ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

AGRICULTURAL PRODUCTIVITY, INDUSTRIALIZATION AND STRUCTURAL TRANSFORMATION IN THE ETHIOPIAN ECONOMY: EVIDENCE FROM RURAL HOUSEHOLDS.

A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Masters of Science in Economics

By

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Acronyms

ADLI Agricultural Development Led Industrialization

AIDS Almost Ideal Demand System

CSA Central Statistical Agency

CSAE Center for the Study of African Economies

ERHS Ethiopian Rural Household Survey

GDF Global Development Finance

GDP Gross Domestic Product

GTP Growth and Transformation Plan

IFPRI International Food Policy Research Institute

MDGs Millennium Development Goals

MOA Ministry of Agriculture

MOFED Ministry of Finance and Economic Development

NBE National Bank of Ethiopia

UNIDO United Nations Industrial Development Organization

WDI World Development Indicators

Abstract

This study tries to investigate the effect of agricultural productivity on the industrial sector and further its effect on the structural transformation of the Ethiopian economy. Inspired by the works of Matsuyama (1992) on agricultural productivity and industrialization we tried to see effect of agricultural productivity from a microeconomic perspective. Using a panel data from Ethiopian rural households which is conducted from 15 rural villages in four rounds with a time span of 15years (i.e. 1994, 1999, 2004 and 2009) we tried to link the agricultural sector with the industrial sector. Taking labor participation on farm activities and the consumption share of manufactured products as dependent variables we develop two independent models considering agricultural productivity as a major explanatory variable. A Housman test is conducted in order to select the appropriate effect (i.e. Random and Fixed models) for the panel model and further tests are also conducted to check validity of the model. An almost ideal demand system is also employed in order to see the consumer's elasticity of demand towards manufacturing products. From the results it was found that development of the agricultural sector is found to be insignificant in making progress for the industrial sector. Furthermore, its role for the realization of a structural transformation of the economy is found to be unfortunate.

Chapter 1

INTRODUCTION

1.1.Background of the study

A given economic development process is mostly signified by a structural transformation that would occur within the major sectors of the economy and this change is both the cause and effect of an ongoing economic growth. A structural transformation in a given economy could be observed through; a declining share of agriculture in gross domestic product (GDP) and employment, the rapid process of urbanization as people migrate from rural to urban areas, the rise of a modern industrial and service economy and a demographic transition from high to low rates of births and deaths(Timmer, 2012). A structural change in economy can also be observed from a different perspective. From a demand perspective it is the change in consumers demand from emphasis on food and basic necessities to desires for diversified manufactured goods and services (Todaro, 2012).

Agriculture employs 65% of Africa's labor force and accounts for 32% of gross domestic product. The performance of the sector has improved since 2000 but, the growth has been mostly based on area expansion (World Bank, 2015). Ethiopia's experience is also not that much different from this fact. Rather it is even worst, nearly half of the country's GDP consists of agriculture and still more than 75% of the population is engaged in the primary sector. The household consumption expenditure on agricultural outputs is still dominant accounting for 77% of the total consumption expenditure (CSA, 2010/11) which shows that still the economy is in the traditional sector. Despite these facts the government is

trying to have economic development plans that are accompanied by a declining share of agriculture in total output while increasing the share of the industry, though agricultural output is expected to increase throughout in absolute terms.

Ethiopia had set a five year plan (i.e. growth and transformation plan (GTP) 2010/11-2014/15) that it is currently implementing. In the plan it has been noted that for having a structural transformation in the economy; industrial sector's share in GDP is expected to grow from 12.9% to 18.8%, the agricultural sector's share will be expected to decrease from 41.6% to 36.9% and the service sector's share in GDP is also expected to decline from 45.6% to 44.3% at the end of the plan implementation period. Even though, the plan tries to achieve a structural transformation of the economy it seems that it could be unlikely from what is observed on the ground. The recent report prepared by Ministry Of Finance And Economic Development (MoFED) on the progress of the plan for the year 2012/13 shows that agriculture accounts for 42.9% share in GDP showing a slight decline compared with 46.5% in 2009/10 while the share of industrial sector increased to 12.4% in 2012/13 from 10.3% in 2009/10 and the share of the service sector shows an increasing trend from 44.1% in 2009/10 to 45.2% in 2012/13 (MoFED,2014).

Agricultural growth has been viewed as a precondition for industrialization because the sector provides surplus labor to industry, saving for capital investment in non-agricultural sectors and more food to meet the increasing demand of a growing nonagricultural labor force, without which labor costs in the industrial sector must rise (xinshen et.al, 2007). Ethiopia's agricultural policy is based on the agricultural development led industrialization (ADLI), where increasing agricultural productivity in smallholder agriculture is the government's top priority (MOA, 2010).

Output in the agriculture sector is dominated by crop production which accounts for over 30 percent of the total gross domestic product. Both areas cultivated and production levels of major crops produced by the smallholder farms and commercial farms show an increasing trend in recent years. In 2012/13 from both smallholder farmers and commercial farms, a total of 251.05 million quintals of production was obtained from major food crops such as cereals, pulses and oil seeds during both Meher and Belg seasons. Smallholder farms take the lion's share in the production of the agricultural output producing 96% (241million quintal) of the total production in the year 2012/13 (CSA & MOFED, 2014). Agricultural research and input supplies are also the major factors that could affect the productivity of agriculture and though it shows a progressive trend in these aspects it still falls behind the target of the growth and transformation plan.

The industrial sector on the other hand is still lagging behind the other sectors and the target set by the development plans of the country. The medium and large scale manufacturing sub-sector that should have grown much faster in order to drive the industrialization and transformation of the economy is growing at 14.9 % on average (MOFED, 2014). However, it still remains low accounting for around 3% of the GDP. At this stage it is somewhat ambiguous to talk about a structural change in the economy by observing the macro level situations as the industrial sector lagged behind its expectation.

Thus the major focus of this paper was investigating the effects of agricultural productivity on the change in the structure of the economy. It also tried to show whether the development strategy (i.e. Agricultural Development Led Industrialization /ADLI/) that the country has followed since the beginning of 1990's is effective enough in bringing a real change in the economy. Rural households demand for manufactured products and

the employment response will be the major variables that this study considers as transmission mechanisms that could show the impact of the agricultural development on the industrialization process of the nation.

1.2.STATEMENT OF THE PROBLEM

A common argument from economic history literature is that 18th century England was particularly well-placed for industrialization because of its high agricultural productivity. Societies with high agricultural productivity can afford to shift part of their labor force to industrial activities. From an early industrial experience it is noted that changes in technology and demand provoked the ability to shift a fraction of labor force to industry. (Acemoglu, 2007)

Matsuyama, (1992) on his work on agricultural productivity considers comparative advantages of countries and depicts that an economy with a less productive agriculture allocates more labor to manufacturing and will grow faster in an open economy. Though, he shows that it is possible to have a positive relation between agricultural productivity and industrialization through shifting labor considering a closed economy case.

Recent studies on structural transformation on the other hand show positive relations with agricultural productivity and industrialization process even in open economy cases. Using a simple neo classical growth model on nine Latin American countries Antonio, et.al (2013) found that low levels of agricultural productivity can substantially delay the process of industrialization. yu-kang and chi (1995) on their work in agriculture and industrial development in Taiwan found that agricultural productivity plays a significant role in the industrialization process through providing labor, capital, agricultural goods,

and a size able markets for non-farm products and having a higher industrial wages and non-farm job opportunities led an outflow of farm labor. Bustos, et.al (2013) studying agricultural productivity and structural transformation in Brazil found that agricultural productivity can lead to industrialization even in an open economy.

Using a static general-equilibrium model with stone-Geary preferences Lee, (2013) tried to show the impact of a shock in the agricultural productivity on manufacturing output in developing countries and found that any negative shock in agricultural productivity will force the manufacturing output to decline. The effect on the manufacturing output will be through two major channels but, the immediate effect is a rise in food prices. Poor households should have to fulfill their subsistence requirements and the rising food price will make them to shift consumption away from manufactured goods. The other one is a supply side effect where factors of production (Labor and Capital) will shift away from manufacturing sector.

Rural households also face their own problems which will constrain their production capacity (e.g. illness (Jhon, 2009), education (Sharada, 1999)) and this in turn will hamper their livelihood (Eleni & Bruce, 1999) The farm cash income constraint will limit the purchase of fertilizer, farm equipment, other inputs that enhance the productivity of a farm household's own resources of land and labor also has serious adverse effects on the positive interaction between agricultural and non-agricultural sector development. A lack in monetary income in a semi-subsistence agricultural economy will clearly limit the emergence of new manufacturing and service activities. To experience a structural transformation from this state it should be a demand driven. The agricultural household

/rural household/ demand could be improved through increase in its farm cash income which is in turn affected by agricultural productivity.

One of the best known theoretical models on a structural transformation from the subsistence sector is developed by W. Arthur Lewis in the mid 1950's. The Lewis two-sector model became a prominent one in dealing with a development process in labor-surplus developing nations in the 1960s and early 1970s. It is still sometimes applied to study development experiences particularly the recent growth experience in china and other developing countries (Todaro, 2012). In the Lewis model the underdeveloped economy consists of two sectors namely overpopulated rural subsistence sector and a high productivity modern urban industrial sector. The former one is characterized by a zero marginal labor productivity which will give rise to a surplus labor that could be transferred to the high productive sector. The major focus of the model is on both the process of the labor transfer and the growth of output and employment in the modern sector. To realize a transfer of a surplus labor, the modern sector should have to experience an output expansion which is in turn determined by investment in the industrial sector and capital accumulation.

The procedure that this paper follows is the reverse of what the Lewis model depicts. Rather than concentrating on the industrial/modern sector it will focus on the subsistence/agricultural sector. The situation that the researcher tends to investigate here emanates from the country's development strategy (i.e. Agricultural Development Led Industrialization /ADLI/) which aims to achieve "initial industrialization through robust agricultural growth and close linkages between the agricultural and industrial growth" (ohno, 2009). Agriculture supplies food and other raw materials including labor for the

industrial sector and in turn it demands agricultural inputs and consumption goods produced by the industrial sector. Considering these major forward and backward linkages that exist between the two sectors the study tries to investigate the impact of agricultural development on the industry and further the situation of a structural transformation in the economy.

Household level panel data set is employed in order to study the house holds consumption of manufactured products with a consideration of agricultural productivity as a major determinant. This paper also tries to find possible answers for the following questions; Is the rural household coming to be a promising market for manufacturing products?, is agricultural productivity playing its role in promoting the rural households livelihood?. Moreover, it assesses the implementation of the development strategy ADLI and the progress made at household level. Finally it also tries to show whether consumption patterns of rural households exhibit a structural change.

1.3.Objective of the study

This study mainly tries to investigate the structural transformation of Ethiopia's economy at microeconomic level which is the main objective of the country's development strategy (ADLI) that is being implemented since 1990s.

Specifically, the paper investigates the:

- Impact of agricultural productivity on the industrialization process
- Determinants of rural household consumption of non-farm goods
- Potentials of the rural households in creating market for the industry

- Factors that determine the amount of labor participation on individual farms

1.4.Significance of the study

Achieving a Structural transformation in the economy becomes the major objective of developing countries through their development plans. Ethiopia also recognizes the need to achieve a structural transformation in order to meet the economic development it aspires in the short period of time. Having this in mind, this paper mainly tries to see the implications of the policies that were being implemented and investigate whether they are making a significant impact on the society.

The researcher also observed that there is a difficulty of finding an empirical work investigating the situation on the structural transformation of the Ethiopian economy at the household level. Thus, this study tries to show the situation at individual household level through using a panel data that is collected from Ethiopian rural households. Furthermore, this particular research contributes to the body of empirical works on structural transformation of Ethiopian economy. The policy implications and findings from the research will also be important in indicating the paybacks of the major policies that were being implemented since 1990's. The research also tries to indicate certain extents and problems that need further investigations by scholars.

Chapter 2

REVIEW OF RELATED LITERATURE

2.1. Theoretical literature

2.1.1. Basic concepts on structural change

Structural transformation in the economy is seen as important component in analyzing economic growth these days. Beside other characteristics of economic growth such as high rate of growth of per capita incomes, rise in productivity, urbanization etc., a structural transformation of the economy is also considered in recent economic growth models.

Simon Kuznets, (1973) on his reflection on modern economic growth asserts that economic growth is characterized by a high rate of structural transformation of the economy. Major aspects of the structural change include the shift away from agriculture to nonagricultural pursuits and, recently, away from industry to services; a change in the scale of productive units, and a related shift from personal enterprise to impersonal organization of economic firms, with a corresponding change in the occupational status of labor. The rapidity of structural shifts in modern times can be easily illustrated by changes in the distribution of labor force between agriculture (and related industries) and the nonagricultural production sectors. Shifts in several other aspects of economic structure could be added (in the structure of consumption, in the relative shares of domestic and foreign supplies, etc.).

Chenery, (1979) in his work on structural change and development policy also supports kuznet's ideas on modern economic growth and stresses that economic transition is

required for having sustainability in income and social welfare. Factors that lead to the economic transition are such as; changes in consumers demand due to rising income (Engel functions), a necessity to accumulate physical and human capital to increase per capita output, an access to technology and international trade. The processes that make up the transition include changes in virtually all economic functions: the increase in productive capacity (accumulation of capital and skills); transformation of resource use (demand, production, trade, and factor use); and such socioeconomic processes as urbanization, the distribution of income, and the demographic transition.

2.1.2. Development Theories with Structural Change

The structural change approach for development is mainly developed in the mid-1950s by W.Arthur Lewis which is commonly called as the **Lewis two-sector model.** Hollis B. Chenery and his co-authors in the 1970s contribute to the theory of structural change with empirical analysis at cross country level and tried to show its importance in development policy.

2.1.2.1. The Lewis Theory of Development[1]

The Lewis two-sector model became the general theory of the development process in surplus-labor developing nations during most of the 1960s and early 1970s.The model consists of two sectors: a traditional sector characterized as overpopulated and has a zero marginal labor productivity which gives a surplus labor and this surplus labor will withdraw from the traditional agricultural sector without any loss of output. The modern

[1] This part is solely taken from the book of M.P.Todaro & S.C. smith "economic development", 11th ed. 115-122

urban sector is also characterized as a high productive one where the labor from the subsistence sector will gradually move in.

