Addis Ababa University, Ethiopian Journal of Business and Economics, EJBE Vol. 10, No 1,
DOI: https://dx.doi.org/10.4314/ejeb.v10i1.3 , p-ISSN: 2311-9772, e-ISSN: 2410-2393
Available online: http://ejol.aau.edu.et/index.php/ejbe and https://www.ajol.info/index.php/ejbe

Impact of Production Expansion in Labor-Intensive Industrial Activities on the Ethiopian Economy: A Stage CGE Modelling Approach

Menberu Atalele[1] and Solomon Tsehay[2]

Abstract

Ethiopia's industrial activity has been characterized by meager growth for the last few epochs. This study examines the likely effects of productivity expansion in labor-intensive industrial activities on the macroeconomy, government priority industries, factors, household income, and the welfare of households. These labor-intensive sectors include dairy, grain milling, milling services, sugar refining, other food processing, beverage manufacturing, textiles, leather products, and wood products. In order to investigate the impact of a 10% increase in the technical coefficients of these labor-intensive industrial activities, the study used the static stage computable general equilibrium (CGE) model. The production expansion, via an increase in the technical coefficient of the sectors, derived a significant change in macro variables such as real GDP, government consumption demand, investment demand, household consumption, and the export and import of goods and services. The GDP of the economy has increased by 3.41%. The findings also suggest that production and exports of government-prioritized industrial products have increased largely. For instance, the production of the textile and leather sectors increased by 26.08% and 41.03%, respectively. Increasing the production of labor-intensive industrial activities showed a significant decline in the import of priority industrial goods. It also resulted in welfare gains for all rural and urban households. The study further extends its recommendation for Ethiopia to develop a strong industrial policy aimed toward promoting labor-intensive industrial activities.

Keywords*:* Labour intensive, production expansion, stage CGE, economy wide impact

[1] *Debre Markos University; Email:* yomkone2121@gmail.com

[2] *Addis Ababa University; PhD in Economics, Email: tsehaysol2015@gmail.com*

1 Introduction

Ethiopia is one of the least developed countries in the world. Agriculture is the mainstay of the economy. This is evidenced by the fact that the sector contributed 42.7% to the GDP, created 80% of employment, and generated 70% of the export earnings of the country in 2012/13 (AfDB, 2014; OECD, 2014). In addition to this, 90% of the exportable commodities of the nation come from the agricultural sector. These mainly include coffee, oilseed, chat, hide and skin, flowers, etc. Given its immense importance, the Ethiopian government has set agricultural development-led industrialization as a long-term development strategy, which was formulated in the early 1990s and put into serious implementation from the early 2000s.

Ethiopia generates foreign exchange from a few agricultural commodities while importing capital goods. This leads the country to entertain a trade deficit over years. Accordingly, the trade deficit escalated to USD 8.4 billion in 2012/13 from USD 7.9 billion in the previous year (AfDB, 2014). The volume and value of exportable items have increased. For instance, the country's exports were growing at an average rate of seven percent from 1981 to 2011, while the average growth of the export proportion to domestic product (GDP) was 10 percent in the same period. In addition to that, in the fiscal year 2010–11, the ratio of exports to GDP increased to about 10 percent compared to 6.7 percent a year ago. The export covered about 33 percent of the import bill during the review year, in contrast to 24 percent last year (NBE, 2010–11).

The country’s capacity to generate foreign exchange and create job opportunities for the growing labor force is challenged by the nation’s narrow base in the industrial sector (GTP). Encouraging export-based and import-substituting industries has been considered a way of giving the highest emphasis to the industrial sector in the first as well as the second five-year growth and transformation plan. Small-scale manufacturing enterprises are the other focus of the plan, as they are the source of employment creation, hasten urbanization, and provide the footing for the establishment and intensification of medium- and large-scale industries.

It is a daunting challenge to select the best-performing sectors among industrial sectors for strategic interference. However, theories have emphasized that dwelling on labor-intensive industries in developing countries would benefit the economy as well as enhance the welfare of society. In addition, at an early stage of development, developing countries suffer from

unemployment. Thus, the rationality that lies behind such a view also considers this problem as one that needs to be addressed. The other argument that has been used as a salient reason to opt for such a policy is the fact that labor-intensive industrial sectors give developing countries a comparative advantage in their export performance. The Vernon product theory implies such justification. According to the 2010 report of the WTO, the share of Ethiopian exports in the world market is only 0.01% (WTO, 2011). For example, in the year 2008, the country's share in world trade was merely 0.027%. From the same source, these figures were 0.052% for Kenya, 0.065% for Sudan, 0.29% for Egypt, 0.050% for Cote d 'Ivoire, 0.049% for Ghana, and 0.51% for South Africa. On the other hand, according to the World Bank (2009), the share of manufactured exports was only 9 percent of the total exports of Ethiopia, which is little compared with the share of primary agricultural commodities, which was 91 percent.

But it is a vivid fact that the prices of primary products fluctuate and are unpredictable, which calls for an alternative endorsement of industrial policy. Recognizing this, the Ethiopian government identified some priority sectors in the GTP in 2010 and has been implementing this plan since then. A special effort has been exerted on the industrial sector in a bid to make this sector the mainstay and leading sector in the Ethiopian economy. This is done with the aim of industrializing the country and increasing the share of the industrial sector by having the government give more consideration to activities like those in the textile and apparel industry, the leather and leather products industry, the sugar and sugar-related industries, the cement industry, etc. Theories have shown that investing in labor-intensive industries in Ethiopia could benefit the overall welfare of the society (Samuelson, 1941).

