Rural Livelihood, Migration, and Human Capital Formation: The Ethiopian Case

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Abstract

This dissertation identifies rural livelihood, migration, and human capital formation as the three major elements of rural-urban linkages which help to transform a predominantly agrarian economy into knowledge-based modern economy. It is emphasized that a smooth and successful rural transformation requires the dynamic interaction of these pillars of transformation; and location of rural based economic activities in relation to urban centres determines the degree of such interaction.

It has been demonstrated that location of an agricultural economic activity in relation to urban centres, and education determine households' decision to allot their agricultural land to the production of either staple crop or a high value but risky cash crop. By applying fractional logit estimation technique as suggested by Papke and Wooldridge (1996) on data from villages in North Eastern Ethiopia, it has been found that proximity to urban centres, access to road, and education along with other factors determine the crop choice decision in favor of the production of high value crops. The pattern of crop choice has been translated into a variation in the level of per capita income across villages where the farthest with no access to road are the poorest.

Moreover, it has been attempted to model the determinants of rural-urban migration in selected villages of Ethiopia. Using the Nakosteen and Zimmer (1980) approach, it has been found that income differential, education, distance from major towns, and age are the most important determinants of rural-urban migration. More interestingly, level of education has been found to be significant in triggering rural-urban migration even after accounting for its indirect effect on migration through earnings. This might support the argument that education changes the preferences of individuals in rural areas in favor of modern public goods in urban centers vis-à-vis rural based traditional goods.

The dissertation has also demonstrated that prospect of rural-urban migration induces human capital formation in rural areas. It shows that with a widely held rural perception that education does not contribute to the productivity of agricultural activities, pessimism in prospect of migration would lead to inadequate human capital formation. Applying ordered logit models on data collected from Ethiopia, it has been found that probability of migration of individuals has been consistently significant in affecting the sustainability of school attendance.

Abstract

In dieser Dissertation werden ländliche Lebensweise, Migration und Humankapitalbildung als Hauptfaktoren zur Unterstützung der Transformation von überwiegend agrarisch geprägten Gesellschaften in wissensbasierte moderne Ökonomien identifiziert. Ein gleichmässiger und erfolgreicher Transformationprozess ländlicher Gebiete erfordert das Zusammenspiel dieser drei Faktoren unterstützt durch den Faktor „Entfernung" der ländlichen Gebiete zu den städtischen Zentren.

Es wurde gezeigt, dass die Entfernung von ländlichen Gebieten zu städtischen Zentren, sowie der Bildungstand die Entscheidung des Haushalts beinflusst, Grundnahrungsmittel für den Eigenbedarf oder hochwertige aber mit hohem Anbaurisiko behaftete „cashcrops" anzubauen. Mit Hilfe von partiellen Logit-Schätztechniken nach Papke und Wooldridge (1996), die auf der Grundlage von Haushaltsdaten aus nordostäthiopischen Dörfern ausgeführt wurden, konnte festgestellt werden, das sowohl Nähe zu städtischen Zentren, Zugang zu Straßen, als auch Bildungsstand sowie weitere Faktoren, die Wahl der Anbaukultur zugunsten von „cash crops" beeinflussen. In Bezug auf das Einkommen der Haushalte wurde festgestellt, das diejenigen Haushalte ohne Zugang zum Strassennetz zu den Ärmsten gehören.

Weiterhin wurden Einflussgrößen der Stadt-Land-Migration in ausgewählten äthiopischen Dörfern modelliert. Die Anwendung der Nakosteen und Zimmer (1980) Methode zeigte, dass Einkommensdisparitäten, Bildungsstand, Entfernung zu städtischen Zentren sowie Alter die Haupteinflussgrößen der Stadt-Land Migration darstellen. Interessanterweise beeinflusst der Bildungsstand direkt, sogar noch vor indirekten Effekten durch höheres Einkommen, die Stadt-Land Migration in statistisch signifikanter Weise. Dies könnte die Vermutung bestätigen, dass Bildung die Akzeptanz von modernen öffentlichen Gütern an Stelle von ländlich traditionellen Gütern erhöht.