Primarily the model focuses on the process of labor transfer and the growth of output and employment in the modern sector. Both labor transfer and modern sector employment growth are determined by output growth with in the sector itself. The growth in the modern sector is again determined by industrial investment and capital accumulation. In other words, the higher the rate of investment and capital accumulation the shorter will be the period to experience expansion in the modern sector. Investment in the modern sector is possible due to the excess of profits over wages on the assumptions that capitalists will reinvest all of it.

Lewis also assumed that the level of wages in the urban industrial sector was constant; it is over a fixed average subsistence level of wages in the traditional agricultural sector. The urban wage (W_M) is above rural average income (W_A), modern sector employers can hire as many surplus rural workers as they want without fear of rising wages. As profit-maximizing modern sector employers are assumed to hire laborers to the point where their marginal physical product is equal to the real wage. Because all the profits will be reinvested, the total capital stock will rise. The rise in capital stock will cause the total product to rise which in turn induces the demand for labor. This process of modern sector self-sustaining growth and employment expansion is assumed to continue until all surplus rural labor is absorbed in the new industrial sector.

Although Lewis's work pioneered for the consideration of structural transformation in development theories, it is criticized on its key and major assumptions. The model

implicitly assumes that the rate of labor transfer to the modern sector is proportional to the rate of capital accumulation. The faster the rates of capital accumulation, the higher the growth rate of the modern sector and the faster the rate of job creation. But, what if capitalists reinvest their profits on labor saving capital equipment? The other is the notion of surplus labor in rural areas while full employment in urban areas which deviate from contemporary literatures which indicate little surplus labor in rural locations

2.1.2.2. Structural Change and Patterns of Development

Chenery and his co-authors (1979) tried to show structural change and development policy issues with a support of some empirical evidences and country level experiences. From the result, it is pointed out that increased savings and investment is a necessary but not sufficient condition for economic growth. In addition to capital accumulation both physical and human, a set of interrelated changes in the economic structure of a country are required for the transition from a traditional economic system to a modern one. These structural changes involve virtually all economic functions, including the transformation of production and changes in the composition of consumer demand, international trade, and resource use as well as changes in socioeconomic factors such as urbanization and the growth and distribution of a country's population.

2.1.3. Agricultural productivity and industrialization

It is rare to find a theory that formulates a relation between agricultural productivity and industrialization in a given economy. Matsuyama (1992) in his work on agricultural productivity and economic growth tries to show the relation that would exist between the agricultural sector productivity and growth in the manufacturing sector. He stresses that if

the economy is assumed to be closed the growth in the productivity of the agricultural sector will facilitate the release of labor from the traditional to the modern sector. Thus, a positive relation would exist between the productivity of agriculture and growth of manufacturing sector which will further defuse to growth in economy. The relation will be the reverse if the economy is assumed to be open, where Matsuyama assumes the existence of comparative advantage will play a significant role. If a given nation has a comparative advantage in agriculture, then the nation will focus on agricultural production and this will delay the growth in manufacturing sector.

Mondal (2014) also tries to show the relation between agricultural productivity and industrialization. He points out that an improvement in agricultural productivity may lead to an expansion of the agricultural sector at the cost of manufacturing. This will possibly takes place when agriculture is already much productive in an economy or where subsistence food production sector is relatively small. However, when agriculture is less productive to begin with, further improvement in its productivity can lead to an expansion in the manufacturing sector. Thus, there will be an inverted U shaped relationship between agricultural productivity and the growth of the industrial sector.

2.2. Empirical literature

In this part we will see some empirical works that show patterns and experiences of structural transformation in different nations with mainly focusing on developing nations. The main focus will be how the nations experienced structural transformation in their economies, and its implication for their economic development. The relation between agriculture and structural transformation of the economy across different nations will also

be reviewed. The methods used in the research works will also be discussed here. Moreover, the situation in Ethiopia will be discussed at last to show the facts on the ground and to reflect some gaps that this particular research work will contribute.

2.2.1. Patterns of structural transformation

There are different forms and perspective in which a structural transformation in the economy can be expressed. From demand perspective, a change in the composition of consumables will be a good indicator and a shift of employment and production from agriculture to manufacturing is a good indicator for both employment and supply side perspectives respectively.

To have a structural transformation in the economy there are major contributing factors. Foellmi & Zweimuller, (2005) points out that change in the structure of production and employment result either from sectoral differences in productivity growth or from sectoral differences in income elasticity's of demand. Result from their analysis show that the hierarchic nature of demand implies that structural change takes the form of a reallocation of resources from old to new industries. At any given date old industries supply necessities and new industries supply luxuries. These sectors experience different growth rates of demand and a reallocation of resources is necessary to satisfy these demands. As an implication, a product's income elasticity is initially high and gradually decreases with growing income. In other words, each good starts off as a luxury with a high income elasticity and ends up as a necessity with low income elasticity.

Other exogenous factors like Globalization also promote specialization and affects structural transformation depending on the comparative advantage that a given nation

experienced. Macmillan and Rodrik, (2011) stresses that developing countries which are well endowed with natural resources and primary products will face a reduction in incentives to diversify towards modern manufactures. Primary sectors such as minerals operate at a very high level of labor productivity and they will have limited capacity in generating employment. So in economies with a comparative advantage in natural resources, it is expected that the positive contribution of structural change associated with participation in the international market to be limited.

2.2.2. Agriculture and economic transformation

A structural transformation in the economy is mainly concerned with moving out the traditional (i.e. Agriculture) sector. The growth in agricultural sector plays a multi-dimensional impact through contribution for the growth of other sectors and in realization of structural transformation in the economy. Heggblade, et.al, (1988) points out that agricultural growth is essential for launching successive rounds of growth in rural areas and the consumption linkage is one of the important contributions. The rise in the productivity of labor boosts per capita income levels that enable consumer diversification from food into non-food items.it will also help in permitting the release of labor from agriculture to non-agricultural sectors.

For most developing countries their economy is highly dependent on the agricultural sector and changes on this sector will be reflected on the whole economy. Thirtle, et.al, (2001) stresses that growth of developing countries is dependent on a change in agricultural productivity level; which provides sufficient food for a growing non-agricultural population. As structural transformation proceeds, agriculture accounts for a

falling proportion of employment and income, but the growth process is driven by the development of the agricultural sector. For this reason, agricultural productivity improvements should be both pro-poor and pro-growth.

Briones and Felipe, (2013) try to study the relationship between agriculture and structural transformation in developing Asia. They found that, developing Asia relative to other developing regions has experienced; a slower decline in employment share in agriculture, compared to its output share. The most successful Asian economies have pursued an agricultural development-led industrialization pathway. But, still agriculture remains the largest employer in many large Asian countries. Finally they recommended that, to achieve a transformation countries need to promote a long term productivity growth in agriculture through upgrading their farms.

Awokuse, (2008) in his work on whether agricultural development matters for economic growth or not: tries to show the relation between the two using a time series econometric methods. The empirical result shows that there is strong evidence which indicates the development of agriculture as an engine of growth

Policies regarding agricultural sector will also have their own implication toward other sectors. Dennis and Iscan (2010) try to study the implications of having agricultural distortions to other sectors. Using novel cross-country time-series data sets with direct measures of agricultural taxation, they examine how a policy bias against agriculture affects the speed of convergence in income per capita, structural change, and economic growth. From their empirical analysis they found that distortionary agricultural policies in poor economies will significantly retard their structural transformation and economic

growth. Overall, they found no evidence suggesting that policies that discriminate against agriculture have been beneficial for long-term economic growth.

Poonyth, et.al, (2001) adopting a simple growth model to explain the effect of the agricultural sectors' growth on the non-agricultural sector in South Africa. They found that, the non-agricultural sector responds by more than 1% for a 1% growth in the agricultural sector.

Bustos, et.al, (2013) study the relation between agricultural productivity and structural transformation in Brazil. They found that a Factor-biased technical change is a key factor in the relationship between agricultural productivity and structural transformation of open economies. If technical change is labor-biased, agricultural productivity growth leads to a reduction in industrial employment. However, if technical change is strongly labor saving, agricultural productivity growth leads to employment growth in industrial sector.

Alvarez-cuadrado and Poschke (2010), try to study the condition for the structural change of agriculture using a time series data on U.S. since 1800 and 11 industrialized countries starting from19th century. Through their analysis they tried to point out the main drivers for the declining share of employment in the agricultural sector. The major ones are; (i) improvements in agricultural technology combined with Engel's law[2] release resources from agriculture ("labor push"), (ii) improvements in industrial technology attract labor out of agriculture ("labor pull").they present a model with both channels and found that the "pull" channel dominated until WWII and the "push" channels afterwards.

[2] Engel's law states that as income rises, the proportion of income spent on food falls, even if actual expenditure on food rises. In other words, the income elasticity of demand of food is between 0 and 1.

Leukina & Turnovsky, (2014) study the push, pull and population size effects on structural development. The process of structural transformation from the farm to a nonfarm sector is accompanied by technological change in both sectors and massive population growth. They investigate the effects of increasing population size (the population effect) and sector-specific productivity (the push and pull effects), both factor-neutral and factor-biased, in a parsimonious general equilibrium model under general forms of utility and production functions. All three effects may coexist and interact in important ways, and all are influenced by the degree of international trade. In the quantitative application to Britain, all of the effects play important and distinct roles in the process of economic development as a whole. The population and push effects matter for the urbanization and the relative price dynamics, with population playing the dominant role in the urbanization process in the later period of 1750-1850. The pull effect fuels economic growth, whereas the push effect drives the process of industrialization.

Kamei and Sasaki (2014), tried to see the impact of agricultural productivity on the industrialization process and the whole economy. Their result shows, the effect of an increase in the agricultural productivity on the total welfare depends on the size of the subsistence level of consumption for agricultural goods. A large subsistence level means that the income elasticity of consumption for manufactured goods is high. In addition, when the subsistence level is large, an increase in the agricultural productivity raises the total welfare. Therefore, they say that if an economy produces high quality, sophisticated manufactured goods; agricultural productivity growth is good for industrialization, whereas if an economy produces low quality, less-sophisticated manufactured goods, agricultural productivity growth is not good for industrialization.

Gollin, et.al, (2002), examine the effect of agricultural policy on a country's development and growth. They found that low agricultural productivity can delay the start of industrialization in a country for a long period of time, causing a country's per capita income to fall far behind the industrial leader. However, once industrialization begins, this trend will be reversed. But, the extent to which a country catches up to the leader depends primarily on factors that affect productivity in non-agricultural activities. Agricultural policy, therefore, is largely irrelevant in the long run. While in the short run, a country that experiences large improvements in agricultural productivity, due to say a Green Revolution, will experience an increase in its income relative to the leaders.

Cao & Birchenall (2013), examine the role of agricultural productivity as a determinant of China's post-reform economic growth and sectoral reallocation (i.e structural change). Using microeconomic farm-level data, and treating labor as a highly differentiated input, they find that the labor input in agriculture decreased by 5% annually and agricultural TFP grew by 6.5%. Using a calibrated two-sector general equilibrium model, they find that agricultural TFP growth: (i) accounts for the majority of output and employment reallocation toward non-agriculture; (ii) contributes (at least) as much to aggregate and sectoral economic growth as non-agricultural TFP growth; and (iii) influences economic growth primarily by reallocating workers to the non-agricultural sector, where rapid physical and human capital accumulation are currently taking place.

2.2.3. Economic transformation in developing economies

In this part we will try to see different empirical evidences on the experiences of developing countries in association with transformation of their economies. As much as possible the focus will be on most of African countries experience in order to have a virtual comparison with Ethiopia's experience.

The study of development policy has arisen from the decline of the colonial system and its replacement by independent governments. Early orientation on development had focused on the problems of initiating growth and increasing investment, subsequent experience shows that developing countries have been able to expand their economies after WWII. Despite the fact that they are growing they face a problem of managing the rapid structural change that is required to sustain it and to improve distribution. In dealing with this development should have to be conceived as a transition from traditional to modern forms of economic organization, rather than as a process of uniform expansion. (Chenery, 1979)

The economic transition is taking place more rapidly in many developing countries than it did in the industrializing economies of the nineteenth century. It is because of the availability of more efficient technology, imported industrial goods, and other influences from the advanced economies. To make use of these opportunities developing countries should coordinate changes in demand, production, trade, and the allocation of capital and labor (Chenery, 1979)

Chenery and syrquin (1975) had estimated each component of GDP (i.e. consumption, investment, government expenditure, exports and imports) as a function of GDP per capital, population size and the level of capital inflow for a country of 10 million. They

found that an income rise from $100 to $1500 per capita, the share of consumption falls from 72% to 60% of GDP. The major changes in the composition of demand stem from the decline of food consumption from 36% to 15% of GDP; nonfood consumption, gross investment, and government expenditure all increase. The shares of exports and imports show only small increases with income although they are greatly influenced by the size of the country.

The historical evidence does give more support to the industrialization thesis; there are no important examples of success in economic development in developing countries since 1950, which have not been driven by industrialization. All the Asian success stories are stories of industrialization. Neither tourism, nor primary exports, nor services have played a similar role, with the possible exception of India since 2000. Sub-Saharan African countries performed weakly in industrialization. It is clear that one of the characteristics of African development in comparative perspective is the failure of industrialization. (Szirmai, 2009)

McMillan, (2012) stresses that the flow of labor from traditional to modern sectors of the economy would be expected to be an important driver of growth in Africa. The growth pattern is even more puzzling in light of the reforms that African countries have undergone since the late1980s. But, labor seems to have moved from a high-productivity activity to a low-productivity activity, which reduced Africa's growth by 1.3 percentage points per year on average. In general, Africa exhibits a lot of heterogeneity, but the sector with the largest relative loss in employment is formal wholesale and retail trade where productivity is higher than economy wide average. The expansion of employment into manufacturing has been insufficient, at around one-quarter of one percent during the past

fifteen years. The sectors experiencing the largest employment gains tend to be community, personal, and government services, which have high levels of informality and are least productive.