This research, therefore, searches only selected labor-intensive sectors and examines the likely impact of such alternative policies on the macroeconomic and general status of both urban and rural households. There is as yet no research that shows the impact of such a policy shift on the Ethiopian economy. So, this study intends to examine the likely impact of increasing the production of labor-intensive industrial commodities on the Ethiopian economy using the STAGE CGE modeling approach.

The main objective of this study is to assess the impact on the general economy when the production of labor-intensive industrial activities increased. And the specific objectives are: to examine the impact of the increase in the production of labor-intensive industrial activities on households' income; to elucidate the possible welfare effect of production increments of labor-intensive industrial activities on different households across different agro-ecologies; and to understand the possible effect of such a policy on priority industrial and other activities in the economy.

Literature Review

Theoretical Literature

Because of its simplicity, partial equilibrium analysis has been the most popular method of analysis in applied economics. Indeed, it can be used to analyze policy issues arising from a shock whose effects are limited to a particular industry. Nevertheless, this approach is only used to show the effect of shocks in a partial way, that is, it has limitations to handle issues of general shocks or policies that affect the outputs and prices of other activities at a wider scope. In the real world, the effects of policies are felt by all sectors and cannot be limited to a certain sector or institution. Their effect trespasses and influences the whole economy, such that all interactions and their feedback effects ought to be captured in an economy-wide general equilibrium framework. This called for the need for economic-wide modeling and gave birth to CGE modeling.

CGE modeling is an attempt to analyze empirically oriented resource allocation and income distribution issues using general equilibrium theory in market economics. It is a multi-sector model based on real-world data for one or several national economies. It is acknowledged that the goal of households and firms is to maximize utility and profit, respectively, and excess demand functions are price homogeneous to degree zero and satisfy Walras' law. Furthermore, in most CGE models, product and factor markets are assumed to be competitive, and relative prices are flexible enough to clear all product and factor markets at the same time. Factors of production are paid according to their marginal revenue productivity. By making all these individual optimizations feasible and mutually consistent, that is, clearing all markets simultaneously, the solution fixed by the model provides a set of prices.

The relevant theoretical development for the CGE literature began in the late 1930s and consists of both pure theoretical work on general equilibrium issues as well as empirical work on different model specifications and solution techniques. The first empirical model of a national economy was developed by Leontief in 1941. The structure of the American economy from 1919–1929 done by Leontief signifies the classic input-output study (Leontief, 1941). This work was influenced by the recession of the 1930s and was applied to policy simulations during World War II. The development of general equilibrium theory was pushed forward by Samuelson, Arrow, Debreu, Hahn, McKenzie, and Negishi, who were inspired by Hicks's publication of Value and Capital in 1939 (Hicks, 1939).

Historically, the first CGE model was presented by Johansen (1960). Scarf´s (1967) famous algorithm for computing a Walrasian general equilibrium sparked another epoch in the development of CGE modeling. Using Scarf´s algorithm, Shoven & Whalley (1983) designed a computational procedure for finding a general equilibrium with taxes. Together with early work on a two-sector model by Harberger (1962), they inspired a series of analyses of tax and trade policy issues using the framework of Walrasian and Heckscher-Ohlin's general equilibrium models. A contribution in the same spirit, but focused on international trade and resource allocation in a small open economy, is Haaland & Norman (1987). Afterward, the application of CGE models becomes prevalent.

In spite of similarities among CGE models, there are also significant differences among individual CGE models. While several classification alternatives can be envisaged, the distinction between static and dynamic models is the main one. In addition to the static-dynamic dimension, single-country, multi-country, and global models are also the other classifications of CGE models. Single-country models tend to be more detailed in terms of sectors and household types, and they are in general used for analyses of country-specific policy issues and proposals. Multi-country and global models, on the other hand, tend to have fewer sector details and are designed for the analysis of proposed multilateral policies such as free-trade agreements.

In the open economy, producers have two options regarding the sale of their product: either sale in the foreign market (export) or supply in the domestic market, while consumers have to choose between imported and domestically produced commodities. Consistently, consumers choose a

mix of imported and domestic goods, while producers often supply both domestic and foreign markets. Regarding the neo-classical trade model, the assumption is that all goods are tradable and all goods are perfect substitutes (McDonald, 2002). Thus, the world price determines domestic prices. However, the assumption that all goods are tradable is relaxed by the Salter-Swan or Australian model by introducing a dichotomy between 'tradable' and 'non-tradable," and the problem of finding a corner solution (denoting complete specialization) or large fluctuations in relative prices is solved by the "Armington assumption'. Armington (1969) proposed that there is imperfect substitutability between imports and domestic demand and between exports and domestic supply. In the Armington assumption to show how CES and CET are used in the modeling of trade flows, the simplest assumption of the 123-model is incorporated: one country, two production sectors (exports or domestic supply), and three goods (imported goods, exported goods, and domestically produced goods).

