The Effect of Improved Productivity of the Manufacturing Industries on the Ethiopian Economy: A Computable General Equilibrium (CGE) Analysis

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Abstract

Ethiopia's manufacturing industry is at the onset of development though there are recent upsurges in the number of firms. This study examines the effect of productivity improvement of the manufacturing sector on the macro economy, sectoral output, factor and household income and welfare of households. In order to investigate this, the study utilized the recursive dynamic computable general equilibrium (CGE) model. The recently updated 2005/06 Ethiopian SAM was used to calibrate the CGE framework. Three policy simulations of high, medium and low TFP growth rates were simulated on agro processing, non-agro processing and overall manufacturing activities. The study demonstrated that the manufacturing sector is a key driver of economic growth in particular; the findings suggest that productivity increase in agro processing, non-agro processing and overall manufacturing sector largely increases real GDP and sectoral outputs. Moreover, both rural and urban households are well-off in all the policy simulations. The study further extends its recommendation for Ethiopia to develop a strong industrial policy aimed towards promoting both agro and non-agro processing industries.

Key words: CGE, Productivity improvement in the manufacturing industry

JEL Classification: L60, C68

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1. Introduction

Industrialized economies are characterized by having a strong manufacturing sector with linkages between and within sectors each being equally strong and dependent on the other. There is a strong correlation between the sophistication of the output produced by the manufacturing sector and economic growth; countries that have recently shown rapid growth are good examples (UNIDO, 2009). Having manufacturing sector at their core, the most industrialized countries have a well thought-out industrial policy that is designed to target industries with high productivity growth and technological transfers while Underdeveloped countries are non industrialized countries that are still dependent on vulnerable and the erratic agricultural sector in the 21st century (Weiss, 2011).

The Manufacturing sector of underdeveloped economies is fragile with weak and unbalanced linkages and spillover effects producing unsophisticated basic consumer goods. Ethiopia is no different; the structure of the manufacturing sector can be summarized as being largely labor intensive producing basic consumer goods; with agro processing industries dictating in terms of growth, employment contribution and value added (Padma and Swamy, 2004). The Manufacturing sector accounted for about 13% of GDP and 5% of total employment in 2010. The sector is the least contributor to total value added; the total manufacturing value added (MVA) was no more than 5% of GDP in the same year. Moreover, MVA is narrow based functioning with the contribution of few sectors; food and beverage industry accounted more than 35% of MVA (CSA, 2011).

The 2003's Industrial Development Strategy is a step towards ratifying a policy that could stand on its own. The strategy identifies key sectors of the industry which include; textile and garment, meat, leather products and agro-processing industries (Tadele *et al.*, 2006).

In 2010, the government has set targets in improving the industrial sector in the newly introduced national development plan namely the Growth and Transformation Plan (MoFED, 2010). But the effect of these massive improvements in the manufacturing sector in other sectors has not been fully investigated.

The first inspiration for this study comes from the research gaps identified from the previous studies conducted regarding the manufacturing industry and industrial policy and strategies and its repercussion on the economy, as many of the studies conducted showed only a partial equilibrium analysis focusing on only the subsectors of the industry. Secondly, there is little research work that analyzed the impact of industrial performance on the economy of Ethiopia using General Equilibrium models, which is more powerful for policy evaluation. Hence, the central objective of the study is to analyze the long run effect of improved productivity of the manufacturing industry on the economy of Ethiopia. More specifically it tries to assess the macroeconomic, factor income, household income and welfare effects of changes in the productivity growth of agro processing, non agro processing industries and overall manufacturing industries. The model is calibrated with the updated 2005/06 SAM of Ethiopia with three possible scenarios of TFP growth. All the three scenarios were compared to the business as usual, base simulation, assuming the economy continues with its past trend (with no policy shock) till 2015.

2. Literature Review

2.1 Theoretical Review

At the end of the Second World War, economists turned their work en route for devising methods to analyze the economies of developing countries such as Africa, Asia and Latin America and devise ways of achieving economic development in these countries. In the process, a new school of thought with the slogan manufacturing as the engine of growth emerged.

The new school had two wings; where economists like Roseinstein-Rodan and Nurkse, advocated the 'Balanced growth' while Hirschman and Streeten sided with the 'Unbalanced growth theories. Both schools agreed on industrialization as being the driver of economic growth, but had different views on the strategies towards industrialization. A balanced growth model assumes a coordinated expansion of several sectors simultaneously, while supporters of the unbalanced growth believe that deliberate distortions and disequilibrium in the economy is the only way to sustain economic growth and development. The situation that some industries are more developed than others provides backward and forward linkages and also provides an inducement to grow.

