Determinants of Total Factor Productivity of Large and Medium-scale Manufacturing Industries in Ethiopia: Time Series Analysis, *Kidanemariam Gidey**

Abstract

Productive manufacturing industries are very important in accelerating the pace of long-term economic growth and hence living standards in a given country. Therefore, this paper aims to investigate the main determinants of total factor productivity (TFP) of large and medium scale manufacturing industries in Ethiopia for the period 1993-2018. An econometric model (system GMM) was applied to analyze the determinants of TFP growth of large and medium manufacturing industries. The result from the econometric analysis confirmed that the intensity of imported raw materials, the loan provided to the manufacturing industries, foreign direct investment, human capital, and infrastructure growth (road coverage) had a significant positive effect on the TFP of Large and Medium Scale manufacturing industries. However, export intensity and macroeconomic instability(inflation) adversely affected TFP. The descriptive analysis showed that, in general, the number of firms, size of jobs created, and value-added per worker by large and medium scale manufacturing industries are continuously increasing from time to time and this sector is dominated by agro-processing industries (food & beverage subsectors) and non-metallic mineral industries. Regardless of the continuous rise in number, employment, and value-added per worker, there has been no similar progress in manufactured exports. Further, it is proved that the current operation of Large and Medium Scale Manufacturing Industries in Ethiopia is highly constrained by a shortage of supply of raw materials; absence of demand for products, and lack of working capital. Therefore, the government should focus on policies aimed at human capital formation, loan access, infrastructure development, attracting foreign direct investment, and creating a stable macroeconomic environment to intensify TFP of Large and Medium Scale manufacturing industries.

Keywords: manufacturing, productivity, determinants, GMM, Ethiopia.

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Introduction

During the last eighteen years, Ethiopia has become one of the fastest-growing economies in the world with an average gross domestic product (GDP) growth rate of about 10% per annum. But the Ethiopian economy is still subject to structural problems. Relative to other developing countries, the base of Ethiopia's manufacturing sector remains to be insignificant (Haile, Srour, & Vivarelli, 2017). The industry sector in the general and manufacturing sector, in particular, has a limited share in terms of production, employment, exports, and inter-sectoral linkages (AACCSA, 2014 &Arkebe, 2018). For instance, the contribution of the manufacturing sector to the gross domestic product was only about 6.4 % in 20018 (NBE, 2018). Its share to GDP is still lower than the sub-Saharan African average which is nearly 10% (Signe, 2018). Though the share of the manufacturing sector is showing slight improvement over time, the service and agriculture sectors are still dominant, constituting about 39% & and 35 % of the country's gross value added, respectively (NBE, 2018).

The current government of Ethiopia has recognized the industry sector in general, the manufacturing sector in particular as a fundamental path to sustainable economic growth and development, at least by prescribing policy. In 2002/03, the Ethiopian government articulated a complete industrial development strategy with the principles of a free-market economy. In addition, the country developed an overstretched comprehensive industrial development strategic plan (2013-2025), aiming to create high manufacturing capability and thereby to bring about the structural change in the economy that plays a leading role in the overall development of the country (FDRE Ministry of Industry, 2013).

Manufacturing industries are a key determinant of long-term economic growth and hence living standards. As economies transform from primary agricultural-based economies to manufacturing-based ones, almost every aspect of life in society could be sustainably changed as it helps to create wealth in the economy. Many economists argued that the expansion of the manufacturing sector is an engine of the growth and development process. It plays a key role in the socio-economic transformation of the economy of a given country (Eshetie, 2018). The importance of the manufacturing sector for economic growth has been ascribed to higher income elasticity of demand for manufactured goods and higher potential of productivity catch-up (Rodrik, 2011; Haraguchi, 2015). Again, when the productivity in the manufacturing sector increases, surplus labor will shift from non-manufacturing activities where there are diminishing returns (Olamade & Oni, 2016).

Recognizing this role, Ethiopia has given more emphasis to the development of labor-intensive manufacturing industries which have a strong backward linkage to agriculture (Ansu et al., 2016). However, despite the policy prescriptions, the manufacturing sector is still in its infant stage dominantly focusing on semi-processing sub-sectors. That implies that the industrialization policy prescriptions could not change radically the industry sector in general and the manufacturing sector in particular.

The performances of the manufacturing industries have generally been far from the target set on the GTP (NPC, 2018). During the first Growth and Transformation Plan implementation period (2010/11-2014/15), it fell short of the planned target both in terms of growth performance and structural change (GTP-II, 2016). During this period, the share of the manufacturing sector in total GDP remained below 5 %, it has registered an annual average growth rate of 14.6 %. The contribution of the manufacturing sector to overall GDP has not only been below the planned target, but it has also remained low relative to the mean performance of the Sub-Saharan Africa (SSA) countries. In the second growth and transformation plan (GTP-II) manufacturing industry is projected to grow by an average annual growth rate of 21.9% and its share in the overall GDP was projected to increase from less than 5% in 2014/15 to 8% by 2019/2020. But, still, the share of this sector in overall GDP in 20018 was poor, accounting for about 6 % (NBE, 2018). This figure is still lower than the sub-Saharan Africa average of nearly 10% (Signe, 2018). Further, the share of manufactured exports in total exports remained less than 13% (Arkebe, 2018). This seems unanticipated, given the emphasis placed by the Ethiopian government to achieve structural transformation through industrial policy.