Empirical Literature

Few studies have been conducted regarding the Ethiopian economy using the CGE model. Yimer (2012) carried out a short- and long-term analysis of the linkages between trade liberalization, growth, income distribution, and poverty using the social accounting matrix of 1999/2000. This paper tried to show the effect of the complete removal of tariffs in the industrial sector and service sector, followed by a 90% tariff reduction in the agricultural sector. Accordingly, in the short run, welfare, and real consumption of the household are decreasing due to exchange rate depreciation, exports growing faster than imports, the demand for agricultural products increasing, the sector expanding while industry shrinking, and the effect on poverty is positive but at a small level. In the long run, the effect also includes increases in real/nominal/ GDP, an improvement in household welfare, an increase in real consumption and income following a decrease in consumer prices, and an increase in real export and output, investment, and import volume. In this case, agriculture plays a major role in production and export. Generally, in the long run, trade liberalization increases both the welfare and real consumption of households; thus, poverty would be reduced and the growth would be pro-poor.

Using CGE simulation, another economic-wide study was done by Fekadu (2007) that attempted to analyze tariff dismantling policy and poverty at the household level in Ethiopia. That is the

effect of trade liberalization policy on poverty and inequality using the 2001/02 Ethiopian SAM. The result showed that trade liberalization increases the export of commodities under the circumstances of improved domestic production capacity and favorable market access. On the other hand, the total elimination of tariffs has an adverse effect on domestic production and investment because of the high competition from cheap and high-quality imported products, which also deteriorates the growth of demand for domestic products. This is especially true for the investment and production of manufacturing products, particularly in the textile, leather, and food processing industries, which are further harmed by cheap imports from another world.

Data and Methods

To address the previously mentioned objectives, different methods and modeling techniques can be used. Since CGE modeling provides both an economy-wide assessment of policies and a framework in which the workings of policies can be more easily understood, the objective of this paper is to present the effect of production improvement in labor-intensive industrial activities on the Ethiopian economy using the static stage of the Computable General Equilibrium model.

Stage CGE

A stage model provides a richer treatment of factor markets and is characterized by several unique features. First, by incorporating provisions for non-traded exports and imports and competitive and non-competitive imports and exports[3], it allows for a generalized treatment of trade relationships. Second, for those exported commodities that do not face perfectly elastic demand on the world market, relaxation of the small country assumption is allowed. Third, the model allows for the modeling of multiple product activities through the assumption of fixed proportions of commodity outputs by activities, with commodities differentiated by the activities that produce them. Accordingly, the numbers of commodity and activity accounts are not necessarily the same. Fourth, valued-added production technologies are specified as nested constant elasticity of substitution (CES).

[3] Non-tradable exports and imports: commodities that are neither imported nor exported, for example, teff; competitive imports: commodities that are imported and domestically produced, e.g., textiles; non-competitive imports: commodities that are imported but not domestically produced; competitive exports: commodities that are exported but consumed domestically, e.g., coffee; non-competitive exports: commodities that are exported but not consumed domestically.

Fifth, the Stone-Geary utility function is used to model household consumption and expenditure. It also has another feature, which is that it includes the generalized system of nested CES functions for the representation of production, the endogenous modeling of unemployment for all factors through a regime-switching mechanism, and the ability for factors to migrate between regions, areas, and factor classifications. The model is designed for calibration using a reduced form of the Social Accounting Matrix (SAM).

Data Source

The main database used to calibrate a 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, 2002).

SAM has three distinct features (Round, 2003). First, it shows agents' interconnection by showing incomes and expenditures in rows and columns. Second, it illustrates all economic activities in a comprehensive and consistent way (consumption, production, accumulation, and distribution). Thirdly, the SAM allows disaggregation from the basic framework, so there is some degree of flexibility.

There are four major accounts in the standard SAM: the activities (production) account, the commodities account, the factors account, and the institutions (households, firms, the government, and the rest of the world). Savings, investments, and taxes are also additional accounts included in SAM. The valuation is different for activities and commodities; in the activity account, income is valued at producer price, whereas in the commodity account, indirect tax and transaction costs are included, so it is valued at market price.

The benchmark data used in this study is the 2009/10 SAM developed by Ethiopian Development Research institute (EDRI) in order to adjust the data so as to match it with economic performance. Regarding the period specification, this paper will use the static or within-period specification, as using one point in time of data is not rational to show the inter-temporal effect.

Simulation Results and Discussion

Calibration Procedures and Elasticities

In order to check the extent to which the existing social accounting matrix fits the existing reality, we first check whether the real and the model calibrated tax rates are similar or not. To do so, we compare the import duty tariff rates implicated in the SAM to the actual import tariff rates. The results show that the calibrated tariff rates and actual tariff rates reveal almost the same result, indicating that calibrating the model based on the existing social accounting matrix is justified. The results are featured in the following table.

Table 1

Computed and Actual Tax Rates and Values of Import

Name of commodities	Model tariff rates(A)	Actual tariff rates(B)	Difference (B-A)
Other Foods Processing	0.3	0.33	0.03
Beverages	0.3	0.17	-0.13
Textile	0.35	0.31	-0.04
Leather Products	0.2	0.41	0.21
Wood Products	0.25	0.08	-0.17

Source: Own computation and ECRA (2015)

The income elasticities of different households have been obtained from Solomon (2015) from the SAM by assuming that rich and poor households in the same agro-ecological zones have the same consumption pattern. Therefore, when income increases, poor households will have the same consumption bundles as rich households, and vice versa. This gives us two sets of income and expenditures, which enables us to compute income elasticities. To do so, the average income of poor and rich households has been calculated from the respective SAM and population data.