Using dynamic panel models with data for 62 developing countries, Souza, (2014) examines whether growth in agriculture stimulates growth in manufacturing. Population weighted average temperature is used as an instrument for growth in agriculture. In the short run an increase in growth in agriculture by one percentage point is estimated to raise simultaneous growth in manufacturing by between 0.47 and 0.56 percentage points. The baseline models also imply sizable long-run effects of permanent increases in growth in agriculture. Extensions of the empirical model suggest that growth in agriculture benefits the manufacturing sector by improving its domestic terms of trade, by increasing the share of investment and saving in GDP, and by increasing the capacity to import industrial inputs.

Proctor (2014), studying the economic diversification in rural sub-Saharan Africa finds out that the growth which is recorded in recent decades is supported by sound economic policies, debt relief, stronger institutions and high levels of investment. Some of them also have begun to reduce poverty and improve living conditions. Such growth is underpinned by investment in natural resources and infrastructure, as well as higher agricultural production in some countries. However, Africa's structural transformations are influenced by context-specific conditions and it is shaped by; historical legacies, inequality of resource endowments and access, elite which is often urban biased, weak and poorly functioning markets,… etc. Levels of growth and the process of structural transformation thus differ between countries and regions, and within countries.

Zhang, (2002) studies the role of education in rural china and its impact in the employment conditions and labor markets. From the results, education increases the likelihood that individuals participate in the off-farm labor force, find jobs when they are unemployed, and earn a higher wage. In addition, assuming that labor has a positive marginal product in agriculture, education also aids the farmer in his/her on-farm activities. The results also suggest that its effect on the labor market will help in facilitating the demographic and economic shifts from rural to urban and from agriculture to industry.

Adeyinka and et.al, (2013), examine structural change in the Nigerian economy and try to see the effect of having structural change in the economy. They document that structural change accounts for approximately one-fifth of the total change in labor productivity in Nigeria between 1996 and 2009. Labor moved out of the agricultural and wholesale and retail trade sectors into manufacturing, transportation and communications, business services, and general services. While structural change did occur in this period, significant gains to aggregate labor productivity are still available from further shifts of labor to higher-productivity sectors. Factors that hinders the process of structural transformation are also discussed which include, poor agricultural productivity, insufficient infrastructure to support high productivity sectors, and a lack of appropriate skills in the labor force.

Breisinger & Diao, (2008), try to put recommendations for the possibility of Africa's transformation based on extensive literature on development economics and some empirical observation from successfully transformed economies (e.g. Thailand and Mexico). They found that success in transformation of the economy depends on agricultural development, and the early withdrawal of public support away from

agriculture slows down the transformation. Transformation also depends on industrialization strategies, but, the strategy should be home-grown, export oriented industrialization led by private entrepreneurs. Finally, government support is required for creating a business-promoting environment and to offer incentives for African entrepreneurs to lead growth.

2.2.4 Economic Transformation in Ethiopia

It is somehow difficult to find empirical works regarding an economic transformation in Ethiopia. Despite this fact we try to review some works which are closely related with the concept of structural transformation. Some empirical works which are concerned with rural households in Ethiopia are also reviewed in order to reflect some ideas and facts regarding the possibility for structural transformation.

Martins, (2014) tries to study structural change from employment perspective in Ethiopia based on macro level data that is disaggregated in to eight sectors for the period 1996-2011. The analysis suggests that the structure of output has changed considerably.it is mainly from agriculture to services but changes in the composition of employment have lagged behind. Labor productivity growth has been strong across most sectors, although mainly driven by within sector productivity improvements. Nonetheless, the pace of structural change is accelerating and its relative contribution to output growth is increasing.

Mellor and Dorosh, (2010) on their work on agriculture and the economic transformation of Ethiopia try to show effects of a growth in the agricultural sector. They implied that a high agricultural growth rate will have a positive implication for having an increase in

employment and accelerates poverty reduction. In order to have this rapid agricultural growth it is necessary to have new technology adoption by farmers and helping them to produce a marketed surplus. Investments in road, electricity and telecommunications are also needed to reduce marketing costs which in turn helps rural market towns. Finally their result shows that if the growth rate of agricultural sector is maintained at six percent, it would provide enough employment to contribute to rapid economic transformation of the economy and rapid decline in poverty.

Abay (2011), examines the possibility of industrialization through ADLI using a micro level data in Tigray, Ethiopia. Emphasizing on the consumption patterns of the farm house holds in generating demand for manufacturing goods while their income grows. The consumption function of farm households is estimated through using an Almost Ideal Demand system (AIDS)[3] to identify how demand for manufactured goods respond to changes income. The result shows that growth in per capita expenditure brings additional demand for durables but no significant change on manufactures goods. Income obtained from hired out labor has a positive impact on demand for manufactured goods while income obtained from crop selling activities increase the demand for durables. Generally income from agricultural activities has a strong positive inter-linkage with consumption of durables than manufactured goods.

Woldehanna (2008), points out that the current unbalanced growth approach with agriculture having a leading position cannot be successful to achieve sustainable growth

[3] The Almost Ideal Demand System (AIDS) (1980) is a consumer demand model used to study consumer behavior. It allows researchers to treat aggregate consumer behavior as if it were the outcome of a single maximizing consumer.

and industrialization in the country. On the one hand due to weak backward and forward production linkages with the industrial sector, agriculture may not create strong demand for purchased capital inputs and supply of raw materials for the development of non-agricultural sector. On the other hand, it has been difficult for non-agricultural sector to respond to demand created by the rural based agricultural development. Rather what is important is to follow a kind of balanced growth approach to development where non-agricultural, particularly the industrial sector and the agricultural sector have to obtain comparable amount of resources and attention so that the two sector can growth simultaneously .

Bedemo and et.al, (2013) examine determinants of household demand for and supply of farm labor in rural western Ethiopia using household sample survey data collected during 2010/11 agricultural season. The instrumental variable estimation technique used to analyze the data indicates the importance of shadow wage, shadow income, and demographic factors at influencing farm labor supply. Similarly, the demand for farm labor is significantly affected by farm attributes, off-farm income and family composition. The findings with regards to farm labor supply imply that measures taken to influence returns to labor on farm may produce different results for labor market participant and non-participant households. Moreover, increasing the off-farm employment opportunities can help release the liquidity constraint and thus promote increased use of hired farm labor.

Diao, (2010) studies the importance of agricultural development for economic growth and poverty alleviation in Ethiopia. He stresses that agricultural growth induces higher overall growth than non-agricultural growth. It also leads to faster poverty reduction since it

generates proportionately more income for farm households who cover the majority of population in the current economy and represent the bulk of the poor. In most cases, the impact of increased consumption demand due to growth in agriculture is much larger than that of the corresponding expansion in input demand. Such growth can, in its own right, have large growth effects within the non-agricultural sector given that such growth creates more production linkages than the growth led by the agricultural sector. More importantly, non-agricultural sectors have to grow in order to match growing supply of agricultural products and increasing demand for non-agricultural products. Otherwise, falling prices of agricultural products may dampen the realized gains in growth and poverty reduction. Thus, exploiting the potential growth linkages towards poverty reduction and structural transformation require a diversified (balanced) growth strategy that encompasses both agricultural and non-agricultural sectors.

Chapter 3

METHODOLOGY AND DATA

3.1. Data type and source

The data to be employed here is mainly the Ethiopian Rural Household Survey which has been supervised by the economics department, Addis Ababa University, the Center for the Study of African Economies (CSAE), University Of Oxford and the International Food Policy Institute (IFPRI). The data collection was started in 1989 with a survey on six farming systems in southern and central Ethiopia. In 1994, the survey was expanded to 15 villages across the country and an additional round is conducted in late 1994, with further rounds 1995,1997,1999,2004 and finally in 2009 (Stefan Dercon & john Hoddinott, 2009). This particular study employs the four rounds from the seven major rounds collected from the 15 rural villages. The rounds that are considered in this study are 1994A, 1999, 2004, and 2009 with a five year gap between them. The study only considers those households with full information in all rounds; any household with a missing value is just filtered out.

Other data sources include the Ministry of Finance and Economic Development (MOFED), Central Statistical Agency (CSA), and the National Bank of Ethiopia (NBE), and these data's are used for a descriptive analysis. International databases such as that of the United Nations Industrial Development Organization (UNIDO) and the World Bank will also be used if needed.

3.2. Method of analysis

3.2.1. Theoretical Frame-work

Societies with a high agricultural productivity can afford to shift part of their labor force to industrial activities. Some type of increasing returns coming from technology (factor combination) or demand is argued to explain a shift in labor force to industry in early industrial experience (Acemouglu,2007). Matsuyama (1992) tries to show this intuition with developing a model which explains how agricultural productivity could be linked with an industrialization process.

The model considers an economy composed of two sectors (i.e. agriculture & manufacturing) and both sectors employ labor where it will be the only input. The size of the population is constant and assumed to be equal to L; the total labor supply is also constant and is normalized to one. The absolute size of the economy itself is assumed not to have any effect in the model.

Technologies in the two sectors are given by

$$X_t^M = M_t F(n_t) \qquad F(0) = 0, F' > 0, F'' < 0 \quad \ldots\ldots \quad . \ .. \quad .. \ eqn\ (1)$$

$$X_t^A = AG(1 - n_t) \qquad G(0) = 0, G' > 0, G'' < 0 \quad \ldots\ldots \quad \ldots \quad eqn\ (2)$$

Where $n_{t,}$ is the fraction of labor employed in manufacturing as of time t as time is assumed to be continuous. Agricultural productivity, A, which may reflect the level of technology, land endowment, and climate among other things, is constant over time and treated as exogenous parameter.

Productivity in the manufacturing sector, M_t, which represents knowledge capital as of time t, is predetermined, but endogenous. Knowledge accumulates as a by- product of manufacturing experience and never depreciates.

$$\dot{M}t = \sigma X_t^M \quad , \quad \sigma > 0 \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots eqn\ (3)$$

Each manufacturing firm treats M_t as given when making production and employment decisions. Thus competition between the two sectors leads to the equilibrium condition in the labor market

$$AG'(1 - n_t) = P_t M_t F'(n_t) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots eqn(4)$$

Where P_t is the relative price of the manufacturing good

All consumers in the economy share identical preferences and the Stone-Geary utility function is applied in order to capture Engel's law which states that "as income rises, the proportion of income spent on food falls, even if actual expenditure on food rises. In other words, the income elasticity of food is between 0 and 1".

$U = \prod_{t=0}^{\infty}(C_t^A - \gamma)^B C_t^M.$

$$logU = Blog(C_t^A - \gamma) + logC_t^M, \qquad \gamma > 0 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots eqn\ (5)$$

Where C_t^A and C_t^M denote the consumption of agricultural and manufactured good, as of time t

The parameter γ represents the subsistence level of food consumption and satisfies the condition that;

$$AG(1) > \gamma L > 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \; eqn\ (6)$$

Where this inequality states, the economy's agricultural sector is productive enough to provide the subsistence level of food to all consumers

Assuming that all consumers have enough income to purchase more than γ units of food; the demand for the two goods by a consumer satisfies

$$C_t^A = \gamma + BP_tC_t^M$$

Aggregation for all consumers will yield

$$C_t^A = \gamma L + BP_tC_t^M \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. \; eqn(7)$$

In autarky;

$C_t^M = X_t^M = M_tF(n_t) and\ C_t^A = X_t^A = AG\ (1 - n_t)$, Combining with eqn (4) and eqn (7)

$$AG\ (1 - n_t) = \gamma L + BP_tM_tF(n_t)$$

$$AG(1 - n_t) = \gamma L + B\left(\frac{AG'(1-n_t)}{F'(n_t)}\right)F(n_t)$$

$$G(1 - n_t) = \frac{\gamma L}{A} + B\left(\frac{G'(1-n_t)}{F'(n_t)}\right)F(n_t)$$

$$G(1 - n_t) - \frac{BG'(1-n_t)F(n_t)}{F'\ (n_t)} = \frac{\gamma L}{A}$$

$$\emptyset(n_t) = \frac{\gamma L}{A} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \; eqn(8)$$

Where $\emptyset(n_t)$ is a strictly decreasing function and hence;

$$n_t = \emptyset^{-1}\left(\frac{\gamma}{A}\right) \equiv$$

$$N(A) is\ constant\ , and\ strictly\ increasing\ in\ A \ldots\ldots\ldots\ldots\ldots\ldots eqn(9)$$

n_t is a strictly increasing function of A which shows that a greater fraction of labor force will be allocated to the manufacturing sector when agricultural productivity is higher. In the model a cobb-Douglas production function combined with a non-homothetic preference, where a certain amount of food production is necessary first. When agricultural productivity,A is high, a relatively small fraction of the labor force can be employed in agriculture.

$$g_M = \frac{\dot{M}}{M} = \delta_M F\big(N(A)\big) is\ also\ increasing\ in\ A \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots eqn(10)$$

Which can be interpreted as a more productive agriculture helps industrialization. With a high agricultural productivity, a smaller fraction of labor is needed to produce the minimal amount of food, so that a larger fraction of labor will be allocated in the manufacturing sector, which leads to a higher productivity growth in the manufacturing sector. A higher agricultural productivity /A/ is accompanied by a lower relative price of the agricultural good. With non-homothetic preferences, the demand for the agricultural good does not rise as fast as the productivity of agricultural sector.