For many decades, economists have debated on the sources of total factor productivity (TFP) productivity in the manufacturing sector. The endogenous theorists such as Romer, 1990; Todaro & Smith, 2012 and other scholars identified many factors that determine the performance of the manufacturing sector productivity in developing countries (NPC, 2018). The theoretical and empirical literature clearly shows that the factors that affect the Total Factor Productivity and output of the manufacturing sector vary from country to country (Ilyas et.al, 2010). But in general, the common determinants of TFP examined in the empirical literature includes variables such as trade openness, macroeconomic stability (inflation rate), human capital, financial sector development (credit to the private sector), governance, economic growth, infrastructure, and research and development, FDI, lending rate, institutions among others (Todaro & Smith, 2012; Frija et.al, 2015; Weil, 1992; Akinlo, 2006; Ford et al., 2008; Arisoy, 2012; Park, 2010;

Baltabaev, 2013; Blomstrom et al., 2000; Demena & van Bergeijk, 2019; Calderón & Servén, 2014; Frija, et.al, 2015; Isaksson, 2007; Kariithi,2017; Jun, et. al, 2007; Xu, et. al.2020; Fadiran & Akanbi, 2017; Rasheed, 2010; Habib, Abbas, & Noman; 2019; Timuno, 2017; Odior, 2013; Olomola & Osinubi, 2018). Given the large variety of the variables that determine total factor productivity, in this study those variables that are commonly touched in the majority of the above theoretical and empirical studies, and are relevant within the context of my study are identified. In addition, the availability of data in Ethiopia is considered while identifying the main determinants of TFP in the large and medium scale manufacturing industries.

Some scholars like Arkebe (2018) have made descriptive analyses of the structure and performance of manufacturing industries in Ethiopia. But his study does not objectively identify the main factor behind the performance of the sector. Melaku (2013) also analyzed the trend and components of total factor productivity (TFP) growth in the manufacturing sector in Ethiopia. But he did not identify the main factors behind TFP growth in the manufacturing sector. Further, there are limited time-series empirical studies that attempted to analyze the determinants of TFP growth in the manufacturing sector in Ethiopia. Therefore this research tries to fill the aforementioned research gap by identifying the main determinants of TFP growth in large and medium scale manufacturing industries (LMSMI) in Ethiopia using quantitative data. In addition, the trend and structure of the Ethiopian manufacturing sector are analyzed descriptively.

Research Objectives

The main objective of the study is to analyze the determinants of total factor productivity in the large and medium-scale manufacturing industry in Ethiopia over the period 1993-2018. The study tries to address the following specific objectives:

i. To analyze the trend and structure (number, employment, and value-added) of the large and medium-scale manufacturing industry in Ethiopia over time.
ii. To investigate the main factors that affect total factor productivity (TFP) in the large and medium-scale manufacturing industry in Ethiopia.

Material And Methods

Data Sources

The study has used twenty-six-year time series data starting from 1993 to 2018. The annual data were obtained from Central Statistical Agency, National Bank of Ethiopia (NBE), Ethiopian Economics Association (EEA), National planning commission, and other international data sources like World Bank (WB), UNCTAD), and IMF.

Variable Description and Measurement

Total Factor Productivity (TFP): is the share of output not described by the number of physical inputs used to produce the output. It was constructed by using the Tornqvist-Theil index approach.

Human capital (ENROL): Due to the absence of human capital index and educational attainment-related data, secondary school enrolment is included in the model as a proxy for human capital. This explanatory variable is expected to have a positive impact on total factor productivity.

Loan (LO): Financial shortage is a major limitation to any manufacturing firm. Some organizations that venture into the manufacturing business do not have sufficient capital or funds to boost their business (Kariithi,2017). Hence the ratio of bank loans to the large and medium scale manufacturing industries will be included in the model.

Foreign Direct Investment (FDI): In this research, FDI is measured in terms of the ratio of foreign firms to total firms in large- and small-scale manufacturing industries. FDI is expected to have a positive effect on total factor productivity growth

Export intensity (EXP): Export intensity indicates the level of exposure to foreign output markets and it is measured as the ratio of manufacturing export to the gross value of production.

Import intensity (IMP): This gauges the firm's degree of exposure to foreign input markets and it is measured as the ratio of the value of imported raw materials to the total value of raw materials used.

Road (ROAD): The level of physical infrastructure like a road can boost total factor productivity through increasing resources and enhancing the productivity of invested capital (Frija, et.al, 2015). Infrastructure can facilitate the reliability of material supply and output delivery, can reduce the delivery time of goods, and ultimately results in increased productivity and profitability of manufacturing industries. In this research growth in the road, coverage is taken as a proxy for infrastructure development.

Real GDP per capita (GDPPC): The level of domestic demand for manufactured products can affect total factor productivity and employment (Wolfe, 1969). Sufficient domestic demand for manufactured products may force enterprises to raise output by fully utilizing their capital and labor, thus causing improvement in total factor productivity (Xu, et. al.2020)

INF(INF): High inflationary situation can macroeconomic uncertainty, which is harmful to productivity improvement and economic growth (Ocran,2007). On the other hand, zero levels of inflation or deflation can negatively affect productivity growth by discouraging producers to produce more goods and services by employing different factors of production. As a result, some economists argued that up to some threshold level, inflation can encourage investment and productivity growth (Khan, 2006). Therefore, the rate of inflation is included as one of the determinants of TFP in large and medium scale manufacturing industries in Ethiopia.

Total Factor Productivity (TFP) Measurement and Estimation

Productivity can be measured in terms of single-factor productivity measures and multi-factor productivity measures which is also known as total factor productivity (Tsegay et.al, 2017). Total Factor Productivity (TFP) is a multi-factor productivity measure that captures the share of output not described by the number of physical inputs used to produce the output. As such, its level is determined by how efficiently and intensely the inputs are utilized in production (Comin, 2010).