The Effect of Increasing Efficiency of Labor Intensive Industrial Activities on the Macro

Increasing production of labor-intensive industrial activities impacts exports and imports, resource allocation in the economy, the GDP of the nation, and the consumption patterns of

consumers as well as government consumption demand. Increasing the production of labor-intensive commodities increases the income of households as remuneration to production factors or value-added increases follow such a change. Hence, household consumption has increased by 1.38%. This induces additional demand for imported commodities by households. In addition, such an increment in production increased demand for imported intermediate goods. The cumulative effect of such incidences increases demand for imports. This induced demand for imported goods requires extra foreign exchange, which urges the economy to export more goods and services. A 10% efficiency increment of labor-intensive industrial activities leads to imports and exports increasing by 0.79% and 2.21%, respectively, in the long run (Table 2).

The change also has an effect on GDP, which rises by 3.41% in the long run when all factors of production are fully mobile across sectors, as shown below. This is because as remuneration to production factors increases, the GDP of the economy also increases. Besides, increasing production in labor-intensive industries induces additional income for the government through taxation, which further increases government expenditure. This would increase demand for goods and services, reducing the amount of imported and domestic goods and services produced. In addition to that, the production improvement in labor-intensive industrial activities has increased government consumption and investment demand by 1.28% and 8.41%, respectively.

Table 2

Effects of Increasing Efficiency of Labor-Intensive Industrial Activities on The Macro-Economic Indicators (In Percentage)

Macro-Economic Variables	Base (in Billions Birr)	Change
Household consumption	338.61	1.38
Government consumption demand	31.82	1.28
Investment demand	87.31	8.41
Import	126.51	0.79
Export	52.14	2.21
GDP (at factor cost)	354.95	3.41

Source: own computation

The Effect of Increasing the Production of Labor Intensive Industrial Activities on Trade Balance of Priority Industrial Goods

Efficiency improvement of labor-intensive industrial activities increases domestic production, which decreases the price of domestic goods and services, thereby causing a lower demand for imports of all priority industrial goods in the long run. This is because the demand for imported goods and services declines as the depreciated nominal exchange rate raises the price of imported goods and services. Accordingly, the higher the price of imported goods and services relative to those domestically produced, As the balance of trade is fixed, production improvement depreciates the nominal exchange rate to promote exports. This will result in a higher tendency to export by increasing the export extent of priority industrial goods.

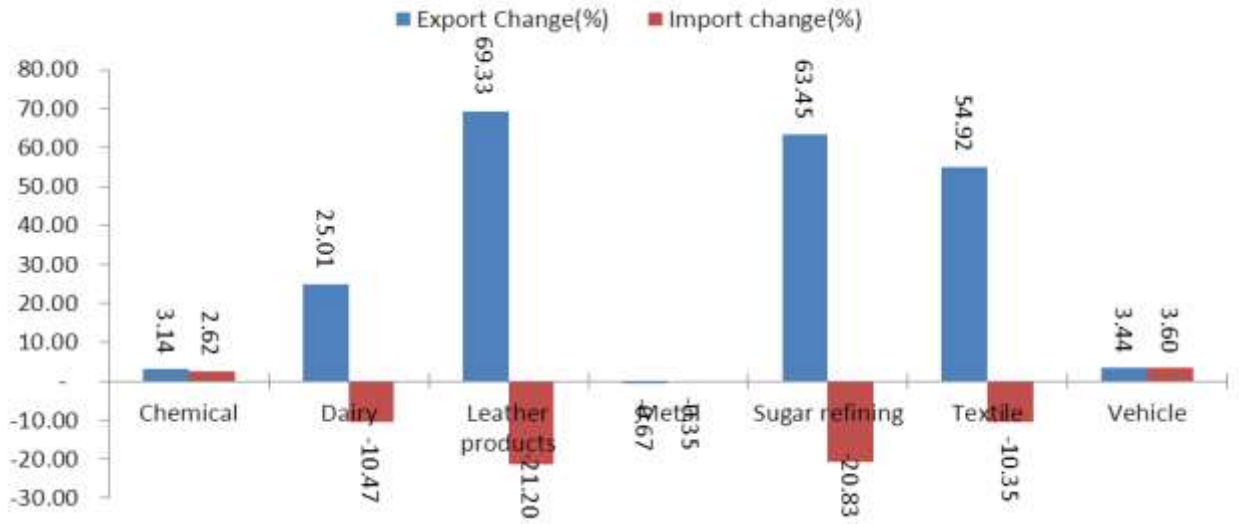
The net trade balance of priority industries is determined by the nature of the commodity itself. The response of the supply of goods to the domestic market and to the international market depends on the share of exports, the rate of substitution, and the price differentials of these two markets. Even if the majority of these government-priority industrial commodities previously had a low share of exports and GDP contribution in the Ethiopian economy but had the prospect of generating foreign currency, increasing the efficiency of labor-intensive industrial activities improves the net trade balance of each of these industrial commodities. Particularly, industries in which the government gives higher priority—chemicals, dairy, leather products, sugar refining, and textiles—show an increment in their export amount and a decline in their import amount after the production of labor-intensive industrial activities increased by 10%. This resulted in a high rate of trade balance surplus except in the metal industry, where both its export and import amounts decreased. In addition, these commodities are heavily consumed by households, except for textiles, where household consumption is lower. So that the tendency of switching to the consumption of imported goods following price differentials caused by efficiency improvements in industrial activities is high and their tendency to be used as intermediate input is low domestically.