For open economy case the result is somewhat dependent on comparative advantage that the home economy will have. Consider a home economy which trades with the rest of the world (ROW), which may have different productivities, $A^* \neq A\ and\ M^* \neq M$. The home economy is considered as small, so that the ROW can be treated as closed and the home economy will face the world relative price given by;

$P(t) = \frac{A^* G'(1-N(A^*))}{M^*(t)F'(N(A^*))}$, and $\frac{\dot{M}_t^*}{M_t^*} = \delta M\ F\big(N(A^*)\big)$,

Since, $P(t) = \frac{AG'(1-n(t)}{M(t)F'(n(t))}$, then $n(t) \geq N(A^*)\ \ if and\ only\ if\ \ \frac{A^*}{M_t^*} \geq \frac{A}{M_t}$

Manufacturing accounts for larger share of the home employment compared to the rest of the world, if the home economy has a comparative advantage in manufacturing. When the home initially has a comparative advantage in manufacturing/ agriculture/, its manufacturing productivity will grow faster/slower/ than the rest of the world and accelerate/slowdown/ overtime. From this model we can deduce that a country that has a comparative advantage in agriculture will have stagnation in industrial growth compared to other countries, which is familiar to Ethiopia's case.

Depending on what is stated above, we could deduce a situation for the relation between agricultural productivity and industrialization process. Furthermore, we will try to investigate the existence of a fertile ground for a structural transformation in the economy that is needed for achieving a sustainable development. The linkage that exists between the two sectors (i.e. Agriculture and Industry) can be expressed in terms of both forward and backward. Agriculture/ rural/ sector supplies food and raw material including labor and it in turn demands industry/urban/ sector outputs (i.e. machinery, fertilizer, other agriculture inputs and consumption goods).

3.2.2. ECONOMETERIC MODEL

As noted earlier the data to be employed here is the panel data collected from households in 15 rural villages in Ethiopia.

From eqn (9)

$n_t = \emptyset^{-1}\left(\frac{\gamma}{A}\right)$…….. Where, n_t= fraction of labor force to be allocated to manufacturing sector

γ= subsistence level of food consumption and A= agricultural sector productivity

From here, our model will try to show the relationship between manufacturing sector and agricultural productivity in other way round.

3.2.2.1 Model for Labor Participation

Using the relation between labor force in agricultural sector and agricultural productivity, the model will use labor force in agricultural sector as a dependent variable. The data to be used here is comprised of rural farm households who are engaged in agricultural related activities and this will help the researcher to see the effect of agricultural productivity on the amount of labor that is to be used on each individual farm. It is expected that the result from this model will implicitly show us the effect of agricultural productivity on the fraction of labor in manufacturing sector. It will also implicitly indicate the possibility of labor to move out from the agricultural sector.

The agricultural system in Ethiopia is predominantly dependent on family labor and the common proxies are number of adults and children working in farming activities (Endale, 2011). The amount of labor participating on a given individual farm will be considered as the dependent variable. Considering these facts the model will take the ordinary form of describing a model based on panel data.

$y_{it} = \alpha_i + x'_{it}\beta + \varepsilon_{it}$, $\varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2)$, where it is assumed that all x_{it} are independent of all ε_{it} (Verbeek, 2004)

Thus, the model to estimate the effect of agricultural productivity on the amount of labor participating on individual farm will take the following functional form.

L= *f (*total value of output of major cereals per hectare, education level of household head, age of the household head, family size, sex of household head, distance from the nearest town, availability of electricity, availability of electricity in the nearest town, availability of public pipe water, distance from the nearest telephone service and regional dummy)

Description of variables

i. ***Total value of output of major cereals***. FANta, (1999) on its measurement guide for agricultural productivity indicators, points out different variables which can be used as an indicator for agricultural productivity such as; crop yield per hectare, gaps between potential and actual yields, amount of hectares with improved practices, value of crop production per household … etc. This particular study uses the total value of output per hectare produced by each household in order to measure the level of agricultural productivity at individual farm level.

ii. ***Education level of household head***. Considering the household head as the main decision maker, the education level of the household head would influence the amount of labor that should participate on his/her farm.

iii. ***Age of the household head***. The age of the household is also considered in a notion that there could be a difference among the decision of households with different ages. The variable will be measured by the age in years of household head.

iv. ***Family size.*** The agricultural system in Ethiopia mainly involves family labor and family size of the household is considered to see its implication on labor participation.

v. ***Sex of the household head.*** There could be a difference among male headed and female headed households. A male dummy is included in the model where '1' is for male and '0' is for female.

vi. ***Distance from the nearest town.*** In order to see the impact of exposure to the urban areas we tried to use the distance from the nearest town as a proxy. The closer a rural area to an urban town is the more it will be affected by factors from the urban area. Veneri and Ruiz, (2013) noted that physical proximity approximates a broad notion of linkages between rural and urban areas. Being remote and distance from cities tends to reduce the attractiveness of rural regions as a place to work and live. The decision to work in rural regions may follow from less access to specific higher order services, transport infrastructure and access to bigger markets.

vii. ***Availability of electricity.*** The impact of infrastructure on the rural households' livelihood is inevitable and here it is tried to show effects of infrastructure variables like electricity,

water and telephone service. An electricity dummy is considered here taking a value "1" for rural villages with electricity and "0" otherwise. Dinkelman, (2010) tries to see the impact of rural electrification on employment in South Africa and points out that the existence of this infrastructure appears to increase the hours of work for both men and women. The household electrification raises employment by releasing women from home productions and enabling micro-enterprises; the migration behavior may also be affected. World Bank IEG, (2008) in its impact evaluation report shows that rural electrification does not in general derive industrial development, but it can spur the growth of home based businesses. These businesses mostly employ family labor and increase their working hour once electricity becomes available.

viii. ***Availability of electricity in the nearest town.*** The impact of a nearby town could be varied among those 15 rural villages depending on the town's condition of infrastructure. In order to see this effect we included a dummy variable that uses "1" for those towns with electricity and "0" otherwise.

ix. ***Availability of public pipe water.*** Public pipe water is another infrastructural variable that is considered. Its availability has a multi impact on rural livelihood it is also described as a factor that could aggravate the rural-urban migration beside other factors. Joshua et.al (2011) recommends that functional amenities like public pipe water and other infrastructures should be provided in rural areas in order to curb a rural-urban migration in Nigeria. Availability of clean water is also related with health issues which directly have impact on labor participation of the household members. Thus, a dummy variable for its availability is considered taking "1" for villages with public pipe water and "0" otherwise.

x. ***Distance from the nearest telephone service.*** The other infrastructural facility that we consider is a telephone service which will have a great role in provision of information through the rural village. Telecommunication and labor are complementary inputs; a telecom infrastructure attracts professional activities (guldmann, 2001). Eriksson, (2011) studies the use of cellphone in rural Kenya and found that it plays a major role in the job market through making the job seeking easier and simple. Hence we tried to show the impact of telephone service availability on the labor participation of the rural households through taking the distance from the nearest telephone service as a proxy variable,

xi. ***Regional dummy***. The data considers four main regions in Ethiopia (i.e. Amhara, Oromiya, SNNP and Tigray) and a dummy variable is considered in order to show the difference among regions.

3.2.2.2. Model for Consumption Share of Manufactured Products

The second model that this particular research needs to consider is the relation that could exist between agricultural productivity and consumption of the rural households. In order to show the relation that could coexist with the agricultural sector and industrial sector we consider consumption by the rural household as a transmitting variable beside labor.

Under autarky we consider that $C_t^M = X_t^M$, where consumption of manufactured good is considered to be equal to production of manufactured good.

$C_t^M = X_t^M = M_t F(n_t)$.

From equation[4] 4 we can deduce that,

$$M_t = \frac{AG'(1-n_t)}{P_t F'(n_t)},$$

$$C_t^M = \frac{AG'(1-n_t)}{P_t F'(n_t)} F(n_t),$$

From here we can infer that there is a positive relation with agricultural productivity (A) and consumption of manufactured products (C_t^M). Variables like price of manufactured products will also affect consumption of manufactured products by the rural households. In order to show the effect of variables that are connected with the consumption pattern of rural households on manufactured products, this particular research would try to estimate the elasticity towards the product.

Abay (2011), uses an Almost Ideal Demand System (AIDS) in order to derive the expenditure elasticity of consumption of manufactured goods on studying the possibility of industrialization through ADLI. Deaton and Muellbaur (1980) introduced a new system of demand equations, the AIDS, in which the budget shares of the various commodities are linearly related to the logarithm of real total expenditure and logarithms of relative prices. Farooq & et.al (1999), uses the Almost Ideal Demand System (AIDS) model in order to investigate consumption patterns of farm households in rural Pakistan through panel data.

Deaton and Muellbaur (1980) consider preferences that permit aggregation over consumers; the representation of market demands as if they were the outcome of decisions by a rational representative consumer. The preferences will be represented via the cost or

[4] $AG'(1-n_t) = P_t M_t F'(n_t)$

expenditure functions which define the minimum expenditure necessary to attain a specific utility level at given prices. The function will be denoted as $c(u,p)$, where u is utility and p is price vector.

The model will be represented as;

$\log c(u,p) = (1-u)\log\{a(p)\} + u\log\{b(p)\}$, where 0<u<1----------eqn(1)

The positive linearly homogenous functions $a(p)$ and $b(p)$ can be regarded as the costs of subsistence and bliss (pleasure), respectively.

$\log a(p) = a_0 + \sum_k a_k \, logp_k + \frac{1}{2}\sum_k \sum_j \gamma_{kj}^{*} \, logp_k logp_j$----------eqn(2)

$\log b(p) = \log a(p) + \beta_0 \prod_k {p_k}^{\beta_k}$ ----------eqn(3)

So that the AIDS cost function is written as

$\log c(u,p) = \alpha_0 + \sum_k \alpha_k \, logp_k + \frac{1}{2}\sum_k \sum_j \gamma_{kj}^{*} \, logp_k logp_j + u\beta_0 \prod_k {p_k}^{\beta_k}$, ---------eqn (4)

The demand function can be derived directly from the above equation with the price derivatives of the cost function,

$\frac{\partial c(u,p)}{\partial p_i} = q_i$, multiplying both sides by$\frac{p_i}{c(u,p)}$

$\frac{\partial \log c(u,p)}{\partial log p_i} = \frac{p_i q_i}{c(u,p)} = w_i$----------eqn(5)

Where w_i is the budget share of good i, differentiating eqn (4) will give us the budget shares as a function of prices and utility.

$w_i = \alpha_i + \sum_j \gamma_{ij} log p_j + \beta_i u \beta_0 \prod {p_k}^{\beta_k}$----------eqn(6)

Where,$\gamma_{ij} = \frac{1}{2}(\gamma_{ij}{}^* + \gamma_{ij}{}^*)$ ----------eqn(7)

For a utility maximizing consumer, total expenditure x is equal to $c(u, p)$ and this equality can be inverted to give u as a function of p and$x$. Doing this on equation (4) and substituting the result into equation (6) we have the budget shares as a function of p and$x$. Thus, the AIDS demand functions in budget share form will be;

$w_i = \alpha_i + \sum_j \gamma_{ij} log p_j + \beta_i \log\{\frac{x}{p}\}$----------eqn(8)

Where p is a price index defined by;

$\log p = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_j \sum_k \gamma_{kj}\, log p_k log p_j,$

To estimate the expenditure elasticity of households demand system, the following model will be employed.

$w_i = \alpha_i + \sum_j \gamma_{ij} log p_j + \beta_i \log\left\{\frac{x}{p}\right\} + \sum_i \theta_i z_i$----------eqn(9)

Where,w_i, budget share of each commodity group (i.e. budget share of manufactured product)

p_j, price index of consumption group j, which will be calculated as $p_j = \prod_{i=1}^{n} {p_i}^{w_i}$

In our case it is the price index for those selected manufacturing products.

z_i, other explanatory variables, such as agricultural productivity; age of the household head, sex of household, education level of the household head, and family size

x, is total expenditure by a household/ per capita income of household/

p, general price index

The budget share for manufactured product then can be rewritten as;

$$w_{man} = \alpha_{man} + \gamma_{man,man} log p_{man} + \beta_{man} \log\left\{\frac{x}{p}\right\} + \sum_i \theta_i z_i + e_i$$ ----------eqn(10)

Here, the budget share of manufactured products is assumed to be determined by price index of manufactured products, per capita income and other household variables. The own price elasticity of demand for manufactured products can be calculated from the parameter estimates using the following formula.

$$\varepsilon_{man,man} = -1 + \frac{(\gamma_{man,man} - \beta_{man} w_{man})}{w_{man}}$$ ----------eqn(11)

Description of variables

i. ***Agricultural productivity:*** the value of major cereals per hectare is considered to measure the productivity level at each household farmland. It is calculated in terms of birr taking the local market price with the amount of output produced (KG/HA).

ii. ***Consumers' price index for manufactured products:*** the CPI for manufactured products (i.e. cigarettes & tobacco, clothing and footwear, construction materials, water, fuel & power, furniture and household equipment) is considered in order to see the effect of price in our model.

iii. ***Total expenditure by household***: the total amount of expenditure for all products from every sector is considered.

iv. ***General consumer price index***: the general price index is considered in order to see the effect of price on the budget share of manufactured output by households

v. ***Distance from the nearest town***: the distance from the nearest town in KM is considered in order to see its effect on consumption of manufacturing output.

vi. ***Availability of electricity***: a dummy variable is included to see the effect of having electricity in the household's consumption of manufactured output. A value of "1" is given for the household with electricity and "0" otherwise.

vii. ***Availability of electricity in the nearest town***: it is believed here that the rural villages has a close relation with the nearest urban town. Thus, the infrastructure in the nearest urban town will also has an impact in the consumption behavior of the households in the rural villages. In order to see this kind of relations we consider a dummy variable for electricity in the town taking "1" for having electricity and "0" otherwise.

viii. ***Availability of public pipe water***: another infrastructural variable that is considered here is the availability of public pipe water in the rural villages. A value "1" is given for those that have public pipe water and "0" otherwise.

ix. ***Distance from the nearest telephone service***. A telephone service is important for marketing purposes, in order to see this effect we take the distance from the nearest telephone service as a proxy.

x. ***Age of the household head***. The age of the household head is included here in order to create a comparison among the consumption behavior of households at different age. The

xi. ***Sex of the household head.*** A male dummy will be included in the model taking '1' for male headed families and '0' for female headed ones.

xii. ***Education level of the household head.*** Education here is considered to have an impact on a person's perception towards product types to be consumed and his/her decision could also be affected by the level of literacy he/she had.

xiii. ***Family size.*** The size of the family will also be considered in order to see its implication on the consumption pattern of the household.

xiv. ***Regional dummies.*** Regional dummies are considered to see differences among those regions taking one of the regions as a reference.