There are many approaches to measuring TFP. In this research, the Tornqvist-Theil index was used to construct the TFP index. This approach allows estimating TFP based on simple pre-defined formulas, and without the need for econometric estimation. This approach avoids the statistical problems resulting from 2nd-stage regressions as the omitted variable problem not resolved in the 1st stage may provide inefficient and biased estimates in the 2nd stage regression (Wang & Schmidt, 2002). According to this approach, growth in TFP is considered comparable to growth in technical change. The Tornqvist-Theil output, input, and TFP index in logarithm form can be specified as follows:

$$\text{Output index} = ln\left[\frac{Q_t}{Q_{t-1}}\right] = \frac{1}{2}\sum_j (R_{j,t} + R_{j,t-1})\, ln\left(\frac{Q_{j,t}}{Q_{j,t-1}}\right)$$

$$\text{Input index} = ln\left[\frac{X_t}{X_{t-1}}\right] = \frac{1}{2}\sum_j (S_{j,t} + S_{j,t-1})\, ln\left(\frac{X_{j,t}}{X_{j,t-1}}\right)$$

$$\text{TFP index} = ln\left[\frac{TFP_t}{TFP_{t-1}}\right] = ln\left[\frac{Q_t}{Q_{t-1}}\right] - ln\left[\frac{X_t}{X_{t-1}}\right]$$

Where;

Rj,t = the share of output (*j*) in total revenue in time (t),

Qj,t = the output (*j*) in time (*t),*

Si,t = the share of input (*i*) in total input cost, and

Xi,t = the input (*i*) in time (*t),*

The TFP index measures TFP changes by calculating the weighted differences in the growth rates of outputs and inputs. The growth rates are in log-ratio form, and the weights are revenue and cost shares for outputs and inputs, respectively.

The Model

The main focus of this study is to analyze the determinants of TFP in the large and medium scale manufacturing sector by using time series data over 1993-2018. Once the TFP is estimated by using the Tornqvist-Theil technique, the following estimable time series model is specified to investigate the determinants of TFP in the large and medium-scale manufacturing sector in Ethiopia.

Method of Estimation

Econometric modeling and descriptive statistics were employed to analyze the data. To show the structure and performance of large and medium-scale manufacturing industries, I used simple descriptive statistics. On the other hand, to analyze the determinants of manufacturing industry growth, I applied an econometric model (Generalized Method of Moment). GMM estimators are more efficient than the common method of moment estimators as it uses a weighted matrix estimation technique that allows accounting for heteroskedasticity and/or serial correlation (Hall, 2005; & Baum, Schaffer, & Stillman, 2003). GMM is also a robust estimator in that it does not require information on the exact distribution of the disturbances (Eviews-9 Manual).

Difference GMM and system GMM are the two recent common variants of GMM. But,

$$TFP_t = \beta_0 + \beta_1 IMPIN_t + \beta_2 LOAN_t + \beta_3 FDI_t + \beta_4 EXPIN_t + \beta_5 ENROL_t + \beta_6 ROAD_t + \beta_7 GDPPC_t + \beta_8 INF_t + v_t \quad \text{.......... (4)}$$

Where is the constant term, **IMPIN** is the intensity of imported raw materials, **LOAN** is a bank loan to large and medium scale manufacturing firms, **FDI** is foreign direct investment index, **EXPIN** is the intensity of exported outputs, **ENROL** is a growth rate of secondary school enrolment, **ROAD** is growth in road coverage which is a proxy for infrastructure development, **GDPPC** is growth rate of real per capita income, **INF** is a rate of inflation, and is an error term that captures all other omitted factors with) = 0 for all i and t .Parameters to are the elasticities of **TFP** concerning each explanatory variable.

given the poor performance of the difference GMM models, particularly in the presence of high serial correlation, Blundell and Bond (1998) designed a system GMM that uses lagged first differences of the explanatory variables and the dependent variable as instruments in addition to the lagged level instruments. Therefore, in this paper, I used the system GMM to identify the determinants of total factor productivity in the manufacturing sector in Ethiopia over the period 1993-2018. Before estimating the GMM model, the stationarity of the series over time was checked. To do this, the standard *Augmented Dickey-Fuller* (ADF) and *Phillips–Perron*(PP) unit root tests were applied. In addition, to test the adequacy of

the GMM model, Sargan's J-test of over-identifying restrictions was used.

Results And Discussion

Descriptive Analysis

Trend and Structure Of Large And Medium Scale Manufacturing Industries (LMSMI)

Under this section, therefore, the trend and structure of large and medium scale manufacturing industries are assessed in terms of the total number of firms, size of employment created, value-added, value-added per labor, and export intensity (export per value of production).

A total number of firms: As depicted in Figure-1(panel A), the total number of large and medium scale manufacturing industries are continuously increasing from time to time. In 1996 the total number of large and medium scale manufacturing firms was 642. After ten years this number has almost doubled and reached 1243 in 2006. The number of large and medium scale manufacturing firms has increased by around three-fold and reached 3627 in 2017.

The distribution of the firms by sector is reported in Table 1. Accordingly, food and beverages, nonmetallic mineral products, and furniture together constitute more than 50% of the large and medium scale manufacturing firms.

Jobs/employment created: As depicted in Figure-1(panel B), the total size of jobs created by the large and medium scale manufacturing sector is generally increasing during the last two decades, except for the year 2015. During 1996-2006, the total number of jobs created in this sector

