandize exports covered only about 18 percent of the cost of imported goods; and manufacturing sector contributed to 7.5 percent of the total merchandize exports. Of these, textile, garments, tanneries, and leather products held about 95 percent (NBE, 2016/17).

[4]To promote local industries, tax holidays, duty free importation of investment goods, exemption of duties and taxes on exportable goods and remittance of a percentage of profits in foreign currencies and imposition of tariff barriers and price regulations of imported goods were pledged (For details, see in Worku, 2015).

The policy was inward-oriented,[5] centrally managed, and intended to strengthen the linkages between industry and agriculture to promote heavy industries (PMGE, 1984). Since the late 1990s, a strategy was implemented to reverse import-substitution towards export-promotion. Restrictions on imports and private sector involvement have been relaxed, and prices have been deregulated. However, the overarching development strategy of the country became agricultural development-led industrialization (ADLI) strategy since 1995 (EEA, 2005), which gave priority to the agricultural sector and agro-processing industries. An industrial development strategy (IDS) was proclaimed in 2004 that aimed to provide special supports to RB and LT industries; such as meat, textile and clothing, leather and leather products, wood and furniture and non-metallic mineral industries in terms of access to foreign currency for inputs and capital goods, etc. (Ministry of Information, 2004).

The Growth and Transformation Plan II (GTP) (2015/16–2019/20) gave due attention to structural transformation in the industrial sector by embracing many industries besides resource-based and light technology ones—such as basic chemical and pharmaceutical industries and metal and engineering industries—by providing government incentive packages. It also intended to enhance productivity and the competitiveness of the sector, transform the domestic private sector, speed up urbanization, invest on human development and technological capacity, address problems associated with logistics and infrastructural services through the construction of industrial parks, electric railways and industrial parks; and side by side directly invest in public industries (National Planning Commission, 2016).[6] In general, the Ethiopian industrial sector has gone through sporadic policy stances over the last several decades.

4.2 Structural Transformation

4.2.1 Input and Output Shares

The evolution of the structure of the Ethiopian manufacturing sector in terms of output, employment, and net capital stock by technology groups is shown on Table 2. RB industries have remained to be the most dominant in the manufacturing sector in terms of output, capital stock and even employment at times, and shows a relatively marginal change over the period between 1999/00–2017/18. It still clutched more than 50 percent of the value of fixed assets on the sector in 2017/18. This has been driven by the increased flow of investment in agro-processing, more specifically food and beverages industries, and non-metallic mineral products such as cement factories.

Except in 2010/11, LT industries hosted nearly half of the workers of all medium- and large-scale industries. LT industries—which produce textiles, wearing apparel, clothing, footwear, and other leather products—use relatively the most labour-intensive technologies, which could be observed from the mismatch between

[5] Marginal tariff rate went up to as high as 230 percent, and there were quantitative restrictions and extended negative list (Athukorala & Worku, 2006), side by side with the use of subsidies for exports in spite of overvalued exchange rate (EEA, 2002).

[6] However, this plan has not been effectively implemented because of the excessively inefficient public project management, inefficient public service provision and public strife that lasted for about two years that required the rule of law and good governance.

their shares of the value of fixed assets and labour. This shows that manufacturing in Ethiopia is mainly more of RB and LT activities. The issue is whether these activities have better returns than MHT.

Table 2: Percent Share of Industries from the Manufacturing Sector and Value-Addition*

Industrial Technology Group	Gross Value of Production	Value Add at Factor Cost	Persons Engaged	Net Fixed Assets	VAFC/ GVP
1999/00					
RB Industries	52.1	60.5	38.2	47.6	41.1
LT Industries	27.4	24.3	54.4	40.3	31.4
MHT Industries	20.6	15.2	7.4	12.1	25.3
20010/11					
RB Industries	56.6	67.0	49.2	52.0	18.0
LT Industries	22.2	16.2	40.2	34.0	27.6
MHT Industries	21.1	16.8	10.5	14.0	21.8
2017/18					
RB Industries	50.2	55.5	37.7	53.8	33.8
LT Industries	31.2	27.9	47.1	23.4	27.4
MHT Industries	18.5	16.5	15.2	22.8	27.3

Note: Monetary values of outputs and inputs are deflated into the 2011 GDP deflator obtained from the National Bank of Ethiopia

Source: Own Calculation based on CSA (Various Years).

The ratio of value added at factor cost to the gross value of production gauges internal capabilities for improved competitiveness and better returns. The ratios of VAFC to GVP were the highest in 1999/00, and the lowest in 2009/10. There is not a clear trend across time. RB industries added more value to the gross value of production than others, except in 2009/10. This might partly explain why resources are more concentrated in RB industries. LT industries were somehow better in 1999/10 compared to MHT industries. Deficient performance of fabricated metals manufacturing was the main cause for the lowest ratio of MHT in 2009/10. The development of MHT industries have not been given a comparable policy backing as in RB and LT manufactures over the years.

One may pose a question on whether RB and LT industries truly depend on local resources. One of the weak links and the manifestation of the low state of industrial development in Ethiopia has been excessive dependence of the sector on imports of not only capital goods, but also intermediate inputs and raw materials.