Nicholas Kaldor (1966) came up with his famous law of economic growth and further developed three major laws after his work on the stylized facts of economic growth. According to Kaldor's first law, "Manufacturing industry is the engine of economic growth", in essence it states that the faster the rate of growth of the manufacturing sector, the faster will be the rate of growth of GDP. His' second law of economic growth also known as Verdoon's law states that the faster the rate of growth of manufacturing output, the faster will be the rate of growth of labor productivity in that sector (Thirlwall, 1983).

The third law is the association between the output of the manufacturing sector and labor transfer where, the faster the rate of growth of manufacturing output, the faster the rate of transfer of labor from non-manufacturing sectors to the manufacturing sector when there is either diminishing returns or where no relationship exists between employment growth and output growth (Chatterji and Wickens 1983).

After the recent global economic recession, there was an urgency to rethink economic development by international organizations like the IMF and World Bank, as the policies developed so far failed to avoid and further resolve the crisis.

Works of the vice president of the World Bank (Lin, 2010) and (Lin and Monga, 2010) emphasized the role of New Structural Economics on industrial policy for economic development. The new structural economics states that industrial structure is endogenous to endowment structure, and further assumes the differences between developed and developing nations arise from endowment base, but a developing country can become developed by changing its industrial structure. With industrial restructuring comes infrastructural upgrading to suit the newly reformed structure, this in turn leads to industrialization, income growth and eventually poverty reduction (Lin, 2010).

2.2 Empirical Review

Libanio (2006) tried to prove the Kaldorian perspective towards economic growth in the study of the relationship between manufacturing output growth and economic performance of a sample of seven Latin American economies. The study confirms the hypothesis that manufacturing is the engine of growth and that there is a positive and a causal relationship between output and labor productivity in the manufacturing sector.

Ghatax and Roberts (1997) analyzed the consequence of adopting two alternative scenarios of promoting a key sector and non key sector using a CGE model for Poland. The study revealed that promoting a key sector, which has the highest level of forward linkages and a large income multiplier, will result in a much higher efficiency gain in terms of GDP, employment, the volume of investment and exports. It also concluded that implementing an industrial policy based on unbalanced growth of promoting key sectors would exemplify a much better macroeconomic performance.

Robinson *et al.* (1999) explored the economy wide income and equity effects of three alternative industrialization strategies in a static CGE model for Indonesia. The study found out that the strategy of ADLI exhibited the highest GDP growth relative to the food-processing and light manufacturing based industrial growth paths. In terms of manufacturing value added to GDP, light manufacturing based industrial growth showed the most significant ratio.

Cororaton and Orden (2008) examined the intersectoral linkages and poverty implications in the cotton and textile sector for Pakistan using CGE modelling of a set of alternative incentives to the sector. The study proposed that a 5% TFP improvement is welfare increasing for both rural and urban households and also resulted in expansion of production, exports and reduction of poverty.

Kim and Cho (2006) used dynamic CGE model to examine the effect of various industrial policies on the Korean economy in terms of efficiency and equity criteria from 2007 up to 2030.

The study proved that in all the possible policy alternatives of corporate tax income reduction, increment of corporate subsidy and R&D investment subsidy supporting the parts and materials industry relative to the final goods industry would be efficient in terms of resource allocation as it performed better in almost all macro variables.

A SAM based analysis conducted by Tadele *et al*. (2006), revealed that the manufacturing sector of Ethiopia is weakly integrated with the rest of the economy portrayed in the low backward and forward linkage effects. Among the manufacturing sector large and medium agro processing activities like; food and beverages, textile and leather industries have better backward linkages compared to other industries. The study also found out that labor intensive manufacturing activities like; food and beverages, textiles, chemical and non-metallic minerals are pro poor.

Urgaia (2007) analyzed the contribution of Ethiopia's manufacturing industries to GDP using Johansen cointegration analysis. The study established that Ethiopia's manufacturing sector contribution to GDP is about 6% which is approximately 1/11th and 1/6th of that of the agricultural sector and service sector respectively with negligible overall annual growth rate of about 0.24%. According to Urgaia, the manufacturing sector is labor intensive and is negatively influenced by total factors of production and the obsolete use of technology could be one reason for the sector's stagnant growth.

3. Data Source and Methodology

3.1 Data Source

The main database used to calibrate the CGE model is a Social Accounting Matrix (SAM), which provides a complete representation of the economy for a particular year. "SAM is a comprehensive economy wide data framework, typically representing the economy of a nation" (Lofgren et al., 2002). It is a general equilibrium (GE) data framework that records transactions taking place during an accounting period based on the underlying principle of double-entry accounting that requires the total incomes (row total) to equal total expenditures (column total) for each account. The benchmark data used in this study is the 2005/06 SAM developed by EDRI but updated for 2009/10 by IFPRI in order to adjust the data so as to match it with the economic performance during the year 2009/10 (Ermias *et al*., 2011)[2].