Diese Dissertation hat gezeigt, dass Möglichkeiten zur Migration aus ländlichen in städtische Räume Humankapitalbildung in ländlichen Regionen fördert, wohingegen fehlende Migrationsmöglichkeiten zu geringerer Humankapitalbildung führt. Es zeigte sich weiterhin, dass –gemäß der weitläufigen Meinung der ländlichen Bevölkerung- Bildung nicht zur landwirtschaftlichen Produktivität beiträgt. Nach Anwendung von geordneten Logit-Modell-Verfahren wurde herausgefunden, dass die Wahrscheinlichkeit zur Migration eng mit einem dauerhaften Schulbesuch zusammenhängt.

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Acknowledgments

My decision to join the primary level school which was run by few teachers under the shade of a tree in one of the remote villages of Ethiopia in 1980, in a desperate attempt to escape subsistent agrarian life, was inspired by a local teacher whose monthly salary was 180 Birr (equivalent to 90 USD by then), and who used to wear neat outfits. Today, here I am to claim my third degree and witness both my luckiness and the tortuous and sometime perilous path I had to pass through fighting against all the odds while sadly almost none out of the first classmates of mine could make it beyond their village level despite their extraordinary competence and thirst for education. This Degree would have more value if it could trigger their children to escape underdevelopment through education. Though that is the time when I would have the greatest happiness of success, as to my achievements so far, I simply say Alhamdulillah!

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Chapter One

General Introduction

1.1 BACKGROUND

One of the realities which the socio-economic history of the past century has witnessed is the fact that development is a concomitant of spatial transformation of societies. As Bardhan and Udry (1999) put it "development involves the transformation of the spatial organization of a society. From a dispersed rural, mostly agrarian society, a nation in the process of development becomes a more concentrated urban and industrial economy." In this century, many developing countries are characterized by a situation where the majority of their population resides in rural areas making its living from subsistent agriculture. As a result, rural transformation still becomes the major challenge, and undergoing through the spatial re-organization of societies has to witness development yet for many nations.

It is usually argued in the literature of development economics that rural-urban linkages play a significant role in transforming a predominantly agrarian economy into a modern economy where manufacturing industry dominates. There are a number of elements of rural-urban linkages that facilitate rural transformation. This dissertation identifies three major pillars of such transformation. These are rural livelihood, migration, and human capital formation. Rural transformation requires the interaction and co-motion of these pillars. To get the transformation moving through the dynamic interaction of these pillars, spatial adjacency of the rural activities and urban centers is crucial.

Dominant in the literature regarding rural-urban linkages is the role of agricultural sector as a source of cheep labor and food for the modern urban sector in particular the manufacturing industry. For instance Ray (1998) argued that the "twin resources" namely food and labor "lies at the heart of the structural transformation that occurs in most developing countries." In particular, in order a non-agricultural sector to develop, agriculture must be capable of producing a surplus and be able to feed the labor in the non-agricultural sector.

Moreover, early theories of both Nurkse (1953) and Lewis (1954) emphasized the role of agricultural surplus in fostering industrial development. They assumed a nearly zero marginal productivity of labor in the rural sector and mopping out such surplus labor to the manufacturing sector would be a basis for economic transformation and growth. Ranis and Fei (1961) extended the issue to what they called disguised unemployment - a labor force above the level where marginal productivity equals wage.

The implicit assumption in these arguments is that the industrial sector is capable of absorbing the rural migrants so that both cheap labor and food would be critical. This might have worked in countries such as China where during the 1978 reform, the manufacturing sector was already dominant accounting for 49% of GDP while agriculture accounted for 30%. In that sense, a mild reform to boost agricultural output was met by high demand from the non-agricultural sector. As a result, agriculture was able to fuel overall growth contributing to 23% of GDP growth during the period 1980-86 until its share in growth drops to 9% for the period 1990-99 [See Berhanu and Seid (2004)].