As indicated in Table 3, the manufacturing sector uses about 50 percent of imported inputs; with MHT and RB industries being with the highest and lowest import intensity, respectively. The high level of reliance on imports is due to the weak inter- and intra-sectoral linkages between the mining sector and the manufacturing sector. Missing industries that could have provided semi-processed or intermediate inputs also contribute to the exceedingly high import dependence. The gaps in the supply of inputs may defeat any would-be indigenous start-up, with cascading impacts on other potential start-ups that might depend on inputs from the first (Henok et al., 2012).

Table 3: Import Intensity as Measured by the Value of Imported Raw Materials to the Value of all Raw Materials Used (%)

Industrial Technology Group	1999/00	2010/11	2017/18
RB Industries	30.6	28.2	27.4
LT Industries	45.3	55.7	75.7
MHT Industries	87.9	78.8	77.7
Total	**51.5**	**47.4**	**49.0**

Source: Own Calculation based on Central Statistical Agency (2001, 2011 and 2018).

An investigation into the types of intermediate and raw material inputs that are being imported reveals the existing market potential in the upstream sectors to be tapped by prospective investors (see Table 4). There are many types of raw and semi-processed inputs that ought to be acquired from the agricultural sector and domestic industries.

Table 4: Imported Inputs that Ought to be Domestically Produced

Type of Technology	Type of Raw Materials & Intermediate Inputs	Units	Quantity		% Share of Imported Inputs
			Total	*Imported*	
RB	Meat	Tons	4,430	377	8.5
	Wheat	Tons	1,839,191	179,482	9.8
	Raw Milk	H.l.	336,208	29,090	8.7
	Sugar	Tons	34,584	3,815	11
	Glucose	Tons	57,316	57,311	100
	Alcohol	H.l.	105,922	13,378	12.6
	Hops	Tons	976	928	95.1
	Malt	Tons	89,039	50,978	57.3
	Barley	Tons	61,020	10,065	16.5
	Formica	Pcs.	52,791	52,711	99.8
	Plywood	Pcs.	55,887	33,305	60.0
	Chip wood	Pcs.	444,342	460,722	96.4
	Veneer	Sqm	13,014	12,810	98.4
	Tobacco Leaves	Tons	446,240	223,120	50
LT	Cotton Yarn	Tons	32,488	34,184	95
	Fabrics	('000 m)	3,056	4,674	65.4
	Sisal (Leaves)	Cub. M.	387	388	99.7
	Wool (Waste)-	Tons	6	9	66.7
	Acrylic (Yarn)	Tons	2,975	4,828	61.6
	Cotton (Lint)	Tons	2,455,560	2,461,261	99.8
	Hides and Skins	Tons	10,959	35,113	31.2
	Leather Lining	('000 Sqft)	271	639	42.4
	Leather Garment	Sq. Ft.	5,122,281	5,343,780	95.9
	Pulp	Tons	1,681	1,533	91.2
	Boxing Paper	Tons	2068	370	17.9
	Caustic Soda	Tons	4,811	802	16.7
	Sodium Compound	Tons	2,871	1,769	61.6

Source: Central Statistical Agency, Large and Medium Scale Industries Survey, (2018).

Some local industries have already demonstrated the ability to produce malt, cotton and synthetic fabrics, acrylic yarn, chip wood, plywood, veneer and similar intermediate inputs, which may not require sophisticated technologies to produce. The shortfall in the supply of inputs that would have substituted imports held back incumbent firms to expand and exploit their capacities and potential entrants to invest and benefit from the existing market. The government has taken some initiatives to address the weak linkages between, for instance, agriculture and industry; but it needs a long way to bring changes.[7]

MHT industries ought to be the main source of capital goods for industry and other sectors. However, these industries are still at a very rudimentary stage; emerging with little impact on technology innovation and transfer into the sector. Overall, the dominance of RB and LT industries might have been driven by returns to investment. High value-low-cost MHT products such as telecommunication equipment, TV sets, mobile phones, and other similar electronic equipment offer the option of using low skill labour for final assembly. The policy initiative to create an enabling environment for local and foreign investors needs to be reinforced because of the role of these industries in substituting the growing imports. This policy direction is consistent with the experiences of successful late industrialized countries in East Asia (Lall, 2004).

4.2.2 Partial and Total Productivity Changes.

(a) Level and Sources of Growth of Labour Productivity

Labour productivity in terms of value-added at constant factor cost per worker is calculated for the period between 1982/83–2017/18 for the three industrial groups. Figure 1 presents the results.