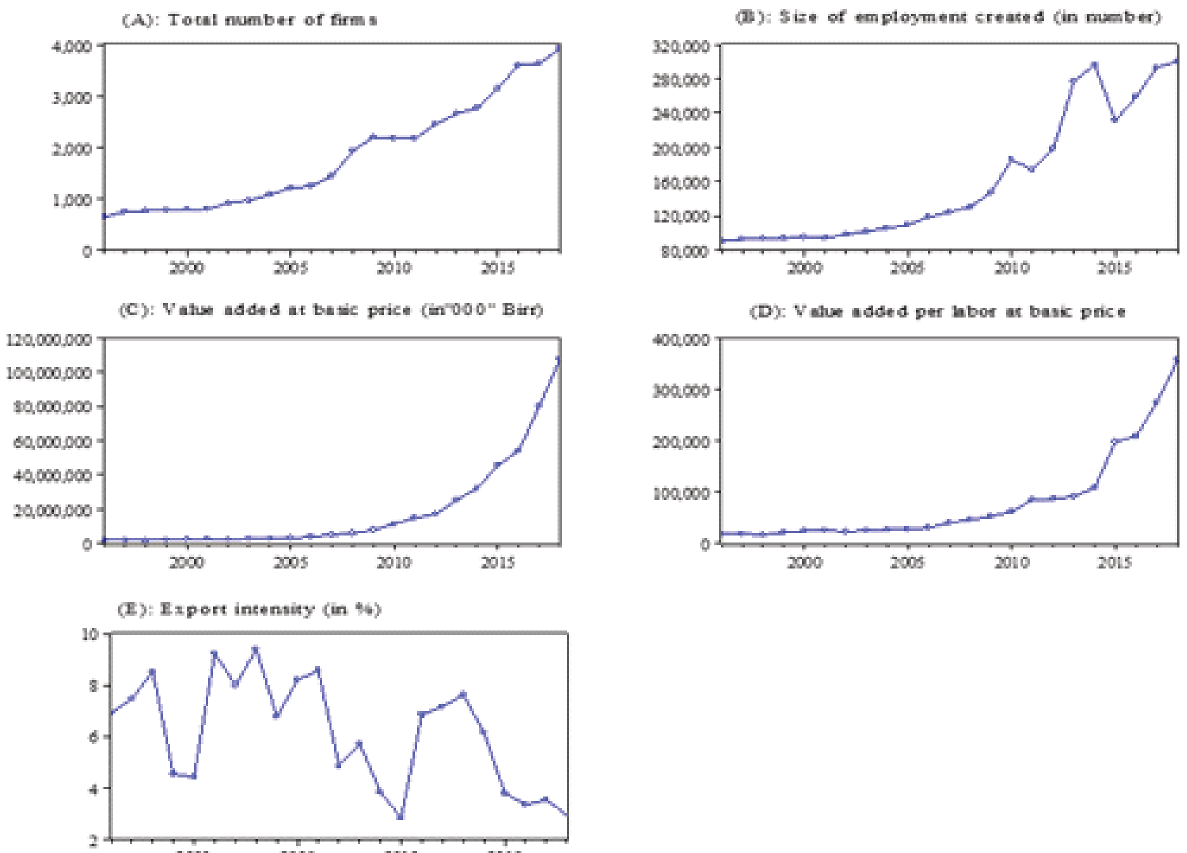

Figure 1: Performance of Large and Medium Scale Manufacturing Industries (1992-2017)

Source: Own Computation Based on CSA Data

increased by nearly 32%. In the next eleven years (1997-2017), total employment created by the firms has increased by 147.4%. This significant increment in the number of firms and employment is due to the government interventions to support the manufacturing sector through a range of incentives like favorable land lease rates, access to commercial credit, free imports of inputs, generous tax breaks, together with substantial investments to improve infrastructure and human capital (Ansu et al., 2016).

Table 1: Number and Share of Large and Medium Scale Manufacturing Industries by Sector, 1996-2017

Industrial Group	Number of Establishments									
	1996		2001		2006		2011		2017	
	Number	Share (%)	Number	Share (%)	Number	Share (%)	Number	Share (%)	Number	Share (%)
Food, Beverage & Tobacco	175	27.3	252	31.7	374	30.1	687	31.7	950	26.2
Textile & Wearing apparel	55	8.6	59	7.4	73	5.9	77	3.6	392	10.8
Leather & Foot wear	63	9.8	54	6.8	63	5.1	141	6.5	159	4.4
Wood & Paper	69	10.7	73	9.2	116	9.3	208	9.6	213	5.9
Chemicals & Chemical Products	35	5.5	40	5.0	53	4.3	75	3.5	148	4.1
Rubber & Plastic	15	2.3	32	4.0	63	5.1	106	4.9	261	7.2
Other Non-Metallic Mineral	85	13.2	87	10.9	152	12.2	409	18.9	649	17.9
Iron, Steel % Metal	42	6.5	63	7.9	124	10.0	180	8.3	304	8.4
Machinery, Equipment & Motor vehicle	28	4.4	17	2.1	23	1.9	14	0.6	51	1.4
Furniture	75	11.7	121	15.2	202	16.3	271	12.5	500	13.8
Total	642	100	796	100	1243	100	2168	100	3627	100

Source: Own Computation Based on CSA Data

On the other hand, food and beverages, textile and wearing apparel industries, and wood & paper industries were the three dominant job-creating sectors constituting nearly 72% of the total employment created in large and medium scale manufacturing industries in 1996. As reported in Table 2, over time the share of rubber & plastic, and non-metallic mineral industries continuously increased and become among the main job creators in 2017. At the end of 2017, food & beverages, textile & wearing apparel, rubber & plastic, and non-metallic mineral industries together accounted for more than 65% of total registered manufacturing employment. This clearly shows that the manufacturing sector in Ethiopia is at its early stage of development which exists before industrialization “take off”. In this early stage, labor-intensive industries have higher development potential in terms of value-added (Haraguchi, 2015).

Value-added: Figure-1, panel C and Panel D show the trend of total value-added and value-added per worker between 1996 to 2017. Accordingly, the value added by the large and medium scale manufacturing industries is showing nonstop increment from time to time. Not only the total value-added but also the value-added per worker is increasing continuously. The value added by the large and medium scale manufacturing industries was worth about 1.6 billion Birrs