Chapter 4

DESCRIPTIVE STATISTICS

In this part we tried to show what was happening at a country level during the same time horizon (i.e. 1994-2009) that we were conducting the study. It could help to compare certain facts of the households with what was happening at the national level during the time.

4.1. Trend of Labor Participation

The labor participation on a given farm land is described by different farm level activities that could help to produce agricultural outputs. Major activities include planting and land preparation, general cultivation (i.e. weeding, watering and pruning) and harvesting (i.e. processing for sale and storage). These activities mainly need the participation of labor (i.e. both family and hired laborers) in order to be implemented.

Table 4.1 Trend of labor participation in farm activities

	1994		1999		2004		2009	
	mean	S.D.	mean	S.D.	Mean	S.D.	mean	S.D.
labor[5]	10.5278	12.34	10.5271	13.8035	12.2789	11.7804	13.9290	16.2837

Source: ERHS and own computation

[5] Here labor refers to the amount of labor that participated on all kinds of farm activities on each individual farms.

From table 4.1 it is simple to observe that there is an increase in labor participation in farm activities as of the year 2004. Let's compare this result with the facts at the macroeconomic level with observing the employment situation by sector.

The agricultural sector is still dominant in creating employment and it is difficult to observe a significant change in its share from the total employment. The manufacturing sector is still too backward in creating an employment opportunity which could imply a difficulty of realizing a structural transformation in the economy soon.

Table 4.2 Employment by sector

	employment (millions)				Annual average growth (%)			% total employment			
	1996	1999	2005	2011	1996-99	1999-05	2005-11	1996	1999	2005	2011
Agriculture	18.3	19.9	25.2	26.7	2.8	4	1	81	79.9	80.2	78
Mining & Quarrying	0.1	0	0.1	0.1	-40.1	31.8	-0.9	0.3	0.1	0.3	0.2
Manufacturing	0.5	1.1	1.5	1	28.9	5.5	-6.6	2.3	4.5	4.9	3
Elect & Water	0	0	0	0.1	-8.7	2.7	7.4	0.2	0.1	0.1	0.1
Construction	0.2	0.2	0.4	0.5	11.6	11.8	1	0.7	0.9	1.4	1.4
Trade	1.6	2.3	2.4	3	13.5	0.5	3.7	7.1	9.4	7.7	8.7
Transport & Coms	0.1	0.1	0.1	0.2	15.6	3	6.1	0.4	0.5	0.5	0.6

Source: CSA and own computation

4.2. Consumption share of manufactured outputs

In this particular study we included certain manufactured products (i.e. clothes, shoes, fabrics, linens (sheets, towels and blanket), lamp/torch, kitchen equipment and building materials) based on their availability from the data. From Table 4.3 one can observe that

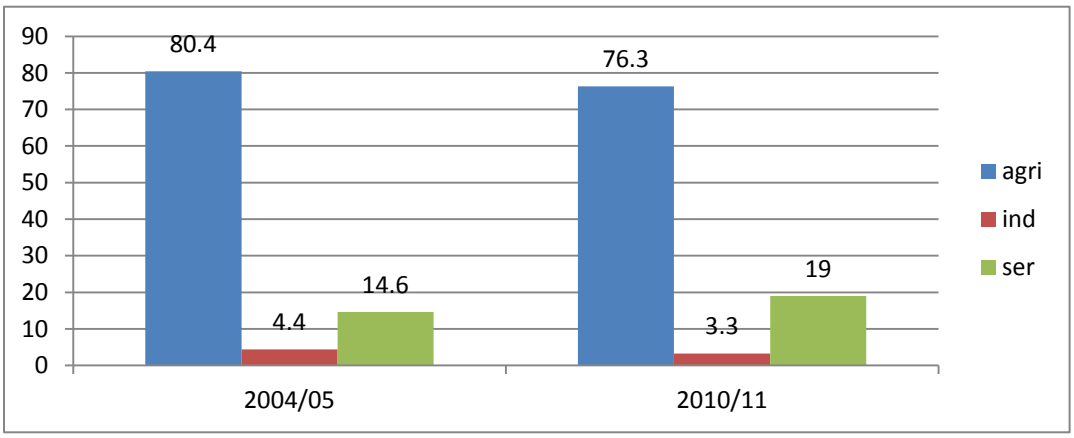
there is no that much a significant change in the share of manufactured products from the total expenditure on consumption.

Table 4.3 Trend of budget share for manufacturing output

	1994		1999		2004		2009	
	mean	S.D.	Mean	S.D.	Mean	S.D.	mean	S.D.
Share of manufacturing output	0 .161	0.326	0 .069	0.104	0.114	0 .184	0.093	0.149

Source: ERHS and own computation

Fig 4.1 household consumption by sector (%)



Source: CSA, HICE survey and own computation

The data at the national level is also not that much significantly different from what we get from ERHS data. It clearly shows as still agricultural outputs are still dominant accounting for 7 more than 75% of the total consumption expenditure.

4.3. Patterns of Agricultural Productivity

In order to measure the agricultural productivity at an individual farm level we used the value of major agricultural outputs per hectare. The production of teff (in different types),

barley, wheat, maize, sorghum, coffee, chat and enset are taken in to consideration. The price per kilogram of a given agricultural output is taken from the nearby market price around the rural villages. We can observe that there is an increase in the value of agricultural output as of the year 2004 without neglecting the impact of the rise in price.

Table 4.4 Trend of Agricultural Productivity

		1994		**1999**		**2004**		**2009**	
	obs	mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Value of agri output (KG/HA)	846	9041.8	86188.86	8513.35	23853.02	106302.5	2887844	335272.9	335272.9
Value of agri output (KG/HA)	742	9640.1	91240.35	8392.69	23062.63	120037.6	3083581	380049.5	5508326

n.b. the variables used above are the same but, the number of observations differ because we are using two independent models and some observations are filtered out during data clearing process.

Source: ERHS and own computation

When we see the performance of the agricultural sector at a national level there is a progress in terms of productivity and expansion. Nevertheless, it is still in question whether it could make that much difference in the transformation of the country's economy.

Table 4.5 key indicators of Agricultural sector performance

	year			
Indicators	1994	1999	2004	2009
crop production (index)	51.55	71.34	92.25	118.92
cereal yield (KG/HA)	974.1	1124.6	1170.9	1652.9
employment in agriculture (% of total employment)	89.3	-	82.09	-
agricultural land (% of land area)	30.47	30.67	33.1	34.98

Source: WDI & GDF

The cereal yield which is calculated in terms of kilogram per hectare shows a progress and can be noted as good indicator for a realization of productivity in the agricultural sector. There is also an increase the amount of land that is cultivated even though the progress is not that much promising. The employment in the agriculture sector is also declining which could be a good signal for a moving out of labor from the sector.

4.4 Sectoral Distribution in the Economy

During the period (1994-2009) where the survey was conducted the net output or the value added by each sector for the gross domestic product can be presented in the following table

Table 4.6 Value Added By Sectors as Percentage of GDP

	year			
Indicators	1994	1999	2004	2009
Agriculture, VA (% of GDP)	58.13	49.5	44.18	50.79
Manufacturing, VA (% of GDP)	4.45	5.48	5.32	3.99
Industry, VA (% of GDP)	9.82	12.87	14.05	10.75
Service, VA (% of GDP)	32.05	37.62	41.76	38.45

Source: WDI & GDF

From table 4.6 it can be pointed out that still agricultural sector is the dominant sector contributing about half of the total gross domestic product. Though, there is a sign for a decline on its share of GDP the progress from the industrial sector is not a promising one to come to the front rather the service sector is taking the step. A recent report by MOFED strengthens this fact showing the service sector is taking the lead in the economy.

Table 4.7 Sectoral distribution in terms of percentage of GDP

Sectors	2009/10	2010/11	2011/12	2012/13	
				plan	Actual
Agriculture	41.6	45.6	44	38.7	42.9
Industry	12.9	10.6	11.1	15.3	12.4
large & medium scale manufacturing	2.6	2.6	2.8	-	2.9
micro & small scale manufacturing	1.3	1.2	1.4	-	1.3
Services	45.6	44.5	45.6	45.3	45.2

Source: MOFED

The composition of the agricultural sector starts to decline as of 2011/12 while the service sector starts taking the leading role. But, the industrial sector which is known with its productive nature and ability to catalyze a transformation process of a given economy is not still promising in the growth of its share in the economy.

In order to see the changes in those sectors we can compare their annual growth rate of their net output. From table 4.8 we can see that the industrial and service sectors are taking the lead in growth at the end of the year this particular survey is conducted (i.e. 2009).

Table 4.8 Annual Value Added Growth of Sectors

Sectors	1994	1999	2004	2009
Agriculture, value added (% growth)	-2.58	3.39	16.9	6.36
Manufacturing, value added (% growth)	11.24	8.7	7.26	8.62
Industry, value added (% growth)	7.2	5.48	11.64	9.67
Service, value added (% growth)	10.26	8.3	4.72	14.92

Source: WDI & GDF

The growth rate of the industrial sector is becoming dominant if we further extend the time for our data even if, the share in GDP is still 12 % in 2012/13. “Despite some gains

of the industrial sector in increasing its role in the economy to about 12 percent, the economy is not yet set on a high level transformation trajectory. The industrial sector particularly the manufacturing industry has to grow faster to set the economy on a sustainable path of structural transformation." (MOFED, 2014).

The recent data about the growth rate of the sectors and the economy can be depicted as follows in order to consider recent facts.

Table 4.9 Annual Growth Rates of Real GDP and Economic Sectors

	2009/10	2010/11	2011/12	2012/13
Real GDP growth rate	10.5	11.4	8.8	9.7
Agriculture	7.6	9	4.9	7.1
Industry	10.8	15	17.1	18.5
Service	13.2	12.5	10.6	9.9

Source: MOFED

Fig 4.2 Annual Growth Rates of Real GDP and Economic Sectors

Source: MOFED

4.5. Pattern of labor participation by selected variables

Here we tried to show the variability of labor participation on farm activities with some selected explanatory variables. Sex of the household head is a significant variable (i.e. -5.6006) where it can bring a difference on the level of labor participation on farm activities. There is also a significant difference of labor participation between families with literate household heads and the ones with illiterate household head. The labor participation of households with a literate household head is significantly higher than that of the households with an illiterate household.

When we see the variability of the labor participation with the availability of certain infrastructures they found to be significant. The labor participation in farm activities of households with the availability of electricity in their village and nearest town is found to be significantly higher than those without it. There is a reverse case that can be observed in the case of the availability of public pipe water though it is significant.

Table 4.10 pattern of the labor participation on farm activities by some explanatory variables

Variables	Categories	Obs	Mean	standard dev	t-value
sex of the household head	male headed household (=1)	2642	12.5133	11.9994	-5.6006
	female headed household (=0)	741	9.33063	8.29503	
education level of the household	litrate (=1)	1346	13.8336	15.7763	-6.9955
	illitrate (=0)	2037	10.4831	12.0131	
availability of electricity	electricity (=1)	621	14.0064	18.1089	-4.4112
	no electricity(=0)	2762	11.3237	12.49	
availability of public pipe water	pubic pipe water (=1)	841	10.3603	11.0135	3.5531
	no public pipe water (=0)	2542	12.2978	14.4888	
electricity in the nearest town	electricity (=1)	2947	12.2613	14.1468	-4.9189
	no electricity(=0)	436	8.80734	10.0076	

Source: ERHS and own computation

4.6. Pattern of consumption of manufactured output by selected variables

When we come to the variability of households' consumption of manufactured products with certain variables the results were not that much significant. We found that there is no significant difference in the households' consumption pattern of manufactured products depending on sex, education and the availability of public pipe water. While we found a significant difference between household's consumption pattern of manufactured products depending on the availability of electricity in both their village and the nearest town.

Table 4.11 pattern of households' consumption of manufactured products by some explanatory variables

variables	Categories	Obs	Mean	standard dev	t-value
sex of the household head	male headed household (=1)	2362	0.113088	0.219913	-1.766
	female headed household (=0)	606	0.961291	0.171122	
education level of the household	literate (=1)	1231	0.10993	0.15892	-0.0664
	illiterate (=0)	1737	0.109409	0.241172	
availability of electricity	electricity (=1)	559	0.866616	0.148901	2.8602
	no electricity(=0)	2409	0.114954	0.222585	
availability of public pipe water	pubic pipe water (=1)	2596	0.111662	0.220462	-1.3898
	no public pipe water (=0)	372	0.095411	0.125305	
electricity in the nearest town	electricity (=1)	740	0.092016	0.158309	2.6234
	no electricity(=0)	2228	0.115474	0.225467	

Source: ERHS and own computation

4.7. Summary statistics of variables used in both models

Our first model is designed to show the relationship between the labor participation on farm activities with taking the agricultural productivity level of an individual farm as a

major explanatory variable. It also includes other demographic characters of the household head (i.e. age, sex and literacy level) and the household size. Variables at a village level are also considered in order to capture the effects of certain characteristics of the surrounding on the dependent variable.

The number of observation considered is around 3384 that is filtered from a total observation which is more than 5150. Omitting those observations with much missed values the study tried to use the remaining 3384 in order to see the effects of those explanatory variables on the dependent variable. Log transformation of some variables is also conducted in order to assure a normality condition in the model.

The maximum amount of labor participation on farm activities is recorded to be 220 while we get a zero value for certain households as a minimum. The maximum age of a household head recorded is 120 with a mean age to be 49.7. The maximum distance to the nearest town is about 25 kilometers while 2 KM is the minimum distance recorded. The mean household size is to be 6.13 while the maximum family size is 22 while 1 is the minimum.