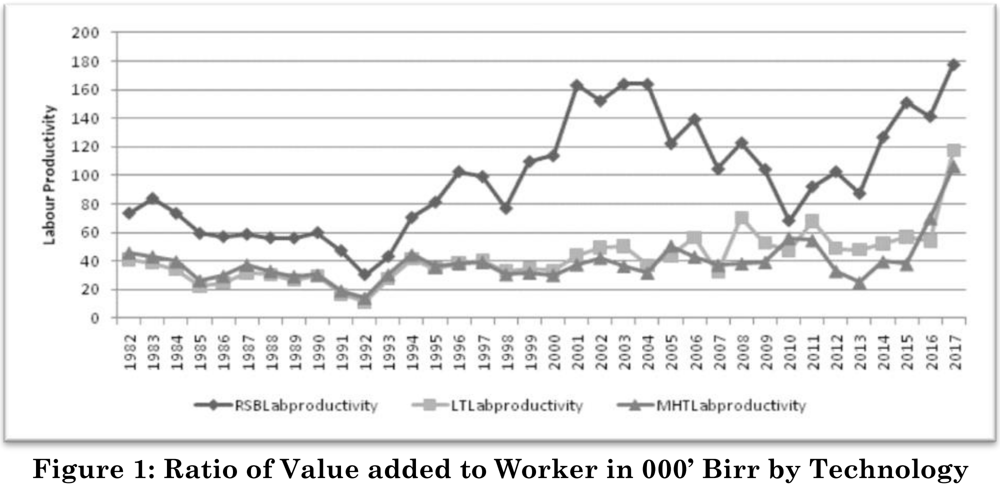

Figure 1: Ratio of Value added to Worker in 000' Birr by Technology Group of Industries

Source: Own Calculation based on CSA (Various Years) and MoFED (Unpublished)

[7] GTP II envisaged to address the weak linkage between industrial and agriculture sectors through, for instance, the establishment of the Ethiopian Inputs Supply Enterprise, mandated to design and implement strategies such as the cotton development strategy to expand the supply of inputs with the required quantity and quality, and buy inputs both locally and from abroad to ensure adequate supply (UNDP, 2016).

Labour productivity showed ups and downs across industrial groups, and over time. However, a simple regression against time shows a positive labour productivity growth across industrial groups (See Table A1 for details). RB industries reported the highest level and rate of growth of labour productivity. As indicated on Figure 1, the labour productivity line of RB lay above the LT and MHT industries; with an annual average growth rate of 2.5 percent, as against 1.2 percent for the LT, and 0.7 percent for the MHT industries.

As indicated in Table 4, in both median and median values, the RB industries were the most productive; and at the same time exhibited the most turbulent performance as witnessed from the standard deviation. Both group mean and median test results indicated RB industries to be the most productive as compared to the other two industrial groups in a statistically significant way, corroborating the above finding (see Tables A2 and A3). MHT industries employ relatively more complex technologies that require highly skilled human power with better capabilities to effectively operate them (Lall, 2001). These attributes were expected to make MHT industries be more productive as compared to both RB and LT industries. This finding is rather inconsistent to the predictions of Lall (2001).

Table 4.4: Level and Source of Labour Productivity Growth and Structural Transformation

Technology Groups	Labour Productivity: VAFC/Person in 000'Birr					% Share from Labour Productivity Growth					
						Case 1			Case 2		
	Min.	Mean	Med.	Max	St. Dev.	*Capital Deepening*	*TFP*	*Within Industry Change*	*Static Real.**	*Dynamic Real.**	*Overall*
RB Industries	30.2	98.1	95.5	177.8	39.7	55.8	44.2	83.4	7.8	8.8	16.6
LT Industries	11.5	42.2	39.5	117.1	18.3	18.2	81.8	149.5	-16.3	-33.2	-49.5
MHT Industries	14.2	39.1	37.5	106.3	15.4	28.3	71.7	80.7	7.9	11.4	19.3
Total	**11.5**	**59.1**	**44.0**	**177.8**	**38.0**	**34.7**	**65.3**	**98.6**	**1.9**	**-0.4**	**1.5**

Key: Real. = Reallocation

Source: Own Calculation based on CSA (Various Years) and MoFED (Unpublished)

Labour productivity is expected to grow if additional capital is injected to improve the degree of automation of industries, and/or resources are cost-effectively and efficiently utilized given the use of technology. As indicated in Table 4, on average, TFP growth accounted for about 65 percent of the growth of labour productivity in the medium- and large-scale industries, whereas capital deepening contributed the remaining 35 percent. Nonetheless, these two productivity growth drivers have contributed differently among industrial groups. Capital deepening contributed around 56 percent in RB industries as compared to the 18 percent and 28 percent in LT and MHT industries, respectively. This is perhaps attributed to the relatively higher growth of investments channelled into RB firms partly because of the incentives extended to this group on account of the investment policy anchored in the agricultural development led industrialization (ADLI) strategy.

Exploiting comparative advantage or use of available resource endowment may be a pathway for industrialization as witnessed in East Asian tigers and China, where labour-intensive light manufacturing substantively contributed for their economic transformation and successful industrialization process (World Bank, 2012). However, this requires also a comparable or better growth of total factor productivity in resource-based industries to have competitive industries on a sustainable basis. A movement of labour away from resource-based industries to other industrial groups sustain and deepen industrial development if productivity elsewhere outweighs.

Assessment of structural transformation within medium- and large-scale manufacturing sector in Ethiopia is made based on Timmer et al. (2015) using equations (5) to (7). This method considers the initial and terminal period values as structural transformation is a change in composition of employment and economic activities between two periods. Decomposed labour productivity scores indicated the absence of meaningful structural transformation over the thirty-six years of the study period. More than 83 percent of the change in labour productivity has remained to be year to year intra- or within industrial group improvement in resource use in all the three technology groups. The remaining 17 percent signifies the presence of structural transformation or inter-sectoral reallocation of employment away from low productive sectors to high productive sectors.