However, for a country that has an economy dominated by traditional agriculture where the industrial sector has a very low share, both surplus creation and smooth rural-urban migration would be too slow to ensure transformation. If the urbanization rate is too low with even high rate of urban unemployment, then any surplus in the first round of production faces low prices and it becomes disincentive for future production. This has been observed in Ethiopia in 1997 when a bumper harvest due to good weather led to a staggering decline in price of agriculture staples.

The importance of urban demand as “a key driver of spatial allocation of economic activities” has been recognized by von Thunen (von Braun, 2007). In the Ethiopian case, Berhanu (2003), Cour (2003) have predicted that a mild change in the rural-urban balance of the population can have a significant positive impact on the level of per capita income of both the rural and urban population.

One of the factors which are believed to facilitate the contribution of such linkage to the transformation process is location of agricultural economic activities in relation to urban centers. On the rural side, accessibility of market for high value crops and urban jobs for rural surplus labor are two of the channels through which location reinforces the positive linkages towards transforming agriculture.

Labor migration to urban centers augments rural income not only through direct wages and remittances but also by increasing labor productivity through increased par capita land size at the rural origins of migration. Sending households can still produce the same level of output from their land after the departure of some of their family members to urban centers [Lucas, 1997].

Capital formation through surplus that can in turn be materialized through productivity gains requires preparedness to acquire skills on new techniques of production. To that end, education could help farmers to quickly adopt such technology of production. It also tends to change their consumption preferences from traditional staple items to industrial goods, and change the form of wealth they accumulate from grain stocks and livestock to liquid wealth. Acquiring education by peasant households is in turn associated with proximity to urban centers through its effect on prospect of migration. Thus, one of the possible interactions of the above-mentioned pillars of transformation is that rural livelihood depends on location (mainly through crop choice), level of education and migration decisions.

Rural-urban migration, though it is historically the effective way of the transformation of the now developed nations form agrarian to industrialized economy (Greenwood, 1997), the current reality is that “much of the policy interest in internal migration derives form concern, or even alarm” in connection with its effect on urban population [Lucas, 1997]. For instance, the policy implications of the Harris-Todaro (1970) model of rural-urban migration, which is one of the most cited models in the area, is that since the equilibrating phenomenon of rural-urban migration is unemployment in urban centers, urban based employment creation schemes might end up in reducing welfare. The policy implication of this theory is to slow down rural-urban migration by increasing its opportunity cost.