3.2 Model Specification

The use of the recursive dynamic Computable General Equilibrium in this study is motivated by the fact that first, it allows multi-sectoral modelling which makes it well suited for this study. Second, it can be used to model changes for which there is no past experience; in that sense it can be used to analyze new shocks to the economy where there is no previous data about that particular shock. Finally, CGE models compared to other econometric models provide a consistent framework to assess the linkages and tradeoffs

[2] For detailed explanation about the SAM and various accounts see EDRI (2009).

among different policy packages and help to pass better-informed policy prescriptions (Robinson, 2002).

The static model assimilates the one period specification of the recursive dynamic CGE model. It is a detailed description of the economy at a particular time period but is restricted to one period and fails to provide explanations about subsequent periods (Thurlow, 2004). The recursive dynamic CGE model developed by International Food Policy Research Institute (IFPRI) which is an extension of the standard static model is based on the adaptive expectations behaviour of agents, where agents make decisions on the basis of their past experience. The dynamic or "between" CGE model allows us to model the course of transitional dynamics accounting for the second and subsequent period effects. [3]

4. Simulation Specification and Results

4.1 Simulation Specification

The policy variable chosen as a shock for this particular study is Total Factor productivity (TFP) growth of the manufacturing industry. According to growth accounting there are two sources of growth; 1) input driven, which is adding up more and more resources into the production and 2) technology driven, what is not input driven is considered as technology or TFP growth or otherwise known as, 'Solow residual' is the growth in real value added after deducting the contributions made by the growth of labour, land and capital (Acemoglu, 2007).Since the former is subject to the law of diminishing returns output growth can't be sustained indefinitely so that's why TFP growth is considered as a policy variable for this study.

Base

In dynamic CGE model, comparative analysis is made with respect to the baseline scenario where the economy is assumed to grow in the absence of any shock. The baseline scenario in this study assumes that business continues as

[3] Refer to Lofgren *et al.*, 2002 for detailed specification of the dynamic model.

usual with continuation of historical growth trends of 2005/06-2009/10 for additional five years, from 2010-2015 with no specific policy changes.

Simulations

The highest, lowest and the average annual growth rate of value added for each industry registered between 2005 and 2010 are used as a shock to proxy TFP in this simulation. This policy simulation is separately conducted on, agro processing, non-agro processing activities and overall manufacturing, in doing so the other activities are left to grow at a rate equivalent to the base simulation.

Table 1: Summary of simulation specification

	Total factor productivity growth % per year		
	SIM 1: High	**SIM 2: Medium**	**SIM 3: Low**
Agro processing	35%	25%	21%
Non-agro processing	58%	30%	13%
Manufacturing	46%	27%	20%

Source: CSA (2007 and 2011) and own computation

4.2 Analysis of the Simulation Results

4.2.1 Effects on Macroeconomic Indicators

A 35% increase in the annual growth rate of TFP of agro processing activities brought about a 0.84% increase in real GDP from the base while a 25% and 21% increase in growth rate of TFP, real GDP growth rate increased by 0.58% and 0.41% respectively. The average growth rates of exports and imports also showed positive changes in all the three simulations compared to the base although the percentage change from the base is high in exports relative to imports. This might be due to the fact that most manufactured exports stem from agro processing industries and as productivity of these industries increase manufactured exports also increase. Moreover, the increased productivity of agro-processing industries would also be able to meet the demands of the local market otherwise fulfilled by imports.

A 58%, 30% and 13% increase in productivities of non-agro processing industries will increase growth rates of real GDP to 0.47%, 0.34% and 0.2% percentage points higher than the base respectively. But, the percentage change from the base is small even in the high case scenario due to the fact that non agro-processing industries take the smallest share in total manufacturing industry and the weak backward and forward linkages of the sector.

Increasing TFP's of all activities that are engaged in the manufacturing process reveals a positive change from the base simulation in all macro variables except a slight decline in the growth rate of investment which seems to diminish with the decline in TFP growth rate.

Table 2: Simulation result: effects of increased TFP growth on macroeconomic variables

Average annual growth rate 2010-2015 (% change from base)										
Macro variables		**Agro processing**			**Non agro processing**			**Manufacturing**		
	Initial	**Sim1**	**Sim2**	**Sim3**	**Sim1**	**Sim2**	**Sim3**	**Sim1**	**Sim2**	**Sim3**
Real GDP	355	0.84	0.58	0.41	0.47	0.34	0.2	0.65	0.48	0.3
Absorption	457.7	0.41	0.3	0.21	0.41	0.29	0.18	0.52	0.39	0.25
Private Consumption	338.6	0.47	0.35	0.23	0.59	0.42	0.25	0.73	0.54	0.35
Investment	85.5	0.31	0.2	0.15	-0.16	-0.11	-0.06	-0.12	-0.08	-0.05
Government	31.8	0	0	0	0	0	0	0	0	0
Exports	52.1	2.7	1.78	1.33	2.48	1.76	1.05	2.8	2.02	1.23
Imports	-127	1.61	1.06	0.78	1.48	1.05	0.62	1.67	1.2	0.73
Real Exchange Rate	90.85	-1.1	-0.7	-0.59	-1.38	-0.97	-0.57	-1.47	-1.05	-0.62