Both RB and MHT industries managed to have positive static reallocation, attracting relatively increased percentage of workers as against LT industries with given baseline productivity levels. Positive dynamic reallocation scores witnessed in RB and MHT industries show that these two industries attracted a relatively more percentage of jobs as a result of a higher rate of growth of value added per worker between the terminal and base periods as compared to the situation in LT industries. However, there has not been dynamic reallocation of resources or a simultaneous change in productivity and share parameters to the overall productivity growth of all medium- and large-scale industries.

(b) Level and Sources of Growth of TFP

A Cobb-Douglas production function is estimated using both fixed effects and dynamic panel data estimation models based on equations 7 and 8 with the purpose of calculating TFP based on the preferred model. Table 5 shows a summary of econometric results. Dynamic panel data GMM model is found to suffer from the 1st and 2nd order autocorrelation of error terms. Sargan test also rejected Ho, that: "overidentifying restrictions are valid." On the other hand, the overall significance test and the individual fixed effects F-tests clearly indicate the robustness of the fixed effects model. Thus, we opt for fixed effects model to calculate TFP.

The sum of elasticity figures shows constant returns to scale with about 70 percent of a change in output being attributed to a unit change in intermediate input. This estimate is consistent with the ratio of value added to gross value of production of the manufacturing sector as specified in Table 1; which implicitly indicates the low level of processing or value addition of the manufacturing sector in Ethiopia.

Table 5: Fixed and Dynamic Panel Models Estimation Results

Variables		Fixed Effects	Dynamic Panel Data Estimation
		Coefficients	*Coefficients*
Ln(Labour)		0.1374***	0.2162***
		(0.02976)	(0.0269)
Ln (Capital)		0.1736***	0.1105***
		(0.0287)	(0.01117)
Ln(Intermediate inputs)		0.7087***	0.7750***
		(0.0329667)	(0.0576)
Constant		0.3583	-0.7931
		(0.2339)	(0.4675)
Overall Significance			
F-value		359***	
-Wald-chi2 Value			3082***
F-value for u_i=0		3.67**	
R-squared (within)		0.98	
Autocorrelation:	A1 (Prob)		0.1625
	A2		0.1297
Sagan Test for Over identification of Restrictions (Prob)			0.0

Source: Own calculation based on CSA (Various Years)

Similar to the case of labour productivity, TFP score also varies across industrial groups. Based on the different statistical measures, RB industries score on average the highest TFP over the study period. It is apparently observed from Figure 4.2, which shows the trend line for TFP in RB industries laying over the other two industries in many of the years. LT industries stand the second highest performer. Contrary to our expectation, MHT industries do not perform good.

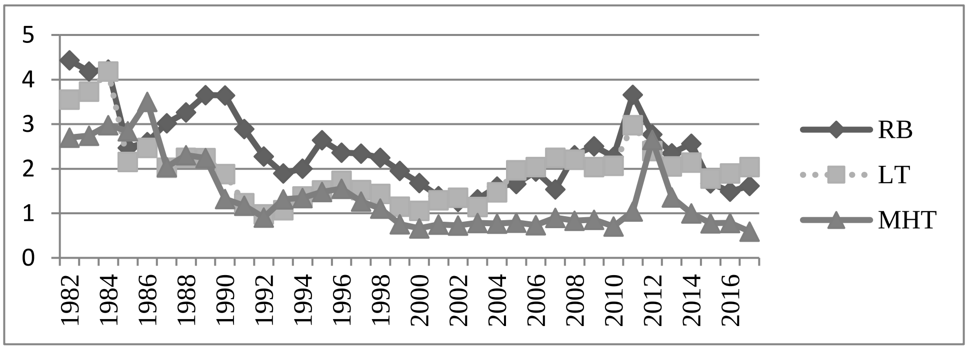

Figure 2: The Trend of TFP over the Years Across the Years
Source: Own calculation based on CSA (Various Years).

The descriptive statistics of TFP and the sources of its growth as calculated based on equation (9) are displaced on Table 6.

Table 6: Level and Source of Growth of TFP and Structural Transformation

Technology Groups	Descriptive Statistics					% Share from Total Factor Productivity Growth			
							Structural Transformation		
	Min.	**Mean**	**Med.**	**Max.**	**St. Dev.**	***Within Industry Change***	***Static Reallocation***	***Dynamic Reallocation***	**Overall**
RB Industries	1.25	2.44	2.32	4.43	0.86	91.5	0.02	8.5	8.52
LT Industries	0.98	1.96	1.99	4.18	0.74	128.4	-0.13	-28.2	-28.33
MHT Industries	0.59	1.4	1.08	3.50	0.81	87.1	5.6	7.3	12.9
Total	**0.59**	**1.93**	**1.90**	**4.43**	**0.90**	**103.3**	**2.1**	**-5.2**	**-3.3**

Source: Own calculation based on CSA (Various Years).