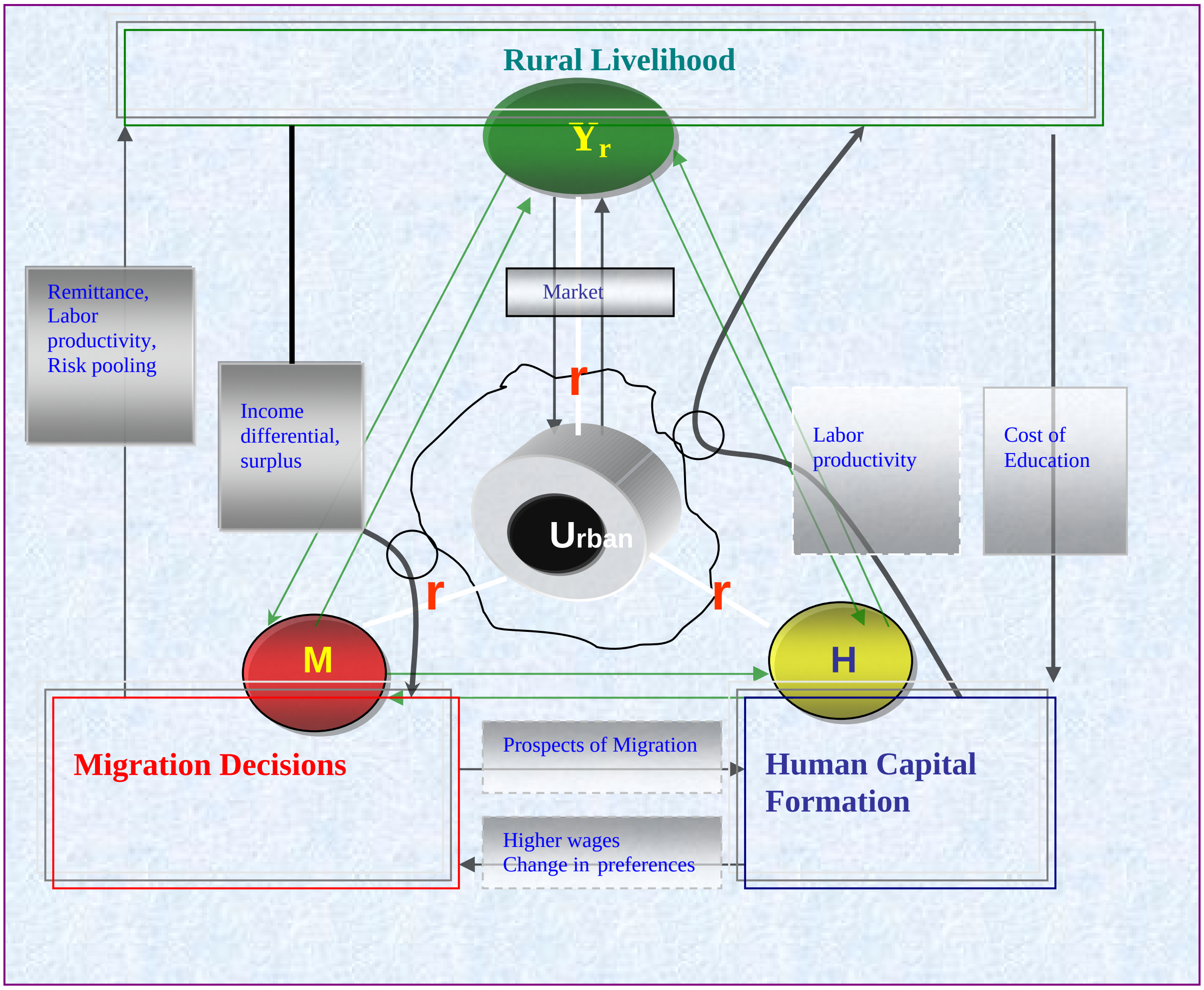

Figure 1-1: Interactions of Some of the Elements of Rural-Urban Linkages: The three pillars of rural transformation

However, in countries where above 80 per cent of their population lives on subsistent agriculture in the face of declining per capita land size, migration remains to be an option. After all, urbanization is basically "part of a healthy development process." [von Braun, 2007]. The question rather lies on how to ensure sustainable smooth rural-urban migration.

Pessimism about prospects of migration due to increased opportunity cost of migration discourages another important pillar of transformation, that is, human capital formation. As it has been argued in many occasions, human capital formation in particular education lies at the center of societal transformation. In a predominantly agrarian economy where the majority of the population lives in rural areas, the possibility of getting the maximum number of emulators by enabling the young peasants to reveal their undiscovered talents requires making education a rural phenomenon. But a peasant child does not go to school for the sake of being an educated farmer for he/she believes education has little or no role in increasing agricultural productivity and make a living any better. They rather invest in education in anticipation for finding job outside agriculture in particular in the urban destinations. That is, prospect of migration induces rural households to send their children to school.

This study is motivated by the situation which prevails in Ethiopia. The country with long history is still characterized by one of the lowest rates of urbanization even by the African standard where about 85 per cent of the population lives in the rural areas eking its living from subsistent agriculture. The increasing population size has put much pressure on the land resulting in a declining per capita land size. The average land holding per household in the country is about 1 hectare which is equivalent to 0.2 hectare per head [CSA, 2005]. Low demand from the urban center primarily due to low rate of urbanization and underdeveloped private sector (the industry sector accounts only for 12% of GDP) has also been resulting in low agricultural prices during occasional bumper harvest. The low labor productivity due to fragmented land holdings coupled with low agricultural prices made surplus creation difficult.