If the efficiency of labor-intensive industrial activities improves, the trade balance of priority industries will remain positive. This is because this improvement increases the extent of exports and the domestic price of exports by commodity, encouraging producers to export more and

thereby making the export market more attractive. In addition to that, most of the producer prices of priority industries' composite domestic outputs decline (other than goods, for which domestic and abroad demand increases constantly as they are basic for the sustainable development of any nation; chemicals, machinery, and metal; and necessary for the daily lives of everyone; sugar) so that consumers switch to domestically produced goods.

Figure 1

Trade Balance of Government Priority Industries (Percentage Change)



Source: Own Computation

The Impact of Efficiency Improvement of Labour-Intensive Industrial Activities on Domestic Production of Priority Industrial Goods

The extent of the price difference between imported and domestically produced goods and services and their respective shares on the domestic market for the supply of goods and services determines the demand for imported goods and services. Hence, efficiency improvement shifts the demand for priority industrial goods and services from imported goods toward locally produced goods and from domestic markets to export markets.

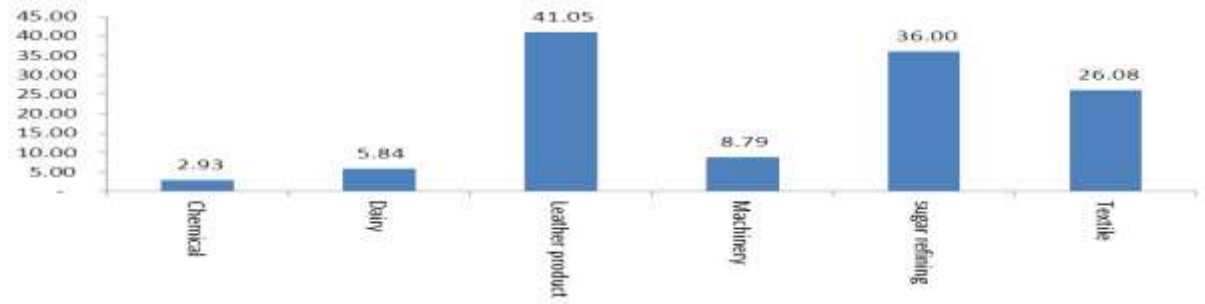
This substitution effect of domestically produced items for imported goods which is accompanied by an increase in exports, expands the production of government priority industrial

goods in the domestic economy. On the contrary, the import of these priority industrial goods tends to shrink due to the lower price of domestic price of these goods and services as their production increases. However, business service, fish and flower are the three activities whose domestic productions are severely affected by the efficiency improvement compared to other activities. Indeed, these activities are not the industries in which government give higher priority. Especially the export of business service and fish decline highly; on the contrary their import increases resulted huge trade deficit compared to other commodities. In addition, their consumption by households increased except flower whose consumption declines by 11.5%. These justify the fact that domestic production most likely to decline for these products. So, the export of business service and fish falls by 59.3% and 32.4% respectively and their import increased by 4% and 10.4%, respectively. So, the domestic production of these commodities declines as well.

As indicated in the following figure domestic production of priority industrial goods will increase by greater percentage, almost all priority industries, when the country increases the efficiency of labor-intensive industrial activities. Accordingly, the prices of domestically produced of these goods relatively cheaper where as domestic price of competitive import of these commodities increased. This increases domestic production. Figure 2 shows the change in the domestic production of priority industrial goods.

Figure 2

Impact of Efficiency Increment of Labor-Intensive Industrial Activities on Domestic Production of Priority Industries (Percentage Change).



Source: Own Computation

Table 3 indicates that the majority of the products of the priority industries are consumed by households, so when household income increases, the demand for goods and services increases, as does importation. Because of the efficiency increment, the income of rural as well as urban households improved. This makes the tendency of agricultural and industrial products to be highly consumed as more incomes of both households spend on these sector products, according to the computed 2009/10 Ethiopian SAM. Thus, when more demand is induced from households, it will be met by domestic production. Therefore, depending on the nature of the demand for the goods, there is an asymmetric effect of the production improvement of labor-intensive industrial activities on domestic production. The implication of this is that the domestic production of those goods, which are heavily consumed by both rural and urban households, increases.

Table 3

Impact of Efficiency Increment of Labor-Intensive Industrial Activities on Household Consumption of Priority Industries

Industry	Percentage change of Household consumption
Chemical	25.3027
Dairy	54.7009
Leather	63.8257
Metal	13.3461
Sugar Refining	36.1099
Textile	0.0026

Source: own computation

Impact of Labor Intensive Industrial Activities on Factor Price and Demand

The efficiency improvement of labor-intensive industrial activities affects the price of factors and their demand positively. As we can see from Table 4, all factors of production price show improvement when production is increased by 10%. However, the level increment is differing among factors; agricultural labor, land, and livestock are more benefited from the efficiency improvement. This is due to the fact that agricultural labor moves into these sectors, and as the wage distortion factor is high for agricultural labor, their income increases when they move to

the industrial sector. Skilled labor has the lowest level of price increase, followed by non-agricultural capital. The implication is that households owning agricultural labor, land, and livestock are benefited more compared with households owning non-agricultural capital and skilled labor, even if the amount of gain depends on the level of price that factors are paid.