Table 2: Number And Share Of Jobs Created By LMSMI By Sector, 1996-2017 Years

Industrial Group	Number of Employees									
	1996		2001		2006		2011		2017	
	Number	Share (%)	Number	Share (%)	Number	Share (%)	Number	Share (%)	Number	Share (%)
Food, Beverage & Tobacco	24,180	26.6	28,082	30.0	36,415	30.8	68414	39.5	62309	21.3
Textile & Wearing apparel	33,441	36.7	28,004	29.9	26,199	22.1	19233	11.1	51009	17.4
Leather & Foot wear	7,748	8.5	7,040	7.5	7,914	6.7	14019	8.1	13958	4.8
Wood & Paper	8,045	8.8	6,552	7.0	9,818	8.3	14064	8.1	12292	4.2
Chemicals & Chemical Products	2,825	3.1	4,291	4.6	5,668	4.8	9744	5.6	17830	6.1
Rubber & Plastic	2,219	2.4	3,401	3.6	6,899	5.8	10984	6.3	42900	14.6
Other Non-Metallic Mineral	6,038	6.6	7,328	7.8	10,093	8.5	17230	9.9	35407	12.1
Iron, Steel % Metal	3,127	3.4	3,577	3.8	7,918	6.7	10967	6.3	18871	6.4
Machinery, Equipment & Motor vehicle	1,141	1.3	1,232	1.3	1,794	1.5	2271	1.3	9337	3.2
Furniture	2,275	2.5	4,230	4.5	5,688	4.8	6471	3.7	29145	9.9
Total	91,039	100	93,737	100	118406	100	173397	100	293058	100

Source: Own Computation Based on CSA Data

in 1996. In the same year, the value-added per person was 17,507 Birr. In the next decade, these figures (value-added and value-added per worker) have almost doubled to 3.7 Billion Birr and 30,996 Birr in 2006 (see also Table 3 and Annex Table-A).

After 2006, value-added and value-added per worker has tremendously increased and reached 80.3 Billion Birr and 273,930 Birr in 2017, respectively. This seems promising performance, though the share of the manufacturing industry to the entire economy is still very low. This research also indicated that the largest value addition was come from the agro-processing industries (food & beverage subsectors), non-metallic mineral industries, and textile and wearing apparel, which together accounted for close to 60% share between 1996-2017. However, the relative share of the value added by the food and beverage industries declined after 2006.

***Exports performance*:** Regardless of the continuous rise in manufacturing value-added and employment, there has been no similar progress in manufactured exports. As reported in Figure-1, panel-E, the ratio of export to a gross value of production is highly volatile. During 1996-2017, the highest export to a value of production (9.4%) was recorded in 2003 while the lowest ratio (2.8%) was in 2010. The composition of the export reported in Figure-2 clearly shows that almost all of the manufactured exports were low-value products, which were generated in the leather & footwear, food and beverage, and textiles, and apparel industries. This could be due to weak international competitiveness that results from low productivity and low-quality products.

Table 3: Amount and Percentage Distribution of Value Added in LMSMI by Industrial Group, 1996–2017

Industrial Group	Value-added at a basic price (in "000000" birr)									
	1996		2001		2006		2011		2017	
	Value	Share (%)	Value	Share (%)	Value	Share (%)	Value	Share (%)	Value	Share (%)
Food, Beverage & Tobacco	732.9	45.99	1,269.2	53.58	1,619.4	44.12	8,169.4	55.49	25,960.8	32.34
Textile & Wearing apparel	171.8	10.78	154.4	6.52	146.0	3.98	437.2	2.97	9,553.3	11.90
Leather & Foot wear	145.8	9.15	112.8	4.76	160.5	4.37	1,130.3	7.68	3,053.0	3.80
Wood & Paper	138.1	8.66	154.9	6.54	226.5	6.17	859.5	5.84	6,432.5	8.01
Chemicals & Chemical Products	50.7	3.18	110.0	4.64	178.2	4.86	1,308.9	8.89	3,273.0	4.08
Rubber & Plastic	52.9	3.32	134.6	5.68	325.5	8.87	746.6	5.07	4,805.6	5.99
Other Non-Metallic Mineral	151.3	9.49	204.7	8.64	576.1	15.70	2,086.4	14.17	11,785.7	14.68
Iron, Steel & Metal	84.5	5.30	86.7	3.66	255.5	6.96	-530.2	-3.60	5,923.7	7.38
Machinery, Equipment & Motor vehicle	41.1	2.58	103.5	4.37	93.3	2.54	223.5	1.52	2,529.3	3.15
Furniture	24.7	1.55	38.1	1.61	89.1	2.43	291.6	1.98	6,960.8	8.67
Total	1,593.8	100	2,368.7	100	3,670.2	100	14,723.2	100	80,277.4	100

Source: Own Computation Based on CSA Data

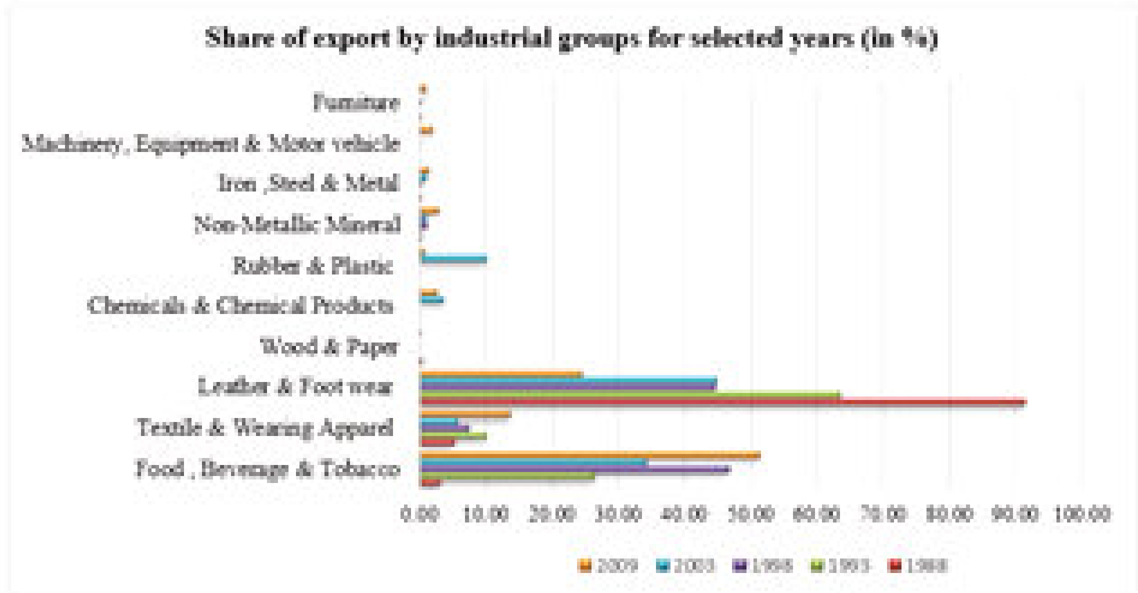

Figure 2: Share of Export by The Industrial Group for Selected Years (1992-2017)
Source: Own Computation Based on CSA Data