An assessment of the sources of TFP growth indicates the absence of tangible structural transformation among industrial groups over the study period. Except around 2 percent of static reallocation, TFP growth has been almost entirely accounted by resource use efficiency within each of the three technology groups. Although it is substantive, we rather observe anticlockwise movements of TFP growth and reallocation of labour, or there was a negative dynamic reallocation at the manufacturing sector level. In other words, when productivity of industries grows, their share in the number of workers tend to decline, or vice-versa; albeit slightly. Contrary to this, we observe positive statistic and dynamic reallocation in both RB and MHT at an industrial group level. This shows a tendency of reallocation of labour away from LT industries when RB and MHT industries perform good; and yet this does not mean that the performance of LT industries might not have been any poorer.

4.3 Overall Observation about the Trend of Structural Transformation

Overall, we do not observe visible structural transformation in the manufacturing sector of Ethiopia. Still there is continued dominance of less complex and less skill requiring RB and LT industries. The role of MHT industries in the economy remained the lowest for a long period although there is a slight growth trend in recent years. Activities of MHT industries to date concentrate on the assembly of motor vehicles and similar less complex and relatively low skill metal products and related activities. This indicates the insufficiency and less diversified nature of investment in medium and high technology industries.

This situation seems to be consistent to the advices of the Economic Commission for Africa (2011), which demands African countries to devise industrial policies by taking into account, among other things, their resource endowments, geographical location and population size. It is also argued that resource endowments of countries need to determine the types of industries that they are supposed to invest on in the face of a highly competitive world (Dinh et al., 2012: 5).

> Ethiopia has many natural resources that can provide valuable inputs for light manufacturing industries serving both domestic and export markets. Among its abundant resources are cattle, which can be processed into leather and its products;

> forests, which can be managed for the furniture industry; cotton, which can support the garments industry; and agricultural land and lakes, which can provide inputs for agro-processing industries. Ethiopia has abundant low-cost labour, which gives it a comparative advantage in less-skilled, labour-intensive sectors such as light manufacturing.

This pattern is a common phenomenon in the early period of industrialization and also consistent with the country's industrial development strategy of the country enacted in 2004 and its medium-term development plans of the country, GTP I and GTP II.

Nonetheless, the existing path has not brought a significant move to speed up the pace of industrialization in Ethiopia. Lower rate of growth and limited role of MHT is related partly to poor production capacity utilization because of many operational constraints. For instance, a simple calculation based on CSA (2017) data indicates that about 46 percent of MHT industries identified shortages of intermediate inputs or shortages of foreign currencies to purchase imported inputs as the first most critical constraint for not fully being operational as compared to 26 percent and 35 percent for RB industries and LT industries respectively. MHT industries are relatively more power-intensive because of their higher degree of processing. Unfortunately, 25 percent of MHT enterprises mentioned inadequacy and interruption of power as the most severe hurdle to their operation; as against 19 percent of the enterprises categorized in RB industries. Problems associated with the availability, affordability and quality conformity of inputs; access to finance; lack of both technical and managerial skills; and poor trade logistics affect all types of industries: and yet they tend to be more severe among MHT industries. Access to industrial land, water and basic infrastructure facilities remained to be a serious problem to attract new investors; and more severely among those who want to invest on MHT.[8]

Moreover, high cost of doing business undermines global competitiveness in terms of attracting foreign direct investment in all types of businesses. The constraints that impede investment in the manufacturing industry partly emanate from incapable bureaucratic machinery and poor work ethics. Ethiopia was ranked 132/189 countries in terms of the easiness of doing business in general; 166/189 in starting a business in 2015 (World Bank, 2015); and further deteriorated to 159/190 in 2020 (World Bank, 2020).

Specialization based on current comparative advantage may result into static gains from trade; but unless the potential for productivity growth in the resource abundant sector is internalized, trade may induce dynamic welfare losses that may outweigh static welfare gains (Redding, 1999). Thus, in addition to properly exploiting the static comparative advantage, faster and sustainable development requires building capacities and diversifying manufacturing activities that widen

[8] Many industrial parks have been established to address these problems, but they host mainly agro-processing and fashion industries such as textiles, wearing apparel and leather processing industries, where there is easier access to one-shop government services and utilities such as power.

both backward and forward linkages within the sector and the rest of the economy. In view of this, MHT industries may give an opportunity to strengthen both backward and forward linkages because these industries are found to create the highest magnitude of overall (backward and forward) linkage effects in the economy (Kibre & Worku, 2006). It could also provide employment opportunities in relatively new fields for the growing educated youth, whose skills and capabilities could be easily nurtured. Enhancing the role of MHT industries requires a policy change accords priority for RB and LT industries.

5 Conclusion

The main objective of this paper was to assess whether there has been structural transformation among resource-based, low technology and medium- and high-technology groups within the Ethiopian medium- and large-scale industries using the Central Statistical Agency survey for the period between 1982/83–1987/88. We used input and output shares, and labour and total factor productivity growth decomposition methods to make a comparative assessment. The findings indicate that Ethiopian manufacturing sector is still at its infancy; wherein resource-based industries—such as cement, food and beverage and similar goods producing industries—account for the largest share of the value of fixed assets and output; and low technology industries—such as textile and leather processing—offer a largest percentage of jobs. Resource-based industries have had a higher return to investment in terms of the ratio of value added to gross value of production, labour and total factor productivity.