Source: CGE simulation result

4.2.2 Sectoral Effects

Productivity improvement of agro processing activities resulted in a slight decrease in the growth rate of the agricultural sector. The reason might be that as the agro processing manufacturing industries develop, their demand for agriculture outputs largely increase and if the sector can't cope up, the agricultural activities that are highly demanded by the industries like, crops and cereals will be hard hit. The industrial sector recorded the highest growth rate, under SIM1 (4.6%) followed by SIM2 (3.15%) and SIM3 (2.49%) compared to the base value.

Since the simulation was to increase the TFP of agro processing manufacturing industries, a wide range of activities were benefited like: beverages, food processing, leather, textile and clothing industries which recorded higher growth rates among the other activities in all the three cases. The service sector's growth rate recorded 0.51%, 0.34% and 0.24% higher average rates in SIM1, SIM2 and SIM3 compared to the base, respectively.

Increasing growth rate of TFP of non agro processing activities resulted in a slight increase in growth rate of the agricultural sector, especially in the medium (SIM2) and low (SIM3) case scenarios. On the contrary, the highest increase in the overall growth of the industrial sector was under the high case scenario (19.92%) followed by SIM2 (19.41%). However activities which were based on agriculture such as raw materials and processed agricultural products showed negative growth trends. The service sector also showed positive changes in all the policy simulations.

Industrial and service sectors showed positive growth trends in all the three cases of increased TFP of the overall manufactured sector, while agricultural growth rate stayed fairly the same in SIM1 and SIM2 relative to the base while it showed a slight decrease under the low case. This simulation tries to inculcate the net effect of the policies, in which case it ascertains that productivity increase in the manufacturing sector increases the sectoral output of the industrial and service sectors while having no impact or only a negligible decline in agricultural output growth.

Table 3: Simulation results: Effects on sectoral output (% change)

Average annual growth rate 2010-2015 (% change from base)									
Sectors	**Agro processing**			**Non agro processing**			**Manufacturing**		
	Sim1	**Sim2**	**Sim3**	**Sim1**	**Sim2**	**Sim3**	**Sim1**	**Sim2**	**Sim3**
Agriculture	-0.03	-0	-0	0	0.01	0.01	0	0.01	-0.03
Industry	4.6	3.15	2.49	1.83	1.32	0.8	1.75	1.04	2.36
Service	0.51	0.34	0.24	0.61	0.44	0.25	0.51	0.32	0.69

Source: simulation results from CGE model

In all the three cases of increased TFP percentage share of agricultural sector declined while that of the industrial sector increased compared to the base scenario. The net impact of industrial policies is captured in the simulation, where the growth of TFP's of all the manufacturing activity is shocked with the high, medium and low productivity growths. For instance, a 46% increase in TFP of all the manufacturing activities (SIM1) reduced the share of agriculture and service from their particular values in the base by 0.61 and 0.05 percentage points respectively.

Table 4: Simulation results: effects on sectoral shares to GDP (%)

Share in GDP (%)									
Sectors	**Agro processing**			**Non agro processing**			**Manufacturing**		
	Sim1	**Sim2**	**Sim3**	**Sim1**	**Sim2**	**Sim3**	**Sim1**	**Sim2**	**Sim3**
Agriculture	-0.78	-0.5	-0.4	-0.45	-0.31	-0.18	-0.61	-0.43	-0.27
Industry	1.19	0.77	0.59	0.41	0.29	0.17	0.67	0.48	0.29
Service	-0.41	-0.3	-0.2	0.05	0.04	0.02	-0.05	-0.02	-0.01

Source: CGE simulation results

4.2.3 Factor Income

The simulations conducted on the agro processing manufacturing sectors revealed that all factor returns (labour, land, capital and livestock) exhibited positive growth from that of the base simulation. Since SIM1 induces a higher productivity shock, we would expect the returns to factors to be greater in this simulation. Returns to labour increased by 0.41%, 0.30% and 0.22% from that of the base in SIM1, SIM2 and SIM3, respectively.