Firm-level Major Operational Problems

Based on the 2017 CSA annual survey on Large and Medium Scale Manufacturing Industries in Ethiopia, the first major operational problem faced by the LMSMIs is summarized in Annex Table-C. Accordingly, all manufacturing industries reported a shortage of supply of raw materials as the first major operational problem faced during each survey year. The industries reported the absence of demand for products (except for Leather & Footwear) as the second major operational problem they faced. Lack of working capital (Food, Beverage & Tobacco; Textile & Wearing apparel; Iron, Steel & Metal; Machinery, Equipment & Motor vehicle and Furniture) and shortage of supply of spare parts (for Wood & Paper; Chemicals & Chemical Products and Rubber & Plastic) are the third major operational problem the large and medium scale manufacturing industries faced.

Econometric Analysis

Stationarity Test

The results of the ADF and PP unit root test are reported in Table 4. The empirical results confirmed that TFP and real GDP per capita have no unit root problem at a 1% level of significance. Similarly, the null hypothesis of the unit root was rejected at a 10% significance level in the case of imported raw materials intensity, export intensity, FDI, and loan while secondary school enrolment growth, growth in road coverage, and rate of inflation are stationary at 5% level of significance.

Table 4: Unit Root Analysis

Variables	ADF Unit Root Test			PP Unit Root Test		
	T-	Prob.Values	Decision	T-	Prob.Values	Decision
TFP	-	0.0007***	Stationary	-5.599315	0.0006***	Stationary
IMPIN	-	0.072*	Stationary	-3.509865	0.060*	Stationary
LOAN	-	0.083*	Stationary	-2.810255	0.071*	Stationary
FDI	-	0.066*	Stationary	-2.845941	0.066*	Stationary
EXPIN	-	0.093*	Stationary	-3.308686	0.088*	Stationary
ENROLg	-	0.021**	Stationary	-4.067676	0.019**	stationary
ROADg	-	0.037**	Stationary	-3.189653	0.033**	stationary
RGDPPCg	-	0.007***	Stationary	-4.550280	0.0068***	stationary
INF	-	0.031**	Stationary	-3.812377	0.0328**	Stationary

Source: Own computation based on CSA data
*Note: Significance at 1%,5% and 10% is shown by ***, **and *respectively.*

Determinants of Total Factor Productivity (TFP) in LMMI

Having constructed firstly the TFP index, I specified and estimated the TFP model using this index as the dependent variable. As it was discussed previously in the methodology part of this paper, I estimated the TFP model through system GMM that uses lagged first differences of the explanatory variables and the dependent variable as instruments in addition to the lagged level instruments. The results of the estimated model for the TFP determinants are presented in Table 5 below. The standard Sargan's J-test (overidentifying restrictions test) reported in Table 5 clearly shows that the model is correctly specified (the specified variables are proper instruments) and the instruments are uncorrelated to the error process (orthogonal to the error process). The endogeneity test (difference-in-Sargan" statistic) reported in Annex Table-B also confirmed the robustness of the specified model.

The result reported in Table-5 indicates the one period lagged value of total factor productivity (TFP(-1), intensity of imported materials (IMPIN), a loan provided to the industries (LOAN), foreign direct investment (FDI(-1)), export intensity(EXPIN(-1)), secondary school enrolment growth (ENROLg(-1)), growth in road coverage (ROADg), and inflation rate (INF(-1)) have a significant negative effect on total factor productivity of Large and Medium Scale manufacturing industries while the effect of per capita GDP (GDPPCg) is insignificant.

The coefficient of the amount of loan provided to the industries (LOAN (-1) was found to be statistically significant at 5%. That means loan provision to large and medium scale manufacturing industries can help to boost their productivity. The coefficient of LOAN is about 5.6 implying that as the ratio of loan to a gross value of production raises by 1 percent, TFP will boost by 5.6 percent.

Technology, new processes, and managerial skills, and know-how diffusion are commonly pointed out in the literature as drivers of TFP Growth. This study supports the proposition that FDI influences TFP growth which is consistent with theoretical and empirical literature that suggest FDI is a major channel of transferring foreign

Table 5: System GMM result

Dependent Variable: TFP ***(constructed based on Tornqvist-Theil approach)***
Method: Generalized Method of Moments
Included observations: 23
Estimation weighting matrix: HAC

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TFP(-1)	0.462204	0.180067	2.566848	0.0234
IMPIN	1.536703	0.288703	5.322791	0.0001
LOAN	5.623690	2.543702	2.210829	0.0442
FDI	0.539662	0.086499	6.238947	0.0000
EXPIN (-1)	-2.532579	0.524882	-4.825040	0.0003
ENROLg (-1)	1.097423	0.174725	6.280857	0.0000
ROADg	1.221906	0.203357	6.008664	0.0000
RGDPPCg	0.394466	0.387947	1.016803	0.3265
INF (-1)	-0.418338	0.124888	-3.349706	0.0048
C	26.10827	17.23476	1.514861	0.1521
R-squared	0.500081		Mean dependent var	113.1394
Adj.R-squared	0.214413		S.D. dependent var	22.13505
S.E. of regression	19.61903		Sum squared residual	5388.691
Durbin-Watson stat	2.01534		J-statistic	8.002840
Instrument rank	22		Prob(J-statistic)	0.843415

Source: Own computation based on CSA data

technology, familiarizing new processes and managerial skills, and know-how diffusion to the domestic market (Kolawole, 2015; Olomola and Osinubi, 2018). The coefficient of FDI is statistically significant at a 5% level of significance. The result showed that as the ratio of foreign capital to total capital in large- and small-scale manufacturing industries increases by 1% TFP increased by about 0.54 percent. This result is consistent with the findings of Jain, Nair, & Jain (2015); Demena & van Bergeijk (2019); Arisoy (2012); Park (2010); Baltabaev (2013).