The establishment of industries based on a country's natural resources is a typical pattern of early period of industrialization. The irony, however, is excessive dependence of resource-based and low technology industries on imported inputs such as malt, cotton and synthetic fabrics, acrylic yarn, chip wood, plywood, and veneer, which ought to be accessed from domestic sources. The contribution of MHT industries in the economy has not only been limited to, but also concentrated on, the assembly of motor vehicles and similar activities requiring relatively low skills and technological complexities.

A simple econometric estimation of workers' productivity against time showed a growth trend across all the three major industrial groups. However, as productivity growth decomposition revealed, within group changes in productivity accounted the largest share from the overall productivity growth in the sector. At the manufacturing sector level, a change in the share of workers from one industrial group to another with a given productivity contributed less than 10 percent in the case of labour productivity, and around 2 percent in the case of TFP to the overall productivity growth between 1982/83 and 2017/83. Furthermore, dynamic reallocation effects were reported to be negative at the sectoral level, implying that there has not been a change in the share of workers across industrial groups stimulated by differetials in the growth rate of productivity across industrial groups. Thus, no vivid structural transformation has been observed over the study period.

This situation shows insufficiency of enablers that facilitates structural transformation. Weak technical and vocational skills, poor entrepreneurial abilities, shortages of local and imported inputs, inadequate electric power, as well as less conducive business environment for manufacturing operations and investments are among the factors that contributed for a dwarf and less-diversified manufacturing sector.

Thus, the government needs, among other things, to work on addressing policy constraints and bureaucratic hurdles to ease the business environment and encourage entrepreneurs to invest in the manufacturing sector and other related sectors to address constraints across the value-chain and create strong inter-sectoral linkages. There is also a need to resolve power shortages and frequent interruptions, coordinate the efforts of higher education, training and innovation centres with industries by way of jointly planning human resource development, designing curriculum and arranging apprentices to improve the quality of education and skill of workers.

Reference

Ackerberg, D., Caves, K. & Fraser, G. (2004). Structural Identification of Production Function. Memo. UCLA.

Akamatsu, K. (1962). A Historical Pattern of Economic Growth in Developing Countries. *Journal of Developing Economies*, 1(1): 3–25.

Amin, S. (1976). *Unequal Development: An Essay on the Social Formations of Peripheral Capitalism*. New York: Monthly Review Press.

Arellano, M. & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *Review of Economic Studies*, 58: 277–297.

Athukorala, P.C, and Gebeyehu, W. (2006). Trade Policy Reforms and Manufacturing Performance in Ethiopia. In K. Sharma and O. Morrissey (eds.). *Trade, Growth and Inequality in the Era of Globalization*. London, Routledge Taylor and Francis Group.

Befekadu, D. (1986). *Growth and Foreign Debt: The Ethiopian Experience*-1964–1986. AERC. 13/1992.

Blundell, R. & Bond, S. (2000). GMM Estimation with Persistent Panel Data: An Application to Production Functions. *Econometric Reviews*, 19: 321–340.

Cadot, O., Melo, J.D., Plane, P., Wagner, L. & Woldemichael, M.T. (2015). Industrialisation and Structural Change: Can Sub-Saharan Africa Develop without Factories? Working Paper, No: 143. www.ferdi.fr.

Central Statistical Agency (Various Years). Report on Large and Medium Scale Manufacturing and Electricity Industries Survey, Addis Ababa.

Cheru, F. (2015). Structural Transformation in Ethiopia: The Urban Dimension: Building 'Economically Productive, Socially Inclusive, Environmentally Sustainable & Well Governed' Cities. Addis Ababa.

Chenery, H. B. & Taylor, L. 1968. Development Patterns among Countries and over Time. *Review of Economics and Statistics*, 50 (3): 391–416.

Chenery, H. B. & Syrquin, M. (1975). *Patterns of Development*, 1950–1970. London: Oxford University Press.

Clark, T.S. & Linzer, D. A. (2015). Should I Use Fixed or Random Effects? *Political Science Research and Methods*, 3(2): 399–408.

Dijkstra, G., A. (2000). Trade Liberalization and Industrial Development in Latin America. *World Development Report*. 28(9) 1567–1582.

Dinh, H.T., Palmade, V., Chandra, V. & Cossar, F. (2012). *Light Manufacturing in Africa: Targeted Policies–Enhance Private Investment and Create Jobs*. World Bank, Washington DC, www.worldbankorg.

Economic Commission for Africa. (2011). Research Report 2: Industrial Policies for the Structural Transformation of African Economies: Options and Best Practices, Addis Ababa.

Economic Planning Board (EBP). (1978). Major Statistics of the Korean Economy. Seoul: Economic Planning Board.

Ethiopian Economic Association. (2015). Report on the Ethiopian Economy, Addis Ababa.

—. (2005). Industrialization and Industrial Policy in Ethiopia. Addis Ababa.

—. (2002). Report on the Ethiopian Economy. Addis Ababa.

Foster, L., Haltiwanger, J. & Krizan, C. J. (2012). Aggregate Productivity Growth Lessons from Microeconomic Evidence. In C. R. Hulten, E. R. Dean and M. J. Harper (eds.). *Developments in Productivity Analysis*. New http://www. nber. org/books/hult01–1.