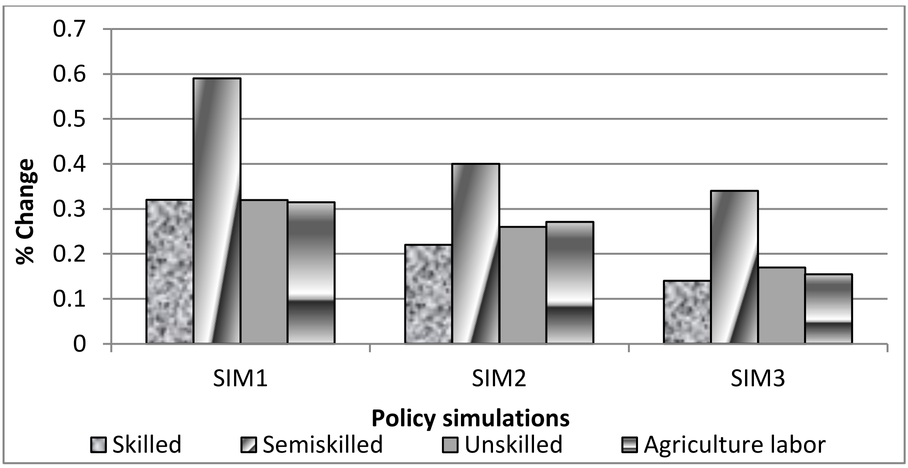
Table 5: Simulation results: effect of increased TFP of agro processing on factor income (% change from base)

Factors	Initial (billion birr)	Share	Sim1	Sim2	Sim3
Labor	174.02	49.03	0.41	0.30	0.22
Capital	110.32	31.08	0.28	0.19	0.10
Land	39.76	11.20	0.53	0.45	0.28
Livestock	30.85	8.69	0.62	0.48	0.32

Source: CGE simulation results

Figure 1, reveals the simulation results on the income of the different categories of the labour force. Since the sector is largely labor intensive particularly with that of semi skilled labor, undoubtedly, semiskilled labour is most benefited due to development in manufacturing industries that are engaged in the processing of agricultural products over all other categories of the labour force.

Figure 1: Effects of increased TFP of agro processing on labour income (% change from base)



Source: CGE simulation results and own computation

Similarly, productivity improvement in the non agro processing manufacturing industries revealed a positive change in all the factors except in the returns to land. Returns to land showed a 0.03, 0.02 and 0.02 percentage point decline in SIM1, SIM2 and SIM3 respectively compared to the base scenario. This is because the shift from agro processing to non agro processing would result in a decline of demand of agricultural raw materials for these industries and as land is one input its return would decline with decline in demand. Returns to capital and livestock both showed improvements. Returns to capital showed the highest change among all factors from the base simulation in all the three scenarios followed by labour implying that the sector is capital intensive.

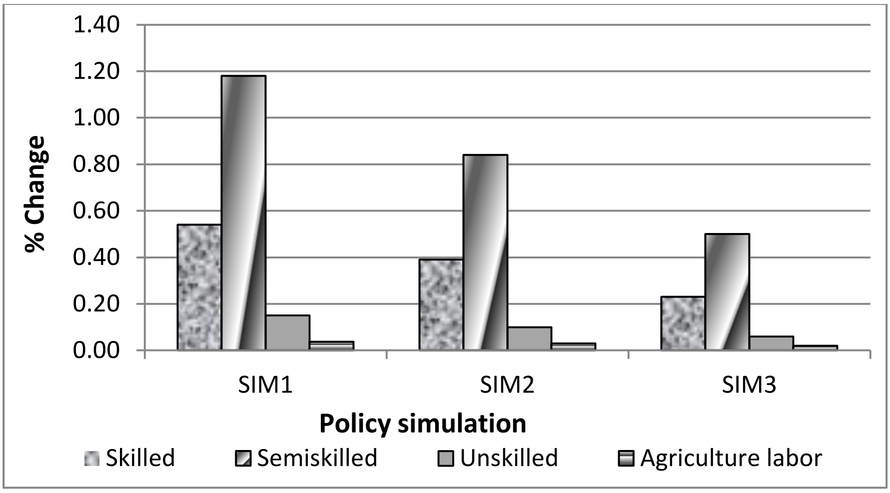
Table 6: Simulation results: effect of increased TFP of non-agro processing on factor income (% change from base)

Factors	Initial (in billion birr)	Share	Sim1	Sim2	Sim3
Labor	174.02	49.03	0.50	0.35	0.21
Capital	110.32	31.08	0.73	0.54	0.33
Land	39.76	11.20	-0.03	-0.02	-0.02
Livestock	30.85	8.69	0.37	0.28	0.17

Source: CGE simulation results

Returns to semi skilled labour showed the highest change in all the three simulations compared to the other categories. For instance, in the high case scenario SIM1, it was 1.18 percentage points higher than the respective value under the base while the figure was small for skilled (0.54%), unskilled (0.15%) and agricultural labour (0.04%).