Our estimation evidences a positive effect of human capital on total factor productivity growth. The positive effect of human capital, as expected, is consistent with endogenous growth theories and empirical findings (Adejumo, 2012; Ahmed & Bukhari, 2007; Kamaly, 2011; Park, 2010; Romer & Weil, 1992), which argues that improvement in human capital (good education and quality investment in human capital) leads to productivity improvement. Having skilled human capital is essential for the adoption and dissemination of new technologies and production processes which promotes productivity (Martins, Domingues, and Branco, 2018). The result of this research shows that as the secondary school gross enrollment rate increases by 1%, TFP raises by about 1.1%.

Infrastructure development (measured in terms of road coverage) is also one of the factors that positively affect the TFP of the manufacturing sector in Ethiopia. The coefficient of ROADg is about 1.2. This implies that as road coverage grows by 1% TFP increases by 1.2%. This supports the argument that physical infrastructure like roads improves productivity by creating a conducive environment for productivity initiatives (Agénor, Canuto, & Jelenic, 2012; Alvarez-Ayuso, Becerril-Torres, & Moral-Barrera, 2011; Olomola & Osinubi, 2018). It can facilitate and enhance the reliability of services and cost minimization in the delivery time of goods which in turn increases the productivity and profitability of the manufacturing industries (Lucas, 1988; Barro & Sala-i-Martin, 2004).

Domestic demand for manufactured products (measured by real per capita income growth) was found to have a positive effect on TFP growth. But, the coefficient of RGDPPCg was found to be statistically insignificant even at the 10% level. This regression result is contradicting with the theoretical literature that suggests an increase in domestic absorption can lead to an increase in the level of TFP, as the producers get effective demand for their products, they will be encouraged to increase their productivity in the future (Xu, et.al, 2020). However, it is not a surprising result as most Ethiopian consumers have low purchasing power and are highly interested in imported manufactured items than domestic products.

Import intensity is also another factor that determines total factor productivity in large and medium scale manufacturing industries. Many scholars have tried to verify the learning-by-importing hypothesis. However, the evidence on the causal relationship is mixed. Some researchers like Smeets & Warzynski (2013) and Abreha (2019) argued that imported inputs may create the possibilities for technology spillovers which boost total factor productivity of firms. In this research, the coefficient of IMPIN is positive and significant. The coefficient of IMPIN shows that a 1% increase in the ratio of imported raw materials to a gross value of production leads to a 1.45% increase in TFP. This is consistent with the findings of Abreha (2019) for the Ethiopian manufacturing sector. According to AACCSA (2014) and Yibeltal (2018), most of the large and medium scale manufacturing industries are highly dependent on imported raw materials from the international market. The dependency on imported raw materials is relatively high in the machinery &

equipment, rubber and plastic, and the chemical and chemical products manufacturing industries than the others. Such reliance on imported raw materials usually happens due to unavailability, irregular supply and low quality of domestic raw materials, and weak linkage between industries.

Many scholars like Baltabaev (2013), and Kolawole (2015) argued that there is a negative relationship between inflation and TFP. This adverse effect could be due to high and unstable prices that can lead to a lot of economic uncertainties that discourage investors from investing in projects that will improve productivity. The result of this research is also consistent with the above argument. The coefficient of inflation rate (INF) was found to have a significant negative effect on TFP in large and medium scale manufacturing industries at 1% levels. The result reported in Table 5 depicts that as the rate of inflation raises by 1% TFP decreased by 0.42 %. This result is consistent with the findings of earlier empirical studies that suggest unpredictable price level spoils macroeconomic climate for healthy economic growth which in turn adversely affects investment and productivity (Jarrett & Selody, 1982 & Ayob & Hussain, 2016).

Likewise, the coefficient of export intensity (EXPIN (-1)) variable was found to have a significant and negative effect on TFP growth. This seems to contradict with theoretical literature (learning-by-exporting hypothesis) that states that an increase in the participation of industries in the international market will lead to an increase in the level of TFP, as their exposure to foreign output markets helps them to advance their productivity (Isaksson, 2007; Arvas & Uyar, 2014; Siba & Gebreeyesus, 2016). The result of this research is similar to the findings of Crinò & Epifani, 2009) which confirms that TFP growth is negatively correlated with export intensity to low-income destinations.

Sometimes trade openness can adversely affect TFP by making a country specialize in traditional low-technology manufacturing. Due to high competition in export markets, output prices are continuously declining in the international market. This can be expected to drive profit margins down in the manufacturing sector, at least until efficiency gains can assimilate the price reductions. As a result, the export intensity of firms can negatively affect TFP up to some threshold level. Most of the manufactured exports in Ethiopia are characterized by low-value products, which generally went to other low and middle-income markets (Arkebe, 2019). This fact may limit firms' efforts to penetrate the export markets of advanced countries and learn from the best practices at the knowledge frontier (Siba & Gebreeyesus, 2016).