Table 4:

Impact of Efficiency Increment of Labor-Intensive Industries on Price of Factors

Factor type	Percentage change
Non-agricultural capital	4.65
Agricultural labor in drought prone	7.08
Agricultural labor in highland cereal	7.08
Agricultural labor in humid lowland	7.45
Agricultural labor in pastoralist	7.08
Skilled labor	4.44
Semi-skilled labor	5.68
Unskilled labor	6.06
Factor livestock in drought prone	11.47
Factor livestock in highland cereal	10.46
Factor livestock in humid lowland	10.10
Factor livestock in pastoralist	10.64
Factor land in drought prone	7.87
Factor land in highland cereal	7.34
Factor land in humid lowland	8.46
Factor land in pastoralist	7.44

Source: Own Computation

So far, we saw that the 10% efficiency increment of labour-intensive industrial activities increased the domestic production of priority industrial activities. This resulted the demand for factor of production increased by these priority industries. Table 5 shows the demand of non-agricultural capital and labor (skilled, semi-skilled and unskilled labor) by the government

prioritize industries and has positive impact except dairy in which the demand for all factor of production by this industry declines.

Table 5

Impact of Efficiency Increment of Labor-Intensive Industrial Activities on Demand of Factors by Priority Industries

Type of factor		Percentage Change of factor demand on government priority industries					
		Chemical	Dairy	Leather product	Machinery	Sugar refining	Textile
Non-agricultural Capital		10.55	-12.21	113.47	34.10	94.85	54.74
Labor	Skilled	14.93	-8.20	118.70	37.90	99.84	59.41
	Semi-skilled	9.88	-12.97	112.39	32.56	93.75	53.82
	Unskilled	8.37	-14.39	110.50	30.97	91.93	52.15

Source: own computation

Impact of Labour-Intensive Industrial Activities Efficiency Improvement on Welfare

Efficiency improvement of labor-intensive industrial activities impacts the welfare of households through the price of commodities as well as household income. So far, we saw that efficiency improvements in labor-intensive industrial activities affect both the prices of goods and factor income differently. The improvement in production of labor-intensive industrial activities increases the return to production factors as production factors shift to sectors that pay relatively higher remuneration. Agricultural labor, land, and livestock secured higher prices compared with other factors of production when the efficiency of labor-intensive industrial activities increased by 10%. All of the labor-intensive industrial activities except milling services are exportable, and most of the exportable sectors are supposed to generate the required foreign exchange to settle down the induced demand for imported goods and services. So, as factors of production that are intensively used in labor-intensive or trade-oriented sectors gain more income, so do households that earn the income from these factors of production.

From the Ethiopian 2009/10 SAM, it is found that out of the total exports of the economy, nearly 27%, 23%, and 50% are contributed by the agriculture, industry, and service sectors,

respectively. As it is indicated above, the impact of the efficiency improvement on the macro economy increases the export of goods and services. So, when production of labor-intensive industrial activities is increased, it improves the country's foreign currency generation, which comes from the industrial sectors. Other sectors also benefit from this channel. The government prioritizes certain sectors, particularly efficiency improvement, because a large portion of exports come from these sectors. Due to labor mobility, in the long run, agricultural labor gains more income, and the return from agricultural labor is higher compared with other labor (skilled, semi-skilled, and unskilled) and non-agricultural capital factors. However, skilled labor is the one that secures the lowest income gain when the production of labor-intensive industrial activities increases. This is owing to the fact that the trade deficit of the economy tends to be lower following the efficiency improvement, which resulted in both labor-intensive and priority industry exports increasing accordingly. As a result, when these labor-intensive industrial activities increase production, the trade deficit gets smaller as imports decrease and exports increase following a lower nominal exchange rate.

Table 6

Changes in Factor Income (%)

Type of Factor	% Change of income
Non-agricultural capital	1.16
Agricultural labor in drought prone	1.77
Agricultural labor in highland cereal	1.77
Agricultural labor in humid lowland	1.86
Agricultural labor in pastoralist	1.77
Skilled labor	1.11
Semi-skilled labor	1.42
Unskilled labor	1.51
Factor livestock in drought prone	2.87
Factor livestock in highland cereal	2.62
Factor livestock in humid lowland	2.52
Factor livestock in pastoralist	2.66
Factor land in drought prone	1.97
Factor land in highland cereal	1.83
Factor land in humid lowland	2.11
Factor land in pastoralist	1.86

Source: Own Computation

The income of both rural and urban households' changes following the change in the remuneration of production factors, remittances, and government transfers. Government transfer might be improved when import tariff gains are increased following the increase in imported products. As the rate of change of the nominal exchange rate is higher, the income from remittance also increases in the long run, as does the income of the government from aid and transfers from the rest of the world.