Figure 2: Effects of increased TFP of non-agro processing on labour income (% change from base



Source: CGE simulation results and own computation

The simulation which replicates the impact of overall policies results in improvement of the returns to all factors in all the three simulations. The rationale might be owing to the higher rise in the output of goods, due to productivity increase which will increase the returns of labour, land, and capital more in these sectors within the simulations conducted on the manufacturing activities and since the combined effect captures both agro and non agro processing all factors will be benefited.

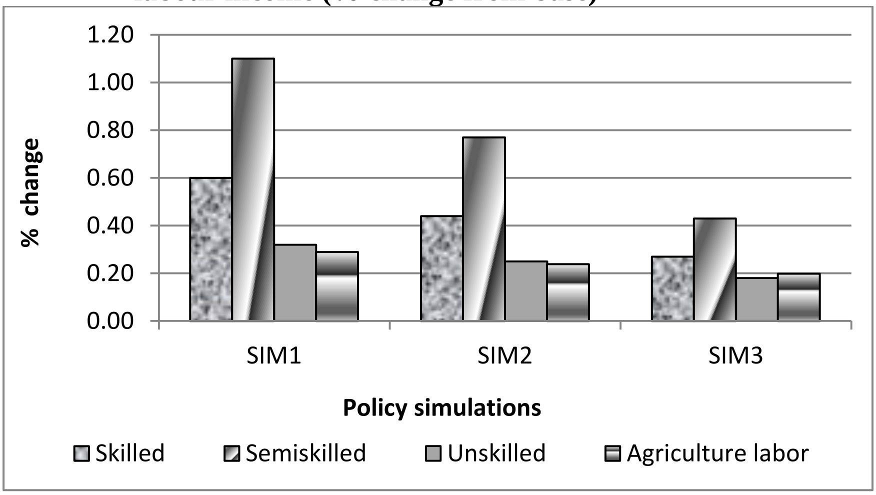
Table 7: Simulation results: effect of increased TFP of all manufacturing industries on factor income (% change from base)

Factors	Initial (in billion birr)	Share	Sim1	Sim2	Sim3
Labor	174.02	49.03	1.11	0.83	0.50
Capital	110.32	31.08	0.79	0.58	0.37
Land	39.76	11.20	0.40	0.33	0.28
Livestock	30.85	8.69	0.62	0.48	0.34

Source: CGE simulation results

The high case scenario resulted in the highest increase in all types of labour force while the smallest change was in the low case scenario. Semi skilled labour still remains to show the highest increase followed by skilled labour; this shows that the manufacturing sector largely employs semiskilled labour.

Figure 3: Effects of increased TFP of all manufacturing industries on labour income (% change from base)



Source: CGE simulation results

4.2.4 Household Income

The higher GDP growth under simulations on agro processing manufacturing industries resulted in substantial increase in real incomes of both poor and non poor households. Average growth of rural household income increased more than the urban counterpart in all the three scenarios. This is because as the productivities of agro processing industries increase, demand for agricultural products would increase hence the rural households who are mostly engaged in agricultural activities get paid more. The highest rural income growth rate was recorded under SIM1 with the non poor benefiting the most. Urban household income also showed improvements from the base value; 0.3, 0.2 and 0.1 percentage points higher in SIM1, SIM2 and SIM3, respectively. There is no distinction on the changes in growth rates between the urban poor and non poor in each simulation.

Productivity increase in the non agro processing manufacturing industries benefits the urban households more than the rural counterpart since the sector are urban based manufacturing industries which will increase the income for capital owners and as urban households are more capital owners compared to rural households their income would also increase. Among the urban households, the income of non poor increased more than that of the poor compared to the base in SIM2 (0.5%) and SIM3 (0.3%) while, in SIM1 both types of urban households showed the same change from the base. The income of the rural poor increased more than the poor in all the three simulations.

Increasing the productivity of overall manufacturing industries led to the urban households' income to increase more than that of the rural in SIM1 and SIM2 while the income of rural households increased more under the low case. The underlying reason is that as productivity of the manufacturing industry increases resources will be shifted to the industrial sector from the agricultural sector thus showing a moderate effect on the rural households. The other reason is that urban households are relatively skilled and own more capital to that of the rural households and since returns to semi skilled labor and capital increased due to TFP improvement income of the urban households would increase at a higher rate than that of the rural.

The increase in income of non poor rural households is higher than the rural poor in all the simulations. The same trend has been observed for urban households; the income of the non- poor urban households improved more than that of the poor.