Conclusion and Recommendations

Conclusions

This empirical study seeks to analyze the determinants of total factor productivity in large and medium scale enterprises in Ethiopia (LMSEs). In addition, it tries to assess the trend and structure of LMSEs. This study, therefore, concludes that intensity of imported raw materials, the loan provided to the manufacturing industries, foreign direct investment, human capital formation, stable macroeconomic environment (stable price), and infrastructure growth (road coverage) are necessary to improve total factor productivity of Large and Medium Scale manufacturing industries. However, there is no significant evidence to suggest that growth in per capita income influence TFP growth, despite strong theoretical support. The study also highlights the negative effect of export intensity on TFP growth. This could be because most of the manufactured exports in Ethiopia are characterized by low-value products and high competition in

export markets. On the other hand, the descriptive analysis confirmed that the number, jobs created, and the of value-added per worker of large and medium scale manufacturing industries are continuously increasing from time to time. This seems promising performance, though the share of the manufacturing industry to the entire economy is still very low. This sector is dominated by agro-processing industries (food & beverage subsectors) and non-metallic mineral industries. However, regardless of the continuous rise in number, employment, and value-added, there has been no similar progress in manufactured exports. This could be due to the weak international competitiveness of the firms that results from low productivity and low-quality products.

Currently, the operation of Large and Medium Scale Manufacturing Industries in Ethiopia is highly constrained by a shortage of supply of raw materials; absence of demand for products, and lack of working capital.

Recommendations

After identifying the main determinants of TFP, it is important to discuss what sort of policies can be formulated to increase TFP growth in large and medium scale manufacturing industries in Ethiopia. First, policies aimed at human capital formation are very important to increase TFP. Human capital development will help firms to easily upgrade the skills of their workers, to use new and advanced technology, and uninterruptedly advance productivity for the continuous growth of efficiency and competitiveness. Human capital, which includes education and training is not only crucial for increasing total factor productivity, it is also helpful to transfer technology from abroad. Therefore quality institutional arrangements that enhance investment in human capital development are more central. Second, technology transfer through FDI attraction should be fully exploited to boost the total factor productivity in large and medium scale manufacturing industries. Therefore, this research suggests that there should be reforms targeted at attracting more foreign direct investment towards this sector. In line with attracting FDI, the government should further ensure peace and security that create a predictable and safe business environment for foreign firms.

The government should also facilitate loan access to LMSMI. This intervention can enhance TFP growth by creating sufficient capital or funds to boost their business. This measure can also allow the creation of new areas of investment and enhances the productivity of firms.

In addition, resources should be directed towards infrastructure development. Such policy can facilitate the reliability of raw material supply and output delivery, reduce the delivery time of goods, and ultimately results in increased productivity and profitability of manufacturing industries.

Further, achieving high TFP growth also requires creating stable macroeconomic stability that creates a stable and predictable business environment. The rate of inflation should be reasonably moderate and stable to intensify the demand for final goods and services which will, in turn, lead to increased production, and as a result, improved productivity. Otherwise, macroeconomic instability (high and unstable inflation) can negatively affect productivity growth by discouraging producers to produce more goods and services by employing different factors of production.

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Annex

Annex Table-A: Value Added per Worker in LMSMI by Industrial Group, 1996–2017

Industrial Group	Value of per worker (in birr)				
	1996	2001	2006	2011	2017
Food, Beverage & Tobacco	30,532	45,194	44,472	139,412	416,646
Textile & Wearing apparel	5,138	5,513	5,873	22,735	187,286
Leather & Foot wear	18,819	16,028	29,284	88,627	218,722
Wood & Paper	17,345	23,639	23,064	61,315	523,388
Chemicals & Chemical Products	17,962	25,651	31,445	134,323	183,542
Rubber & Plastic	25,881	39,872	47,182	67,870	112,019
Other Non-Metallic Mineral	25,068	27,927	97,876	121,891	352,864
Iron, Steel % Metal	27,086	24,238	32,278	-48,347	313,983
Machinery, Equipment & Motor vehicle	36,047	84,018	52,801	98,427	278,886
Furniture	10,049	8,899	15,472	45,040	258,833
Total	17,987	25,278	38,896	84,910	273,930

Source: Own Computation Based on CSA Data

Annex Table-B: Endogeneity Test

	Value	df	Probability
Difference in J-stats	0.107204	1	0.7434
J-statistic summary:			
	Value		
Restricted J-statistic	8.135984		
Unrestricted J-statistic	8.028780		

Source: Own Computation Based on CSA Data

Annex Table-C: Percentage Distribution of Establishments by Major Operational Problems Faced (2017).

Industrial Group	Shortage of raw materials	Shortage / supply of spare parts	Absence of demand / market	Lack of working capital	Frequent machinery breakdown	Lack of working premises	Problems with employees	Government rules	Others	No problem faced	Not stated	Total
Food, Beverage & Tobacco	54.13	1.82	9.34	4.03	3.03	3.52	0.97	3.94	11.71	6.67	4.49	100
Textile & Wearing apparel	53.26	3.97	16.15	7.03	0.00	0.00	1.70	3.42	6.08	3.38	3.03	100
Leather & Foot wear	27.15	1.32	6.61	2.65	1.32	0.00	47.02	3.31	5.61	1.32	0.66	100
Wood & Paper	48.99	10.61	11.11	1.52	3.03	2.02	1.52	2.02	13.13	5.56	3.54	100
Chemicals & Chemical Products	50.75	6.48	9.33	2.24	1.49	3.36	0.75	4.48	14.93	2.24	2.24	100
Rubber & Plastic	57.40	3.99	8.82	3.34	1.70	3.35	0.48	0.48	11.46	5.83	5.83	100
Other Non-Metallic Mineral	24.59	4.29	22.54	4.95	6.77	4.62	4.46	5.78	12.38	4.95	4.29	100
Iron, Steel & Metal	49.09	4.36	21.09	5.09	1.45	2.55	1.09	0.73	9.36	4.00	2.18	100
Machinery, Equipment & Motor vehicle	48.00	2.00	8.00	12.00	4.00	2.00	0.00	2.00	14.00	5.00	4.00	100
Furniture	48.07	2.15	14.59	6.65	1.29	3.86	3.07	3.00	7.30	4.51	7.51	100
Total	46.75	3.51	14.03	4.85	2.81	2.59	3.81	2.71	10.34	5.09	3.51	100

Source: Summarized From Report on Large and Medium Scale Manufacturing and Electricity (2017)