Due to the free mobility of factors and the switch to high payment, the factors earn a high income due to the efficiency improvement. This is because the demand for factors and their prices increased after the efficiency increment. Most of the priority industries factor demand increases when efficiency improvement is done such that the remunerations of these production factors increase when production of labor-intensive industrial activities increases, thereby increasing the income of rural as well as urban households. The bigger income increment occurred in the highland cereal-poor households compared to another household. This is due to the fact that this household generates the lion's share of its income from agricultural labor, whose price and income increase on average faster. Whereas the lowest change was recorded on large urban non-poor households, as this household highly generates its income from skilled labor, in which its price and income increase at a lower rate (Table 7).

Table 7
Changes in Household Income (%)

Type of Household	Income change (%)
Drought prone non-poor household	1.55
Drought prone poor household	1.79
Highland cereal non-poor household	1.58
Highland cereal poor household	1.84
Humid lowland non-poor household	1.51
Humid lowland poor household	1.72
Large urban non-poor household	1.17
Large urban poor household	1.26
Non-farming non-poor household	1.24
Non-farming poor household	1.29
Pastoralist non-poor household	1.59
Pastoralist poor household	1.84

Source: Own computation

The improvement of production in labor-intensive industrial activities increases the price of imported goods and the prices of other goods. The price of basic staple food items such as teff, vegetables, wheat, and dairy increased after efficiency improvements. This basically emanates from the fact that in the long run, labor moves out of agriculture. Thus, as the wage rate of agricultural labor increases, so does the cost of production of cereals, which intensively use agricultural labor. Table 8 shows the price changes of basic cereals and food items.

Table 8

Changes in Price of Selected Goods (%)

Name of the good	Change
Milk	2.155475
Maize	1.698598
Teff	1.666588
Vegetable	1.768928
Wheat	1.623007

Source: own computation.

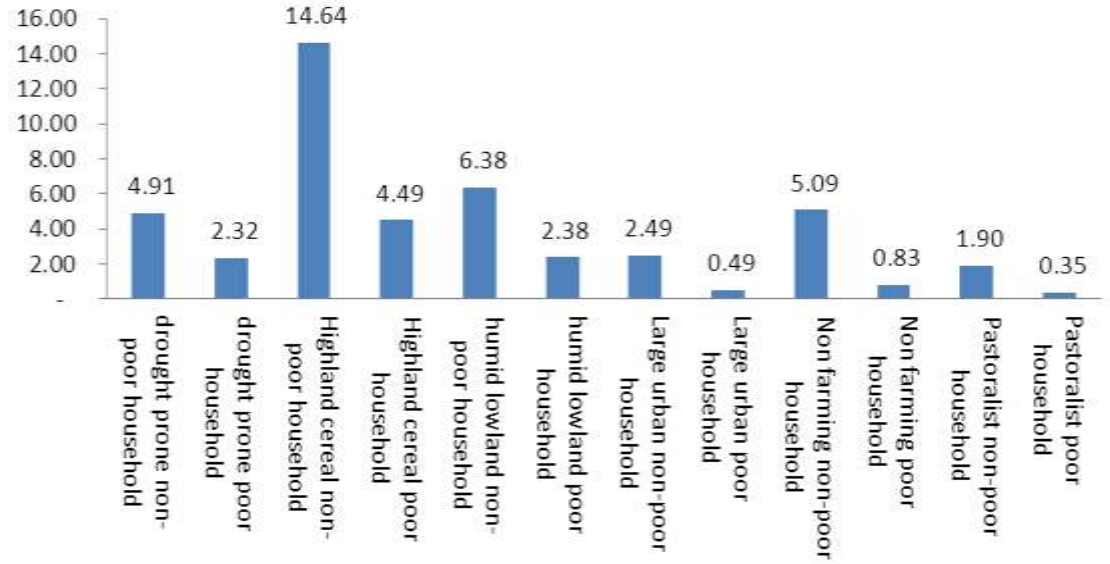
Both the change in price as well as the change in income affect the welfare of different households differently. To examine the net effect of such reactions, the welfare change is analyzed using the equivalent variation method (EV)[4]. Equivalent variation is negative if the price and income change would make the consumer worse off, and vice versa. The result of the simulation (Figure 3) shows that if efficiency improvement applies to labor-intensive industrial activities, it benefits more non-poor households while having a lower welfare impact on poor households, both rural and urban. But, when comparing the welfare impact on urban and rural households, the efficiency improvement more benefited rural households (both poor and non-

[4]Equivalent variation is defined as the amount of money paid to an individual with base prices and income that leads to the same level of satisfaction as that generated by a price and income change. The expression of the LES is given by $P_i X_i = \gamma_i P_i + \beta_i (Y_i - \sum_{i=1}^{n} \gamma_i P_i)$ where P stand for price, X_i for quantity of goods i consumed and γ_i is the minimum expenditure on goods and services and β_i is the marginal budget share of good i. $\beta_i = \omega_i \varepsilon_i$ Where ω_i and ε are the average budget share and the income elasticity of good i respectively. $\gamma_i = \frac{Y_D}{P_i}(\omega_i + \frac{\beta_i}{\phi})$ where Y_D is disposable income and ϕ is the Frisch coefficient

poor) than urban households (both poor and non-poor). This is due to the fact that more labor is obtained in rural areas, and the free mobility of labor across sectors means the return for labor will be higher for rural households.