Jones, P., Mengistae, T. & Zeufack, A. (2018). Selection, Firm Turnover, and Productivity Growth Do Emerging Cities Speed up the Process? World Bank Policy Research Working Paper 8291.

Hirschman, A. (1958). The *Strategy of Economic Development*. Yale University Press. New Haven, CT.

Hoch, I. (1962). Estimation of Production Function Parameters Combining Time Series and Cross-Section Data. *Econometrica*, 30, 34–53.

Imperial Government of Ethiopia (IGE). (1950). Legal Notice No. 10, Addis Ababa.

—. (1957). *First Five-Year Development Plan*, Addis Ababa, Office of the Planning Commission.

—. (1962). *Second Five Year Development Plan,* Addis Ababa, Office of the Planning Commission.

—. (1968). *Third Five Year Development Plan*, Addis Ababa, Office of the Planning Commission.

—. (1979). *International Financial Statistics*. Washing-ton, DC: International Monetary Fund.

Kidanemariam, B. H., Gebreeyesus, M. & Ohno, K. (2019). Ethiopia Productivity Report. FDRE Policy Studies Institute (PSI), Addis Ababa.

Kaldor, N. (1966). *Causes of the Slow Rate of Economic Growth in the United Kingdom*. Cambridge: Cambridge University Press.

—. (1967). *Strategic Factors in Economic Development*. Ithaca, NY: Cornell University Press.

Kibre, M. & Gebeyehu, W. (2006). Inter and Intra Linkages in the Ethiopian Manufacturing Sector. In *Proceedings of the Third International Conference on the Ethiopian Economy*. EEA, Addis Ababa. (2006).

Kuznets, S. (1971). *Economic Growth of Nations: Total Output and Production Structure. Cambridge Massachusetts*. The Belknap Press of Harvard University Press.

Lall, S. (2003). Reinventing Industrial Strategy: The Role of Government Policy in Buildin Industrial Competitiveness. QEH Working Papers No. 111: University of Oxford, Oxford.

—. Background Paper for the United Nations Development Programme's Human Development Report 2001: Harnessing Technology for Human Development.

Lavopa, A. M. (2015). Structural Transformation and Economic Development: Can Development Traps be Avoided? Ph.D. Dissertation at Maastricht University.

Levinsohn, J. & Petrin, A. (2003). Estimating Production Functions Using Inputs–Control for Unobservables. *Review of Economic Studies,* 70: 317–341.

MacMillan, M., Rodrik, D. & Sepúlveda, C. (eds.). (2016). *Structural Change, Fundamentals and Growth: A Framework and Case Studie*s. International Food Policy Research Institute Washington, D.C.

Marschak, J. & Andrews W.H. (1944). Random Simultaneous Equations and the Theory of Production. *Econometica*, 12(3–4):143–205.

Ministry of Information. (2004). *Ethiopian Industrial Development Strategy*. Addis Ababa.

Mundlak, Y. (1961). Empirical Production Functions Free of Management Bias. *Journal of Farm Economics,* 43: 69–85.

National Bank of Ethiopia. (2017/18). 2016/17 Annual report, Addis Ababa.

—. (2020/21). 2019/20 Annual Report, Addis Ababa.

National Planning Commission. (2016). Second Growth and Transformation Plan (GTP II: 2016–2020): Addis Ababa.

Nurkse, R. (1953). *Problems of Capital Formation in Underdeveloped Countries*. Oxford University Press. New York.

Olley, S. & Pakes, A., 1996. The Dynamics of Productivity in the Telecommunications Equipment Industry. *Econometrica*, 64: 1263–1297.

Page, J. & Tarp F. (2017). The *Practice of Industrial Policy: Government Business Coordination in Africa and Asia, UNU-WIDER*. Oxford University Press. London.

Pesaran, M. H. (2015). *Panel Data Econometrics*. Oxford University Press.

Redding, S. (1999). Dynamic Comparative Advantage and the Welfare Effects of Trade. *Oxford Economic Papers,* 51. (1999): 15–39.

Roodman, D. (2009). How to Do xtabond2: An Introduction to Difference and System GMM in STATA. *Journal,* 9(1): 86–136.

Rosenstein-Rodan, Paul N. (1943). "Problems of Industrialization of Eastern and South-Eastern Europe," The Economic Journal . Vol. 53, No. 210/211.

Shiferaw, A. (2016). Constraints to Private Investment in a High-growth Environment: Firm-Level Evidence from Ethiopia. Working Paper 168: Economics Department, the College of William, and Mary.

—. (2005). Firm Heterogeneity and Market Selection in Sub-Saharan Africa: Does it Spur Industrial Progress. ISS, the Hague. Working Paper Series 414.

Shiferaw, A. & Bedi A. S. (2013). The Dynamic of Job Creation and Job Destruction in Sub-Saharan Africa: Evidence from Ethiopia. *Journal of African Economies,* 22: 651–92.

Shiferaw, A. & Manyazewal, M. (2019). Economic Policy and Structural Transformation in Ethiopia. C. F. C. Cramer, and A. Oqubay (eds.). The *Oxford Handbook of the Ethiopian Economy*. Oxford University. Oxford.