Table 4.12 summary statistics of model 1

Variable	description of variables	Obs	Mean	std.dev.	min	Max
labor	labor participation on farm activities	3383	11.81614	13.73143	0	220
agripro	agricultural productivity value of KG/HA	3384	114782.6	2958473	0	1.30E+08
age	age of the household head	3383	49.69701	15.00795	15	120
sex	sex of the household head	3384	0.781028	0.413611	0	1
hhsize	household size	3384	6.133274	2.645745	1	22
litracydummy	litracy dummy	3384	0.39805	0.489568	0	1
distance	distance from the nearest town	3384	12.34959	6.29261	2	25

distancetel	distance from the nearest telephone service	3384	9.319444	7.48078	0	25
electricit~y	electricity dummy	3384	0.183511	0.387142	0	1
twnelectri~y	the nearest town with electricity dummy	3384	0.871158	0.335074	0	1
pupipewate~y	public pipe water dummy	3384	0.248523	0.43222	0	1
amharadummy	amhara region dummy	3384	0.343972	0.475102	0	1
oromyadumm y	oromya region dummy	3384	0.28487	0.451419	0	1
snnpdummy	snnp region dummy	3384	0.241135	0.427835	0	1
tigraydummy	tigray region dummy	3384	0.130024	0.336379	0	1

Source: ERHS and own computation

For the regions we consider amhara dummy taking "1" if the region is in Amhara and "0" otherwise. This is the same for both Oromiya and SNNP dummies and we take tigray region as a reference.

When we come to the second model, it is mainly proposed to show the relation between the industry and the agricultural sector using consumption as a linking variable. The share of manufacturing expenditure from the total consumption expenditure is assumed to be a dependent variable and agricultural productivity, price indexes and other demographic characters are included as explanatory variables.

The share of manufacturing expenditure is assumed to be in between 0 and 1 as it is a ratio from total consumption expenditure. The mean share of manufacturing consumption expenditure is around 1% which is too low. Consumer price indexes were included in order to study the consumers' price elasticity. The data for consumers' price indexes is collected from the central statistics authority as it is not available from the survey for manufacturing and general price indexes. Moreover, we tried to use consumer price

indexes on region (i.e. Amhara, Oromiya, SNNP and Tigray) basis rather than the national one.

Table 4.13 summary statistics of model 2

Variable	Description of variables	Obs	Mean	Std. Dev.	Min	Max
manushare	the share of manufacturing expenditure from the total	2968	0.1096	0.210954	0	0.98432
agripro	agricultural productivity value KG/HA	2968	129530	3158742	0	1.30E+08
age	age of the household head	2966	49.347	14.70019	15	100
sexdummy	male headed household	2968	0.7958	0.403168	0	1
familysize	household size	2968	6.247	2.625224	1	22
distance	distance from the nearest town	2968	12.201	6.100233	2	25
distancetel	distance from the nearest telephone service	2968	9.1338	7.273924	0	25
edudummy	literacy dummy	2968	0.4148	0.492763	0	1
cpiman	consumer price index for manufactured products	2968	100.28	35.1613	70.876	167.7
conscpi	Total consumption expenditure/CPI	2968	33.981	29.16153	0.706	274.164
electricit~y	electricity dummy	2968	0.1883	0.391051	0	1
twnelectri~y	the nearest town with electricity dummy	2968	0.8747	0.331156	0	1
pupipewate~y	public pipe water dummy	2968	0.2493	0.432696	0	1
amharadummy	amhara region dummy	2968	0.3733	0.483766	0	1
Oromyadummy	oromya region dummy	2968	0.2722	0.445186	0	1
snnpdummy	snnp region dummy	2968	0.2493	0.432696	0	1
tigraydummy	tigray region dummy	2968	0.1051	0.306761	0	1

Source: ERHS and own computation

CHAPTER 5

ECONOMETRIC ANALYSIS

5.1. Analysis of the model with labor participation as a dependent variable

5.1.1. Model selection test

Before dealing with any panel data it is important to choose between the two estimators (i.e. fixed effect estimators and random effect estimators). The Housman test is conducted where the null hypothesis is that the preferred model is random effect vs .the alternative fixed effects. It basically tests whether the unique errors (ui) are correlated with the regressors; the null hypothesis is they are not.

From the Housman test result, we selected the fixed effect model which is conditional upon the values of α_i. Verbeek, (2004) noted that in case of larger population of individual units, a random effects frame work seems appropriate but there are conditions where the fixed effect may be preferred. This may be for that case that α_i and x_{it} are correlated.

5.1.2. Estimation results and Analysis

After conducting the necessary tests for the model results from the regression are presented with analysis. Most of the explanatory variables used in the fixed model are resulted to be statistically significant at 99% level of confidence interval. The details on tests and regression results are depicted in the annexes.

Table 5.1 Regression Result

The amount of labor on individual farm	fixed effect		
explanatory variables	Coef	t-value	std.err
agricultural productivity	0.537873***	6.06	0.008874
age of the household head	0.469461***	4.39	0.106844
household size	0.286794***	5.2	0.551849
distance from the nearest town	1.180294***	2.12	0.557201
distance from the nearest telephone service	0.028655	0.7	0.040668
sex of the household head	-0.81901	-1	0.082026
literacy of the household head	0.206839***	3.76	0.054961
availability of electricity	0.307764***	4.81	0.063988
availability of public pipe water	0.166192	1.9	0.087354
Cons	-3.69614	-2.6	1.419993

n.b. *** is significance at 1%

Agricultural productivity which is measured as the value of major agricultural outputs per hectare is found to be statistically significant and it has a positive coefficient. This result can be interpreted as the more productive is agriculture the more will be labor participation on farm activities. Intuitively this shows us that the agricultural production is still dependent on labor input and an improvement in its productivity even did not decrease its dependency on the labor force. This would imply that the labor force is still in the agricultural sector even if, there is improvement in the productivity level.

We can forward some reasons at this stage for the fact that the labor participation has a positive relation with agricultural productivity. One could be from the character of the agricultural sector itself; if the increase in productivity comes from the labor participation on farm activities (i.e. increasing returns to scale) it could be a result of an increase in labor demand. The other one could be the situation in the industrial sector; the industrial

sector may not create a significant employment opportunity for the rural labor and may leave them with a single choice in the labor market.

Matsuyama, (1992) noted that in an open economy the relationship between agricultural productivity and economic growth of a country depends on the initial pattern of comparative advantage that a nation acquires. A nation with a comparative advantage in agriculture will have slower manufacturing sector productivity than the rest of the world. The nation's ultimate production will be towards agricultural production and thus, the employment in the manufacturing sector will shift down when the productivity in the agricultural sector increases.in other words, a process of deindustrialization will takes place which hampers the possibility of having a faster economic growth. An economy with a productive agriculture sector squeezes out the manufacturing sector and hamper the industrialization of a given economy.

What is stated above could give us some clue on explaining the existence of the positive relationship between the two variables though it may deviate from some facts on the ground. There could be a loose relationship between agricultural and non-agricultural sectors in most developing countries in terms of labor market. Jatta, (2013) the sectors of employment (agricultural and non-agricultural) appear to have a limited importance in determining the household uses a wage employment as a choice. Rather, the assets of the individual household and in particular educational and infrastructural investment are critical in providing better opportunities in the labor markets of most developing countries.

Tocco et.al (2012), try to review studies on agriculture and rural labor markets and reveals that farm production characteristics like land ownership, land size, livestock etc. are

positively related with more on-farm labor. At the same time, on-farm labor returns and farm output prices are positively associated with labor supply on the farm. From here, we can see that a better agricultural sector could make a rural household laborer to decide to supply more for on-farm activities rather than off-farm one. Though our model didn't not include farm production characteristics as explanatory variable we believe that there effect can be observed through agricultural productivity.

The situation in the labor market should be also considered as to whether there is a situation for having a choice for a given rural laborer to decide between agricultural and non-agricultural employment or not. During the time this survey was conducted (i.e. 1994-2009) the improvement in the industrial sector at the country level is not that much significant in creating employment opportunities. Thus, this may leave the rural household laborer with a single choice that is to stay in the agricultural sector.

Other explanatory variables considered in the model are also found to be statistically significant and have a positive relation with the labor participation on farm activities. Age of the household head is found to have a significant positive relation. This could be justified as the older the household head the more will be the experience and as most household heads are considered to be decision makers they would increase the amount of labor to participate on their farm land depending on the return. Older household heads are also likely to have a larger family even they could have also had a larger extended family which will increase the probability of having more family labor.

Household size is also found to be significant with having a positive relation with the participation of labor on farm activities. This could result from the characteristics of the

labor itself; most of the farm labor in developing countries is largely dominated by family labor including child labor. Thus, the more the size of the family it is likely to have a more labor that could participate on the farm land. Literacy level of the household head is also found to be significant and positive which signals households with a literate household head had a probability of having more labor to participate on their farm. This could be due to the fact that literate households could have the knowhow on the techniques of production and the importance of using more laborers on their farm activities. Tocco, (2012), at low level of education, an increase in education increases farm labor while higher education are associated with less on-farm labor.

Distance from the nearest urban town is included in the model to show some effects of the urban characters in to the rural villages. The result shows that it has a significant positive relation with labor participation on farm activities. In other words, it can be explained as the far the village is from the nearest urban town the more will be the labor participation on farm activities. This could be to the situation of what the labor market looks like. Bagamba et.al (2009) road access has a positive effect on the time that is to be allocated for off-farm activities. This access for off-farm opportunities can take away more labor from farm production. Thus, investment in road infrastructure will improve the bottlenecks in labor markets and improve resource allocation between farm and non-farm activities.

Improvement in the road infrastructure is important as it determines the distance for a given rural village from the nearest town. There could also be a situation in which the development of road infrastructure plays an important role in the process of urbanization and improving the livelihood of the rural household. Thus, the result from our regression

could be justified as villages with a distance far from a nearest town could be characterized by a tightened chance of getting an off-farm opportunity for a given rural household laborer.

The availability of electricity in the rural village is also considered to have a significant positive relation with the labor participation on farm activities which is found to be unlikely. Thus, it can be justified as the availability of electricity could improve the livelihood of households and may also possibly increase the working hour of laborers. Dinkelman (2010) found that the infrastructure of electricity appears to increase the working hours of both men and women in rural South Africa. It also increase employment by releasing women from home production and enable them to participate in micro enterprises. Though his work involves an off-farm activity we can deduce the advantage of getting an increment in working hours for farm works also.

Other variables like sex of the household head, telephone service and availability of public pipe water becomes insignificant. This shows there is no significant difference between the households whether they are headed by males or females. Other infrastructural developments like telephone and public pipe water are not also significant in determining the participation of labor on farm activities.

5.2 Analysis of the Model with Expenditure Share of the Manufacturing Outputs as a Dependent Variable

5.2.1. Model selection test

A Housman test is conducted as in the first model in order to test the existence of consistency between the estimates in both fixed and random effect models. Based on the test conducted we chose the random effect model which is not conditional up on the individual α_i's rather integrating them out (verbeek, 2004).

5.2.2. Estimation Results and Analysis

After selecting the appropriate model we tried to discuss the major results in this part using some empirical works that can support our justification. As our model is a random effect we have a number of variables which are time invariant. The major objective of this model is known to be analyzing the potential of the rural households demand for manufactured products. In order to see this we tried to take the budget share of manufactured products as a dependent variable and tried to see the effect of agricultural productivity with other variable including price indexes.

Table 5.2 Regression Result

Explanatory Variables		random effect	
	coef.	z-value	std.err
Agricultural Productivity	-0.00375***	-2.2	0.001707
Age Of The Household Head	-0.01787	-1.32	0.013582
Sex Of The Household Head	0.00988	0.94	0.010529
Household Size	0.045364***	5.1	0.008897
Distance From The Nearest Town	-0.00348	-0.33	0.010552

Distance From The Nearest Telephone	0.009023	1.57	0.005744
Literacy Of The Household Head	0.006375	0.73	0.008776
Consumer Price Index For Manufactured Products	-0.03556***	-2.11	0.016836
Ratio of total consumption expenditure with CPI	-0.0399***	-6.89	0.005794
Availability Of Electricity	-0.00587	-0.43	0.013624
Availability Of Electricity In The Nearest Town	0.013816	0.89	0.015448
Availability Of Public Pipe Water	-0.01112	-1.03	0.010851
Amhara Region Dummy	0.029659	1.83	0.016227
Oromiya Region Dummy	0.054879***	2.83	0.019383
Snnp Region Dummy	0.036521	1.83	0.019962
Cons.	0.355619***	4.01	0.088693

n.b. *** is significance at 1%

Agricultural productivity is found to be statistically significant with a negative coefficient that shows it has a negative relation with the rural household's consumption share of the manufactured products; Further From the IV regression result it found to be insignificant. From the survey we considered certain types of manufactured products which are both durables and non-durables outputs. Abay, (2011) found that the increment in agricultural productivity will subsequently increase the income and per capita expenditure of the households which will in turn generate a demand for durables (i.e. mobile, radio, furniture….construction materials etc.). But, it fails to increase the demand for non-durable manufactured products ((i.e. cloth, shoe, cosmetics…etc.). the non-agricultural income (i.e. non-farm income) is more important in creating demand for non-durable manufactured products than the income form crop selling (i.e. on-farm income).

What we can deduce form above is that the increment in agricultural productivity tends to increase the demand for durable manufactured items. Most of these items are also considered to be as an asset by the rural households and it could be difficult to say there is a promising market that had been created for the industrial sector depending on this effect only. When we return back to our result an increase in one unit of KG/HA will cause a decrease in the budget share of manufacturing products by a very low amount (i.e. 0.00375). Thus, this could show as the rural households could have a tendency for other products rather than manufactured products while productivity increases.

It could also be due to the inelasticity nature of rural households' consumption pattern though there is a change. Ayalew, (2009) studying the impacts of irrigation on the consumption pattern of food found that there is a stagnant nature on the households food consumption pattern. Even though, the irrigation changes their overall agricultural system and in turn increases the agricultural income of the households. In order to clarify this more we need to see the demand elasticity for manufacturing products by the rural households. The magnitude and sign of elasticity will provide us more information about the consumption pattern of the rural households.

In order to see the own price elasticity of manufacturing products we can begin with our initial budget share equation.