Figure 3

Equivalent Variation of Household Income (In Million Birr)



Source: Own Computation

Equivalent variation increases for all households when labor-intensive industrial activities increase production. However, the extent is different among households. Particularly, the variation in rural and urban households' increments has differences as income sources differ.

Conclusions and Policy Implications

This research examines the long-run, economy-wide impacts of productivity improvement in labor-intensive industrial activities on the Ethiopian economy. To such an end, the study deployed a staged CGE model and used a 2009/10 SAM to calibrate and compute the necessary parameters of the model. The study identified nine industrial sectors as labor-intensive based on their production characteristics. These sectors include dairy, other food processing, and textiles. The Ethiopian 2009/10 SAM reveals that households obtain much of their income from labor.

The SAM further pinpoints that agricultural commodities are highly consumed by rural households, whereas urban households consume more industrial products.

The efficiency increments of labor-intensive industrial activities; increased real GDP; government consumption demand; investment demand; household consumption; imports and exports. The income of factors and households increased as well. The prices of the most consumed agricultural items have increased. In general, increasing the efficiency of labor-intensive industrial activities enhances the welfare of all household groups. Particularly, the efficiency increment increases the exports of government-prioritized industries and lowers the extent of their imports. The implication is that such an increment in production makes the priority industries very competitive. This is manifest in the increase in domestic production in the prioritized industries. As we discussed in the previous section, the efficiency increment has a positive impact on the simulated variables. This is consistent with Ricardo's comparative advantage and HO factor endowment theories.

One of the most daunting challenges in policy making is choosing an industrial policy that boosts the production of the most selected sectors and enhances the welfare of society while also achieving macroeconomic betterments. Given the Ethiopian context, increasing the production of labor-intensive industrial activities would substantially affect the entire economy and achieve the aforementioned policy objectives. This calls for the development of a strong industrial policy that aims to ensure the long-run productivity of the sector.

The study recommends that policies and strategies for increasing the output of labor-intensive industrial activities be carefully examined, and that supply-side interventions be implemented. Furthermore, results from this study advocate policy interventions towards the agricultural sector in terms of improving the technology used in the production process as more labor is switched to other sectors that have a higher return on investment to maintain and improve the productivity of agriculture. Finally, the study recommends for further research to use the estimated production increment on labor-intensive industrial activities as a policy shock since this might lead to different conclusions.

References

AfDB (2009). African Developpment Bank, African Economics Outlook 2009.

Armington, Paul S., 1969, "A Theory of Demand for Products Distinguished by Place of Production," International Monetary Fund Staff Papers, Vol. 16, No. 1, pp. 170–201.

Blonigen, B. A., Flynn, J. E., Reinert, K. A.(1997). Sector-focused general equilibrium modeling. In: J. F. Francois and K.A. Reinert (Eds.). Applied Methods for Trade Policy Analysis: A Handbook. Cambridge University Press, pp. 189-230.

Fekadu B. (2007). Trade liberalization, poverty and income inequality in Ethiopia: a CGE micro simulation analysis.6th PEP research network general meeting.

Haaland, J, and Norman, V(1987). EFfA and the world economy.Comparative advantage and trade policy.EFTA Occasional Paper no. 19.

Harberger, A.C. (1962). The incidence of corporation incometax. Journal of Political Economy, 70(3), 215-240.

Hicks, J. R. (1975). Value and capital: An inquiry into some fundamental principles of economic theory. OUP Catalogue.

Johansen, L. (1960). A multi-sector study of economic growth (Vol. 21). North-Holland Publishing Company.

Leontief, W. (1941) The Structure of American Economy, 1919-1929. Cambridge, (mors): Harvard University Press, (Second Ed. 1951, New York, Oxford University Press).

Lofgren, H., Harris, R. L., & Robinson, S. (2002). *A standard computable general equilibrium (CGE) model in GAMS* (Vol. 5). Intl Food Policy Res Inst.

McDonald, S. (2002). A Basic 123 Open Economy Model. Mimeo.

NBE (2010/11). National Bank of Ethiiopia, Annual report 2010/11.

OECD (2014). Organization for Economic Co-operation and Development annual report.

Round, J. (2003). Social accounting matrices and SAM-based multiplier analysis. The impact of economic policies on poverty and income distribution: Evaluation techniques and tools, 14, 261-276.

Samuelson, P. A. (1941). The stability of equilibrium: comparative statics and dynamics. Econometrica: Journal of the Econometric Society, 97-120.

Scarf, H. (1967). The approximation of fixed points of a continuous mapping. SIAM Journal on Applied Mathematics, 15(5), 1328-1343.

Shoven, J. B., & Whalley, J. (1984). Applied general-equilibrium models of taxation and international trade: an introduction and survey. Journal of Economic literature, 22(3), 1007-1051.

Solomom, T. (2015). Effect of trade liberalization on poverty, income inequality and the Ethiopian economy : a CGE modelling approach.

World Bank (2009). World Development Report 2009: Reshaping Economic Geography

WTO (2011). World Trade Organization, world trade report.

Yimer, S. (2012). Impacts of trade liberalization on growth and poverty in Ethiopia: Dynamic computable general equilibrium simulation model. International Journal of Business and Social Science, 3(11).