Table 8: Simulation results: Effect of increased TFP on household income (% change from base scenario)

Households	Initial (billion birr)	Agro processing			Non agro processing			Manufacturing	
		Sim1	Sim2	Sim3	Sim1	Sim2	Sim3	Sim1	Sim2
Rural	325.8	0.38	0.29	0.18	0.44	0.32	0.21	0.61	0.43
Poor	74.6	0.39	0.33	0.19	0.23	0.19	0.08	0.46	0.32
Non- poor	251.2	0.38	0.28	0.18	0.5	0.36	0.24	0.66	0.46
Urban	34.6	0.3	0.2	0.1	0.6	0.49	0.29	0.69	0.49
Poor	3.7	0.3	0.2	0.1	0.6	0.4	0.2	0.6	0.4
Non-poor	30.9	0.3	0.2	0.1	0.6	0.5	0.3	0.7	0.5

Source: CGE simulation results

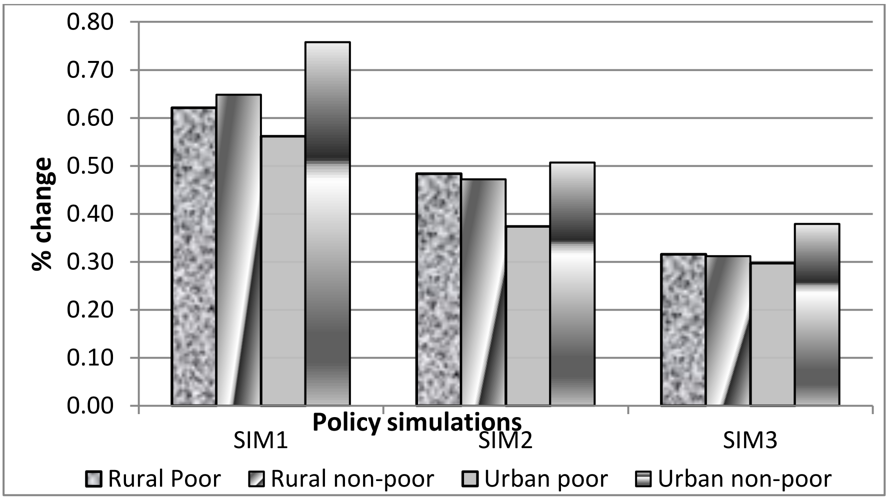
4.2.5 Welfare Effects

EV measures the change in utility due to the change in prices by using the current prices as the base price and asks what income change is needed at the current price that corresponds to the anticipated change in terms of its impact on utility (Varian, 1992). In other words, it measures the level of income that the consumer needs to forgo or payback before the shock so as to make him/her as well off after the price increase. Importantly, EV is extensively used as welfare indicator in the literature for CGE models as it measures the income change at current prices and keeps price fixed at status-quo for different policies, making it suitable to compare more than one proposed policy change. Negative EV would imply that there is welfare (utility) loss due to the policy shock while positive EV implies a welfare gain.

The simulation of increased TFP of agro processing activities resulted in improved welfare for all the household groups in all the simulations.

The welfare of urban household improved by 0.76%, 0.51% and 0.38% (non poor) and 0.56%, 0.37% and 0.30% (poor) in SIM1, SIM2 and SIM3 respectively. The rate of welfare improvements in the rural households seemed to be diverse in each simulation; in SIM1 rural non poor seemed to be somewhat better-off relative to the poor with 0.65% for the non poor and 0.62% for the poor. In SIM2 and SIM3, the welfare increase slightly shifts to the rural poor; 0.48% and 0.32% for rural poor while 0.47% and 0.48% change for rural non poor in SIM2 and SIM3, respectively. This is due to the fact that a small TFP improvement in agroprocessing industries would avail similar gains to both the rural poor and nonpoor however, a higher TFP growth rate would be much beneficial for the non-poor as they enjoy higher consumer surplus and higher income.

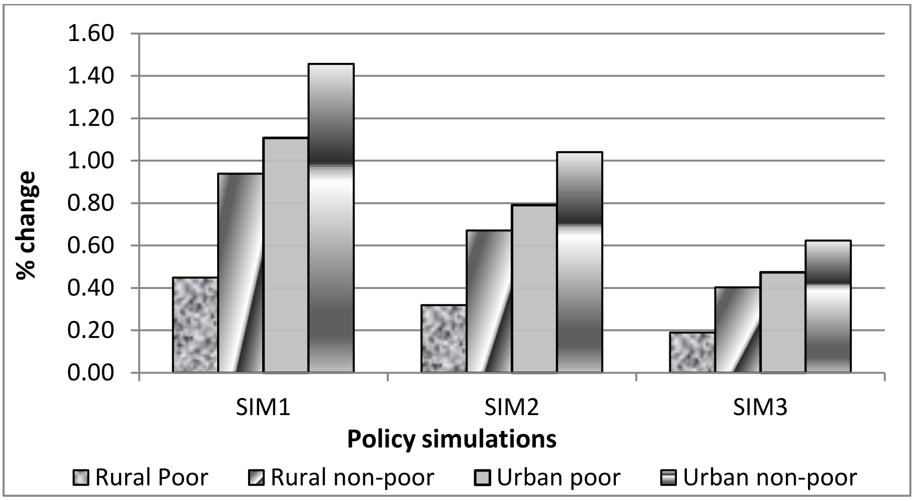
Figure 4: Effects of increased TFP of agro processing on welfare (EV) of households (% change from base)