The budget share of manufactured products is expressed in our model as follows;

$$w_{man} = \alpha_{man} + \gamma_{man,man} logp_{man} + \beta_{man} \log\left\{\frac{x}{p}\right\} + \sum_i \theta_i z_i + e_i \text{.....eqn(1)}$$

From the result that we get from the regression this can be rewritten as;

$$w_{man} = 0.355619 - 0.03556 logp_{man} - 0.0399 \log\left\{\frac{x}{p}\right\} + \sum_i \theta_i z_i + e_i \text{.....eqn(2)}$$

Thus, own price elasticity of demand for manufactured products can be calculated from the parameter estimates using the following formula.

$$\varepsilon_{man,man} = -1 + \frac{(\gamma_{man,man} - \beta_{man} w_{man})}{w_{man}} \text{.....eqn (3)}$$

Substituting the respective results this could be rewritten as;

$$\varepsilon_{man,man} = -1 + \frac{(-0.03556 + 0.0399 w_{man})}{w_{man}} \text{.....eqn (4)}$$

If we consider the mean value for the budget share of manufactured products (i.e $\overline{w_{man}}$=0.109625) we would get an own price elasticity to be;

$$\varepsilon_{man,man} = -1 + \frac{(-0.03556 + 0.0399 * 0.109625)}{0.109625} \text{.....eqn(5)}$$

$\varepsilon_{man,man} = -1.28448$, which is elastic

The own price elasticity of demand for manufactured product is found to be negative and is greater than one in absolute value which indicates an elastic demand. This elastic nature of demand shows that there is a quantity demand that falls more proportional to the price

increment. The effect of price in our model can support our result about the relationship between agricultural productivity and the consumption share of manufactured products.

It is obvious that an increase in the output productivity will increase the income from agriculture for the rural households. But, this increase in income did not create a demand for manufactured products by the rural households rather it declines. The effect of the price increase could be a justification in line with consumption behavior factors or due to other factors that our model did not consider.

There other significant variable that is to be found significant is the household size and it has also a positive coefficient. This could be due to the fact that households with large family size are likely to use more non-durable items (i.e. cloths) and their could also be a possibility of having a non-farm income by household members that in turn could be used for consumption of manufactured products. Other explanatory variables found to be insignificant except a regional dummy oromiya.

Chapter 6

CONCLUSION AND POLICY IMPLICATIONS

6.1. Conclusion

This paper tries to see the implication of agricultural productivity for industrialization process and structural transformation of Ethiopian economy. Using a 15 years panel data (i.e. four rounds with 5 year gaps) that is collected from 15 rural household villages, the study tries to investigate the condition on the structural transformation of the economy from a microeconomic perspective.

We employed a model developed by Matsuyama, (1992) with some minor manipulations of our own in order to have a link between the agricultural sector and industrial sector. Particularly we tried to see the effect of agricultural productivity on the industrial sector from both employment and demand perspectives. We also tried to investigate the co-existing relationship between Ethiopia's traditional/agricultural sector with modern/industrial sector using hypotheses from development and growth theories (i.e. Lewis development theory).

The time period of our data (i.e. 1994-2009) is found to be also helpful in order to see the changes in the economy due to the fact that this period was where the major economic plans were implemented. Furthermore, the major economic strategy (i.e. ADLI) is found to be the fundamental element for economic policies designed by the government during the period. The millennium development goals (MDGs) are also start to being implementing in this time span.

Considering these facts we tried to see the development of agricultural sector and its spillover effects for the other sectors; mainly the industrial sector. In order to see this we designed two independent econometric models; the one taking labor participation on farm activities as a dependent variable and the other taking the expenditure share on manufactured products as dependent variable. The agricultural productivity which is measured as the value of major agricultural outputs per hectare is also included in order to see the effect of agricultural development in both models. Certain macro level data were also included for comparison purpose and to see facts after the end of the survey period (i.e. 2009).

The major results from both of our models show that there is no evidence for having a structural transformation of the economy depending on the development of the agricultural sector. Though there is a growth in the productivity of agricultural sector still there is high labor participation rate in farm activities. The farm income of rural households is believed to be increasing as a result of an improved productivity in agricultural output and expected to change the consumption pattern of the rural households. But, unfortunately this did not happen based on our result; the household consumption expenditure for manufactured products declines while productivity of agriculture in increasing.

In order to experience a structural transformation in the economy it is believed that the employment share in the agricultural sector should decline beside with an increase in the consumption share of industrial products from the total consumption expenditure. The result that we get totally deviates from the fact that is shared by most scholars about the concept of structural transformation of a given economy. Moreover, we can say that the agricultural sector is not capable enough in playing a role for the development of the

industrial sector which shadows the achievement of the Agricultural Development Led Industrialization /ADLI/ economic strategy.

In general the major results indicate that possibility of achieving a structural transformation is difficult through unbalanced growth[6]. It is also difficult to experience a structural change with giving a prior for the agricultural sector only. We believe that in order to achieve a change in the structure the option is to shift the focus towards the industrial sector rather than focusing on the agricultural sector only. Furthermore, even if it is difficult to conclude about the condition based on this data at least it helps us to realize some facts regarding the progress of agricultural sector and its implication towards the realization of a structural transformation of the country's economy.

6.2. Policy Implications

Depending on our major findings from the analysis there are some issues that we can elaborate in detail. The positive relation between agricultural productivity and labor participation on farm activities needs to be altered. In order to change this fact we could have possible solutions from both the agricultural and industrial sector. Making certain changes on the production function of the agricultural production system (i.e. using technology and other inputs substituting labor) could make a difference. Improving the production technology mix could cause the agricultural sector not to be that much labor intensive which can help to release labor from this sector.

Releasing labor without having the proper industrial sector potential to absorb it will be worthless. Thus the solution should also be from the industrial sector also; the rural labor

[6] A growth which is not based on simultaneous and coordinated expansion of several sectors of the economy

should have to have a labor market that could let it have a choice between whether to stay in the traditional sector or not. This decision will also be affected by the market wage for labor which intern determined by other factors including the concentration of major industries in the nation.

Other policy options could also be used in order to transform the economy from the employment perspective. Improving the availability of major infrastructure including education could help in accelerating urbanization process in line with major investment activities from both foreign and domestic sources. This could create more employment opportunity for the rural households and could improve their livelihood which will further have impact on their consumption patterns.

The consumption pattern of rural households is heavily related with their employment condition also. We did see from our result that income from farm activities are not creating a demand for the products produced by the industrial sector. The negative elasticity of demand for manufactured products could be changed simultaneously with the policy options that we could use in order to improve the condition of employment. If the labor gets a chance of employment in the manufacturing sector there could be a possibility of a change in composition of demand by the individual laborer. This change could also be transmitted towards other family siblings also which could contribute towards creating a demand by the households for manufactured products.

Finally we could recommend that further studies need to be done in order to see the effects of changes in a given sector on the remaining sectors. Other kinds of methodologies could also be used in order to create a framework for the relationship between sectors of the

economy and their inter relations. This paper uses a partial equilibrium analysis which may lack consideration of many variables thus results may be found difficult to make general conclusions. Thus, doing further investigations is too helpful for policy makers and scholars in the field.

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Annex1 a t-test table between labor and some selected variables

```
. ttest labor, by(sex)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	741	9.330634	.5275155	14.35967	8.295029	10.36624
1	2642	12.51325	.2620736	13.47068	11.99936	13.02714
combined	3383	11.81614	.2360831	13.73143	11.35326	12.27902
diff		-3.182613	.5682642		-4.296789	-2.068437

```
    diff = mean(0) - mean(1)                                      t =  -5.6006
Ho: diff = 0                     degrees of freedom =     3381

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

This can interpreted as the labor participation of female headed households is significantly (1%) less than male headed households.

```
. ttest labor, by(litracydummy)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	2037	10.48306	.2661704	12.0131	9.961069	11.00506
1	1346	13.83358	.430015	15.77633	12.99001	14.67715
combined	3383	11.81614	.2360831	13.73143	11.35326	12.27902
diff		-3.350518	.4789526		-4.289584	-2.411452

```
    diff = mean(0) - mean(1)                                      t =  -6.9955
Ho: diff = 0                     degrees of freedom =     3381

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

The labor participation of households with an illiterate household head is significantly (1%) less than the literate household head.

```
. ttest labor, by(electricitydummy)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	2762	11.32368	.2376571	12.49001	10.85767	11.78968
1	621	14.00644	.7266851	18.1089	12.57938	15.4335
combined	3383	11.81614	.2360831	13.73143	11.35326	12.27902
diff		-2.682763	.6081732		-3.875187	-1.490338

```
    diff = mean(0) - mean(1)                                      t =  -4.4112
Ho: diff = 0                                     degrees of freedom =     3381

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000

. ttest labor, by(pupipewaterdummy)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	2542	12.2978	.2873725	14.48882	11.73429	12.86131
1	841	10.36029	.3797762	11.01351	9.614864	11.10571
combined	3383	11.81614	.2360831	13.73143	11.35326	12.27902
diff		1.937512	.5453006		.8683594	3.006664

```
    diff = mean(0) - mean(1)                                      t =   3.5531
Ho: diff = 0                                     degrees of freedom =     3381

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9998         Pr(|T| > |t|) = 0.0004          Pr(T > t) = 0.0002


. ttest labor, by(twnelectricitydummy)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	436	8.807339	.4792753	10.00756	7.865356	9.749323
1	2947	12.26128	.2605958	14.14678	11.75031	12.77225
combined	3383	11.81614	.2360831	13.73143	11.35326	12.27902
diff		-3.453943	.7021814		-4.830686	-2.0772

```
    diff = mean(0) - mean(1)                                      t =  -4.9189
Ho: diff = 0                                     degrees of freedom =     3381

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Annex2 a Housman test for estimation of labor participation on farm activities

anne

```
. hausman FE
```

	Coefficients (b) FE	(B) .	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lagripro	.0537873	.0656927	-.0119054	.0048911
lage	.4694608	.107053	.3624079	.0889082
sex	-.0819008	.000044	-.0819448	.0677365
lhhsize	.2867942	.3877774	-.1009832	.0405174
litracydummy	.2068385	.1774476	.0293909	.0384752
ldistance	1.180294	-.1179829	1.298277	.5545698
ldistancetel	.0286554	.1210146	-.0923591	.0317526
electricit~y	.3077639	.3397935	-.0320295	.035709
pupipewate~y	.1661919	.0308419	.13535	.0722446

```
                b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                chi2(9) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                        =       63.06
              Prob>chi2 =      0.0000
```

Annex3 hetroskedasticity and multicollinearity tests

```
. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of llabor

         chi2(1)      =     7.21
         Prob > chi2  =   0.0073
```

```
. estat vif
```

Variable	VIF	1/VIF
oromyadummy	4.36	0.229425
snnpdummy	4.24	0.236014
ldistance	3.58	0.278981
amharadummy	3.34	0.298994
ldistancetel	2.51	0.397932
twnelectri~y	1.62	0.618009
pupipewate~y	1.47	0.681955
electricit~y	1.40	0.716309
lagripro	1.31	0.763888
litracydummy	1.21	0.828806
sex	1.19	0.840798
lage	1.15	0.871291
lhhsize	1.12	0.892951
Mean VIF	2.19	

```
. estat imtest

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	470.45	86	0.0000
Skewness	465.23	13	0.0000
Kurtosis	0.61	1	0.4351
Total	936.29	100	0.0000

Annex4 Endogenity Tests

Test of endogenity

Running the reduced form regression against the endogenous variable (i.e. suspecting agricultural productivity to be endogenous)

Source	SS	df	MS
Model	5810.62023	12	484.218352
Residual	18707.6666	3370	5.55123637
Total	24518.2868	3382	7.24964128

```
Number of obs =    3383
F( 12,  3370) =   87.23
Prob > F      =  0.0000
R-squared     =  0.2370
Adj R-squared =  0.2343
Root MSE      =  2.3561
```

lagripro	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lage	.7797411	.1362101	5.72	0.000	.5126783	1.046804
lhhsize	.4214933	.0864294	4.88	0.000	.252034	.5909527
ldistance	-1.248819	.122882	-10.16	0.000	-1.48975	-1.007889
ldistancetel	.7533128	.0573372	13.14	0.000	.6408935	.8657321
sex	.2621757	.1067684	2.46	0.014	.0528383	.471513
litracydummy	.6930314	.0901628	7.69	0.000	.5162521	.8698107
electricitydummy	.511067	.1233192	4.14	0.000	.2692791	.752855
twnelectricitydummy	.6937799	.1533186	4.53	0.000	.393173	.9943868
pupipewaterdummy	.5500687	.1130951	4.86	0.000	.3283268	.7718107
amharadummy	.655931	.1347047	4.87	0.000	.3918198	.9200422
oromyadummy	.6750843	.1159875	5.82	0.000	.4476714	.9024973
snnpdummy	0	(omitted)				
tigraydummy	-1.831449	.192353	-9.52	0.000	-2.20859	-1.454309
_cons	3.712162	.5773437	6.43	0.000	2.580183	4.844142

Extracting the residuals and running the main equation including the residuals as explanatory variables

Source	SS	df	MS	Number of obs =	3383
				F(13, 3369) =	60.00
Model	799.939699	13	61.533823	Prob > F =	0.0000
Residual	3454.95729	3369	1.02551419	R-squared =	0.1880
				Adj R-squared =	0.1849
Total	4254.89699	3382	1.25810083	Root MSE =	1.0127

llabor	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lagripro	.0658988	.0074039	8.90	0.000	.0513821	.0804154
e	.3587655	.0321422	11.16	0.000	.2957453	.4217857
lage	-.1768828	.0610869	-2.90	0.004	-.2966539	-.0571117
lhhsize	.2378932	.0398023	5.98	0.000	.1598542	.3159323
ldistance	.3285315	.0784227	4.19	0.000	.1747705	.4822924
ldistancetel	-.1481531	.0383726	-3.86	0.000	-.2233891	-.0729171
sex	-.0932075	.0477673	-1.95	0.051	-.1868633	.0004484
litracydummy	-.0722596	.0446594	-1.62	0.106	-.1598219	.0153026
electricitydummy	.1557204	.056962	2.73	0.006	.0440368	.267404
twnelectricitydummy	-.6245228	.0781886	-7.99	0.000	-.7778247	-.4712209
pupipewaterdummy	-.1674244	.0502173	-3.33	0.001	-.2658839	-.0689649
amharadummy	-.3029197	.0526873	-5.75	0.000	-.4062221	-.1996174
oromyadummy	0	(omitted)				
snnpdummy	.1826081	.04947	3.69	0.000	.085614	.2796023
tigraydummy	0	(omitted)				
_cons	-.5886371	.2891546	-2.04	0.042	-1.155573	-.0217007

Testing the residual if it is significantly different from zero using a F test