StataCorp. (2019). *Stata: Release 16. Statistical Software.* College Station, TX: StataCorp LLC.

Szirmai, A. (2009). Industrialisation as an Engine of Growth in Developing Countries. MERIT Working Papers 2009–010, United Nations University.

Timmer, M.P., de Vries, G.J. & de Vries, K. (2015). Patterns of Structural Change in Developing Countries. In J. Weiss and M. Tribe (eds.). *Routledge Handbook of Industry and Development*. Routledge, New York, 65–83.

Todaro, M.P. & Smith, S.C. (2015). *Economic Development*. 12th Edition. Pearson. New York.

UNDP. (2018). Understanding African Experiences in Formulating and Implementing Plans for Emergence: Growing Manufacturing Industry in Ethiopia. Addis Ababa.

UNIDO & UNU. (2012). Structural Change, Poverty Reduction and Industrial Policy in the BRICS. Vienna, 2012.

—. (2012). Economic Development in Africa Report 2011: Fostering Industrial Development in Africa.

Weiss, J. (2002). *Industrialization and Globalization: Theory and Evidence from Developing Countries.* Routledge, London.

Wooldridge, J. M. (2009). on Estimating Firm-Level Production Functions Using Proxy Variables to Control for Unobservables. *Economics Letters*, 104: 112–114.

Worku, G. (2015). Trade Regime Changes and Manufacturing Performance in Ethiopia. PhD Dissertation, University of Dar es Salaam, Dar es Salaam.

World Bank. (2008). Unleashing Prosperity, Productivity Growth in Eastern Europe and the Former Soviet Union. Washington D.C.: World Bank.

—. (2012). Light Manufacturing in Africa: Targeted Policies to Enhance Private Investment and Create Jobs. Washington DC, World Bank.

—. (2015). *Doing Business 2015 Going Beyond Efficiency*. Washington.

—. (2020). *Doing Business 2020 Comparing Business Regulation in 190 Economies*. Washington.

Annexes

Table A1: Labour Productivity Trend against Time in Years by Industrial Group

Variables	RB	LT	MHT	Notes_Titles
Yr	2.536***	1.200***	0.6639***	Robust standard
	(0.408)	(0.302)	(0.223)	errors in parentheses
Constant	-4,973***	-2,358***	-1299***	*** p<0.01, ** p<0.05,
	(-813.4)	(-03.2)	(-2205)	* p<0.1
Observations	36	36	36	

Source: Own calculation based on Central Statistical Agency Data.

Annex 2: Labour Productivity and TFP Group Mean Test

Test Between Groups	Industrial Group	Labour Productivity		TFP Score	
		Mean	***t-test***	***Mean***	***t-test***
• RB Industries and Non-RB Industrial Groups	RB Industries	98.1	10.56	2.44	4.44
	Non-RB Industries	40.6		1.68	
• RB and LT Industries	RB Industries	98.1	7.68	2.44	2.55
	LT Industries	42.2		1.96	
• RB and MHT Industries	RB Industries	98.1	8.3	2.44	4.4
	MHT	39.1		1.4	
• LT and MHT Industries	LT Industries	42.2	0.759	1.96	3.1
	MHT Industries	39.1		1.4	

Source: Own Calculation based on CSA (Various Years) and MoFED (Unpublished).

Annex 3: Labour Productivity Median Comparison Test by Industrial Group

VAFC/ Person Greater than the Median (# Years)	RB Industries	LT Industries	MHT Industries	Total
Value added per Worker in Reference to the Median				
No	2	23	29	54
Yes	34	13	7	54
Total	**36**	**36**	**36**	
Pearson Chi2(2) =44.667		Prob= 0.000		
TFP Scores in Reference to the Median				
No	10	17	27	54
Yes	26	19	9	54
Total	**36**	**36**	**36**	
Pearson Chi2(2) =44.667		Prob= 0.000		

Source: Own Calculation based on CSA (Various Years) and MoFED (Unpublished)

Table A4: Growth of Labour Productivity and its Source of Growth over Time

Year	Growth Rate			Percentage Share to Labour Productivity	
	Labour Productivity	*Capital Deepening*	*TFP*	*Capital Deepening*	*TFP*
RB Industries					
1982-1993	-2.9	2.71	-5.6	93.1	193.1
1994-2005	7.72	6.38	1.34	82.6	17.4
2006-2017	8.5	3.01	5.49	35.4	64.6
Total	**6.87**	**3.84**	**3.04**	**55.8**	**44.2**
LT Industries					
1982-1993	17.3	8.05	9.26	46.5	53.5
1994-2005	-0.37	2.13	-2.5	-575.7	675.7
2006-2017	6.48	2.52	4	39	61
Total	**12.85**	**2.34**	**10.51**	**18.2**	**81.8**
MHT Industries					
1982-1993	-7.64	1.72	-9.36	-22.5	122.5
1994-2005	0.22	4.63	-4.42	2109.1	2009.1
2006-2017	15.02	4.08	10.94	27.2	72.8
Total	**13.29**	**3.76**	**9.53**	**28.3**	**71.7**
Grand Total	**10.0**	**3.46**	**6.52**	**34.7**	**65.3**

Source: Own calculation based on CSA (Various Years)