Source: CGE simulation results

Likewise, increased TFP growth rates of non agro processing industries, is welfare enhancing for all households in all the scenarios. (Comparatively the urban households are better-off from rural households with the non poor reaping the higher advantage in all simulations. Welfare of rural poor and non poor also showed positive changes from the base but the gain is small relative to the urban households. This may be due to the very nature of non agro processing industries being not dependent on agriculture, hence showing a small increase in the welfare of rural households. Furthermore, urban households earn more from these activities relative to rural households hence as the productivity of the sector increase so does the gains to the factors and households.

Figure 5: Effects of increased TFP of non-agro processing on welfare (EV) of households (% change from base)

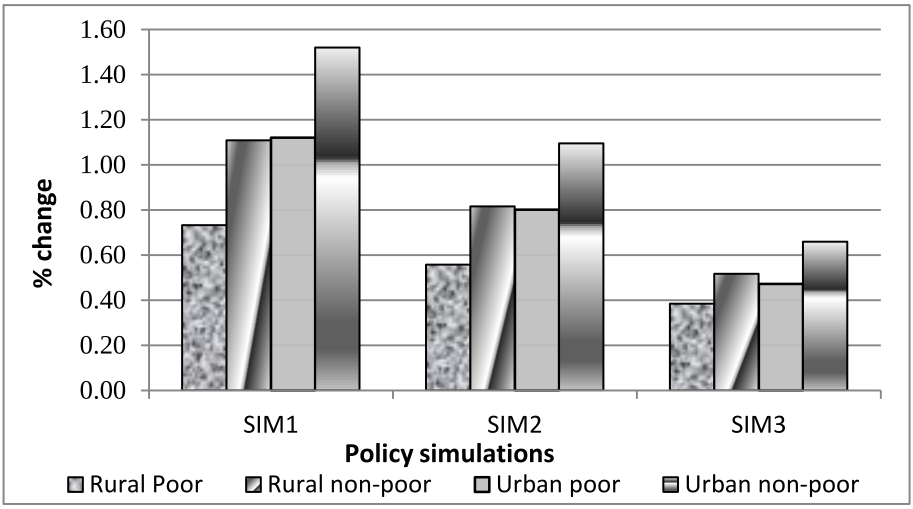


Source: CGE simulation results

Increased productivity of all manufacturing activities is translated into improved wellbeing of all household groups where the urban enjoys most of it in all the scenarios. Moreover, The EV result implies that relatively the non-poor receive much of the welfare gain in both rural and urban areas.

The urban poor and non poor were 1.12 (SIM1), 0.8 (SIM2) and 0.47 (SIM3) and 1.52 (SIM1), 1.1 (SIM2) and 0.66 (SIM3) percentage points well off from the base simulation. The result suggests that rural households will also be better-off with more or less the same rate with that of the urban households though the latter seems to be benefited a little bit more in all the three scenarios. Welfare of the rural poor and non poor increased by 0.73 (SIM1), 0.56 (SIM2) and 0.38 (SIM3) and 1.11 (SIM1), 0.82 (SIM2) and 0.52 (SIM3), respectively.

Figure 6: Effects of increased TFP of all manufacturing activities on welfare (EV) of households (% change from base)



Source: CGE simulation results

5. Conclusions

This study, tries to examine the dynamic economy-wide impacts of productivity improvement in the manufacturing industry on the macro and sectoral variables, factor and household incomes and welfare of the society utilizing a recursive dynamic CGE model.

Using the 2005/06 SAM for Ethiopia the scenarios of increasing activity specific TFP showed that, macro variables such as real GDP, private consumption, imports and exports all showed increasing trend in the high, medium and low scenario. The income of factor and households also showed improvements in all the scenarios. In general, increasing TFP growth of agro processing, non-agro processing and overall manufacturing industries is welfare increasing to all household groups.

Based on the empirical analysis, it is observed that the manufacturing sector has a positive impact on the Ethiopian economy and this impact was observed from TFP improvement hence efforts should be made to increase TFP through research and development and technological innovation and infusion. This calls for the development of a strong industrial policy that aims at ensuring the long-run productivity of the sector. Furthermore, results from this study advocates policy interventions towards both the agro and non-agro processing industries but recommends to give emphasis to agro-processing industries. Finally, the study recommends for further researches to use estimated TFP growth as a policy shock since this might lead to different conclusions.

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