```
. test e

 ( 1)  e = 0

       F(  1,  3369) =  124.59
            Prob > F =    0.0000
```

Annex5 AN IV regression of the model

```
Fixed-effects (within) IV regression          Number of obs      =         3383
Group variable: id                            Number of groups   =          846

R-sq:  within  = 0.0792                       Obs per group: min =            3
       between = 0.0111                                      avg =          4.0
       overall = 0.0001                                      max =            4

                                              Wald chi2(9)       =     14372.17
corr(u_i, Xb)  = -0.7467                      Prob > chi2        =       0.0000
```

llabor	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lagripro	.0537873	.0088744	6.06	0.000	.0363938	.0711809
lagripro	0	(omitted)				
lage	.4694608	.1068439	4.39	0.000	.2600506	.678871
lhhsize	.2867942	.0551849	5.20	0.000	.1786339	.3949546
ldistance	1.180294	.5572008	2.12	0.034	.0882002	2.272387
ldistancetel	.0286554	.0406681	0.70	0.481	-.0510526	.1083635
sex	-.0819008	.0820263	-1.00	0.318	-.2426694	.0788678
litracydummy	.2068385	.0549613	3.76	0.000	.0991164	.3145606
electricity~y	.3077639	.0639878	4.81	0.000	.1823501	.4331778
twnelectric~y	0	(omitted)				
pupipewater~y	.1661919	.087354	1.90	0.057	-.0050187	.3374026
amharadummy	0	(omitted)				
oromyadummy	0	(omitted)				
_cons	-3.696137	1.419993	-2.60	0.009	-6.479273	-.9130016
sigma_u	1.0736112					
sigma_e	1.0005272					
rho	.53519213	(fraction of variance due to u_i)				

```
F  test that all u_i=0:     F(845,2528) =     1.21        Prob > F    = 0.0002

Instrumented:   lagripro
Instruments:    lagripro lage lhhsize ldistance ldistancetel sex litracydummy
                electricitydummy twnelectricitydummy pupipewaterdummy
                amharadummy oromyadummy snnpdummy
```

Annex6 a t-test for the share of manufactured products with some selected variables

```
. ttest manushare, by(sex)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	606	.0961291	.0069514	.1711222	.0824774	.1097809
1	2362	.1130875	.0045249	.2199127	.1042143	.1219607
combined	2968	.109625	.0038722	.2109543	.1020325	.1172174
diff		-.0169584	.0096026		-.0357868	.0018701

```
    diff = mean(0) - mean(1)                                      t =  -1.7660
Ho: diff = 0                                     degrees of freedom =     2966

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0387         Pr(|T| > |t|) = 0.0775          Pr(T > t) = 0.9613
```

```
. ttest manushare, by(edudummy)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	1737	.1094086	.0057866	.2411716	.0980591	.1207582
1	1231	.1099302	.0045295	.1589195	.1010439	.1188166
combined	2968	.109625	.0038722	.2109543	.1020325	.1172174
diff		-.0005216	.0078608		-.0159347	.0148915

```
    diff = mean(0) - mean(1)                                      t =  -0.0664
Ho: diff = 0                                     degrees of freedom =     2966

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.4736         Pr(|T| > |t|) = 0.9471          Pr(T > t) = 0.5264
```

```
. ttest manushare, by(electricitydummy)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	2409	.1149535	.004535	.2225846	.1060607	.1238464
1	559	.0866616	.0062978	.1489009	.0742913	.099032
combined	2968	.109625	.0038722	.2109543	.1020325	.1172174
diff		.0282919	.0098917		.0088966	.0476872

```
    diff = mean(0) - mean(1)                                      t =   2.8602
Ho: diff = 0                                     degrees of freedom =     2966

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9979         Pr(|T| > |t|) = 0.0043          Pr(T > t) = 0.0021
```

```
. ttest manushare, by(twnelectricity)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	372	.0954105	.0064968	.1253049	.0826354	.1081856
1	2596	.1116619	.0043269	.2204615	.1031773	.1201465
combined	2968	.109625	.0038722	.2109543	.1020325	.1172174
diff		-.0162514	.0116931		-.0391787	.006676

```
    diff = mean(0) - mean(1)                                      t =  -1.3898
Ho: diff = 0                     degrees of freedom =     2966

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0823         Pr(|T| > |t|) = 0.1647          Pr(T > t) = 0.9177
```

```
. ttest manushare, by(pupipewaterdummy)

Two-sample t test with equal variances
```

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	2228	.1154735	.0047767	.225467	.1061063	.1248407
1	740	.0920161	.0058195	.1583088	.0805913	.1034409
combined	2968	.109625	.0038722	.2109543	.1020325	.1172174
diff		.0234575	.0089416		.005925	.0409899

```
    diff = mean(0) - mean(1)                                      t =   2.6234
Ho: diff = 0                     degrees of freedom =     2966

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9956         Pr(|T| > |t|) = 0.0088          Pr(T > t) = 0.0044
```

Annex7 a Housman test for estimation of manufactured products

```
. hausman . random_effects
```

	Coefficients (b) .	(B) random_eff~s	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lagri	-.0035367	-.0037482	.0002115	.0012087
lage	-.0114434	-.017868	.0064247	.0208078
sexdummy	.0095383	.00988	-.0003417	.0145781
lfam	.0450607	.0453642	-.0003035	.0091821
ldis	.0324819	-.0034811	.0359629	.1117507
ldistl	.0097708	.0090225	.0007483	.0083758
edudummy	.0047337	.0063745	-.0016408	.0086745
lcpm	-.0278482	-.0355588	.0077107	.0102432
lcp	-.0491008	-.0399028	-.009198	.004168
electricit~y	.0006962	-.0058699	.0065661	.0077354
pupipewate~y	-.060124	-.0111221	-.0490019	.0153547

```
                b = consistent under Ho and Ha; obtained from xtreg
     B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                chi2(11) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                         =       19.25
              Prob>chi2 =      0.0568
              (V_b-V_B is not positive definite)
```

Annex8. Heteroskedasticity and multicollinearity test

```
. estat imtest

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	183.87	117	0.0001
Skewness	26.12	15	0.0368
Kurtosis	1.06	1	0.3028
Total	211.05	133	0.0000

```
. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of manushare

         chi2(1)      =  4170.96
         Prob > chi2  =   0.0000
```

```
. estat vif
```

Variable	VIF	1/VIF
snnpdummy	4.92	0.203425
oromyadummy	4.89	0.204550
amharadummy	4.05	0.246715
ldis	3.55	0.281510
ldistl	2.53	0.394740
electricit~y	1.96	0.511357
lcpm	1.87	0.533335
twnelectri~y	1.73	0.579643
pupipewate~y	1.48	0.675438
lcp	1.45	0.688042
lagri	1.34	0.746633
edudummy	1.26	0.791276
lfam	1.24	0.803313
sexdummy	1.21	0.828754
lage	1.21	0.828972
Mean VIF	2.31	

Annex9. Lagrangian Multiplier Test For Random Effects

```
Breusch and Pagan Lagrangian multiplier test for random effects

         manushare[id,t] = Xb + u[id] + e[id,t]

         Estimated results:
                              |       Var     sd = sqrt(Var)
                     ---------+-----------------------------
                    manushare |    .0445167       .2109897
                            e |     .042267       .2055894
                            u |    .0007303       .0270236

         Test:   Var(u) = 0
                                  chibar2(01) =     1.02
                               Prob > chibar2 =   0.1563
```

Annex10. Test for Endogenity

Source	SS	df	MS	Number of obs =	2966
				F(14, 2951) =	71.82
Model	5057.66315	14	361.261653	Prob > F =	0.0000
Residual	14843.9107	2951	5.03012901	R-squared =	0.2541
				Adj R-squared =	0.2506
Total	19901.5739	2965	6.71216657	Root MSE =	2.2428

lagri	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lcpm	2.204367	.177786	12.40	0.000	1.85577	2.552964
lage	.3477577	.1444671	2.41	0.016	.0644913	.6310242
lfam	.2275282	.0951923	2.39	0.017	.0408782	.4141781
ldis	-.7077685	.1112756	-6.36	0.000	-.9259543	-.4895828
lcp	.3595967	.0620423	5.80	0.000	.2379462	.4812472
ldistl	.5829086	.0602985	9.67	0.000	.4646773	.7011398
sexdummy	.5431566	.1118015	4.86	0.000	.3239397	.7623735
edudummy	.4407542	.0936777	4.71	0.000	.257074	.6244344
electricitydummy	-.4118683	.147063	-2.80	0.005	-.7002249	-.1235118
twnelectricitydummy	.6640139	.1628595	4.08	0.000	.3446842	.9833436
pupipewaterdummy	.5830283	.1152948	5.06	0.000	.3569619	.8090946
amharadummy	2.489573	.165173	15.07	0.000	2.165707	2.813439
oromyadummy	2.598266	.1990484	13.05	0.000	2.207978	2.988553
snnpdummy	2.103113	.2074515	10.14	0.000	1.696349	2.509877
tigraydummy	0	(omitted)				
_cons	-8.369956	.944066	-8.87	0.000	-10.22105	-6.518861

Source	SS	df	MS	Number of obs =	2966
				F(15, 2950) =	7.39
Model	4.7843267	15	.318955113	Prob > F =	0.0000
Residual	127.242469	2950	.04313304	R-squared =	0.0362
				Adj R-squared =	0.0313
Total	132.026796	2965	.04452843	Root MSE =	.20768

manushare	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lagri	-.0037074	.0017046	-2.17	0.030	-.0070498	-.000365
e	-.016196	.0076605	-2.11	0.035	-.0312165	-.0011756
lcpm	0	(omitted)				
lage	-.0122714	.0142091	-0.86	0.388	-.0401321	.0155893
lfam	.0489508	.0089409	5.47	0.000	.0314197	.0664819
ldis	-.0152186	.0114412	-1.33	0.184	-.0376521	.0072149
lcp	-.0337312	.0062441	-5.40	0.000	-.0459745	-.0214879
ldistl	.0185923	.0065816	2.82	0.005	.0056874	.0314972
sexdummy	.0186267	.010504	1.77	0.076	-.0019692	.0392226
edudummy	.0135524	.0099418	1.36	0.173	-.0059412	.0330459
electricitydummy	-.0127004	.0122608	-1.04	0.300	-.0367411	.0113402
twnelectricitydummy	.0246707	.014989	1.65	0.100	-.0047193	.0540607
pupipewaterdummy	-.0005731	.0113119	-0.05	0.960	-.0227532	.021607
amharadummy	.06994	.0239323	2.92	0.003	.0230144	.1168657
oromyadummy	.0969051	.027339	3.54	0.000	.0432996	.1505106
snnpdummy	.0705353	.0255667	2.76	0.006	.0204049	.1206657
tigraydummy	0	(omitted)				
_cons	.2197152	.0573277	3.83	0.000	.1073088	.3321216

```
. test e

 ( 1)  e = 0

       F(  1,  2950) =    4.47
            Prob > F =    0.0346
```

```
G2SLS random-effects IV regression              Number of obs      =      2966
Group variable: id                              Number of groups   =       742

R-sq:  within  = 0.0355                         Obs per group: min =         3
       between = 0.0373                                        avg =       4.0
       overall = 0.0351                                        max =         4

                                                Wald chi2(14)      =    107.32
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000
```

manushare	Coef.	Std. Err.	z	P>|z|	[99% Conf.	Interval]
lagri	-.0031907	.0016799	-1.90	0.058	-.0075178	.0011364
lcpm	-.0349028	.0168392	-2.07	0.038	-.0782776	.0084721
lage	-.0206485	.013499	-1.53	0.126	-.0554197	.0141227
lfam	.0464061	.0088813	5.23	0.000	.0235294	.0692827
ldis	-.0123877	.0093642	-1.32	0.186	-.0365084	.0117329
lcp	-.041712	.0057109	-7.30	0.000	-.0564223	-.0270016
lagri	0	(omitted)				
ldistl	.0124776	.0054264	2.30	0.021	-.0015	.0264552
sexdummy	.0128666	.0104041	1.24	0.216	-.0139325	.0396657
edudummy	.0056201	.0087688	0.64	0.522	-.0169667	.028207
electricitydummy	-.0045201	.0136092	-0.33	0.740	-.0395752	.0305349
twnelectricitydummy	.0275994	.0134881	2.05	0.041	-.0071437	.0623424
pupipewaterdummy	-.0113728	.0108521	-1.05	0.295	-.0393259	.0165803
amharadummy	.0082143	.0112223	0.73	0.464	-.0206924	.0371211
oromyadummy	.0259868	.0112396	2.31	0.021	-.0029645	.054938
_cons	.3879148	.0869519	4.46	0.000	.1639415	.6118881
sigma_u	.02675448					
sigma_e	.20581338					
rho	.01661759	(fraction of variance due to u_i)				

```
Instrumented:   lagri
Instruments:    lcpm lage lfam ldis lcp lagri ldistl sexdummy edudummy
                electricitydummy twnelectricitydummy pupipewaterdummy amharadummy
                oromyadummy snnpdummy
```

DECLARATION

I, the undersigned, declare this thesis work as my own work and it has never been presented in any other institution for any kind of purposes. All the resources and materials used for preparing it has been duly acknowledged and the standard citation for the resources is being used.

Declared by:

GETAENDALE SIMESH

Signature_____

Confirmed by Advisor

ADANE TUFFA (PhD)

Signature_____

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ADDIS ABABA, ETHIOPIA