The low productivity in the agricultural sector and the resistance by agricultural households to make a living outside agriculture even during times when they can get surplus is due to the low level of education. Human capital formation through education in the country in general and in the rural area in particular has been very slow until recently. In 1994, in the country at large, the enrolment ratio of primary and secondary schools were about 23%, 7.3%, respectively. The significant achievement in primary level enrolment in rural areas in the past couple of years is not matched by increases in secondary school enrolments. In 2003, overall secondary school enrolment ratio has increased to about 19%. However, the figure for rural based schools is still less than 1%. With such low level of education that has persisted for so long in the past, it should not be surprising if rural households think that the best that life can offer is the level of wealth of the richest man in the village.

The formal sector is characterized by a significant level of skill gap in the sense that while skilled labor is in critical shortage, unemployment is rampant among the youth with some primary and secondary level of education. A survey result by the Ministry of Capacity Building (MCB) of the Federal Democratic Republic of Ethiopia (FDRE) showed that out of the total approved civil service positions of the districts in the major regional states of the country, namely, Amhara, Oromiya, South Nations, Nationalities and Peoples (SNNP), and Tigray, about 43 per cent were vacant in the year 2004. The low share of the industrial sector in the GDP can still provide a basis for mopping out labor from the agricultural sector [MCB, Human Resource Planning Survey, 2004].

The theme of the study is that for a country whose economy is characterized by a subsistent agriculture and significant skill gap, rural transformation requires the interaction of rural livelihood, migration, and human capital formation which would serve as a starter of smooth transformation of a predominantly agrarian economy into a vibrant knowledge based modern economy. To get the transformation process moving, the interaction of these three pillars has to be ensured through urbanization wherein location of rural activities in relation to urban centers plays a catalytic role.

More specifically, the dissertation addresses the issue under three sub-themes:

i. It demonstrates how location of an agricultural activity in relation to urban centers and level of education determine households' decision to allot their agricultural land for the production of either staple crop or a high value but risky cash crop in the face of meager demand from urban centers. It also investigates how this decision translates into level of income of rural households which in turn determines the magnitude of surplus generated that serves as a basis for agrarian transformation.

ii. It attempts to show how individuals from rural households, depending on the level of their education, respond in the form of migration to utility differences that exist between rural and urban areas not only due to a mere income differentials but due to differences in demand for urban public goods vis-à-vis rural traditional values, and differences in cost of living.

iii. Based on Stark et al (2004) notion of international migration and human capital formation, it demonstrates how prospect to rural-urban migration induces human capital formation in rural areas. In particular, it attempts to show that in a society where the role of education in agriculture is widely discredited, pessimism to prospects of rural-urban migration erodes the trust of rural households in education.

The analysis of the interaction of rural livelihood with human capital and location is the subject matter of Chapter Two. Chapter three demonstrates theoretically and empirically how income differentials, distance, and education both through ensuring high earnings and changing individuals' preference from traditional goods to urban based public goods, trigger rural-urban migration.

Based on the Field's (1975) extension of the Harris-Todaro model and the Stark et al (2004) model of international migration, Chapter four of the this dissertation demonstrates how prospects of migration induces rural households to invest in a purposeful education while pessimism about the prospects of migration might result in under-investment of the critically needed human capital formation by considering the Ethiopian case.

1.2 *STUDY SITES*

The study covers six villages in four locations in North and South Wollo Administrative Zones of the Amhara Regional State in Ethiopia. The villages were systematically selected based on their location relative to urban centers. Moreover, agro-ecological differences, availability of irrigation, and access to road are considered in selecting the villages. Familiarity to the survey area and easy access to the collection of data have contributed to the selection of the Amhara regional state in general and the Wollo area in particular to be the study site. Such familiarity to the region has partly served as a basis of inspiration for the study and it has made inferences more intuitive.

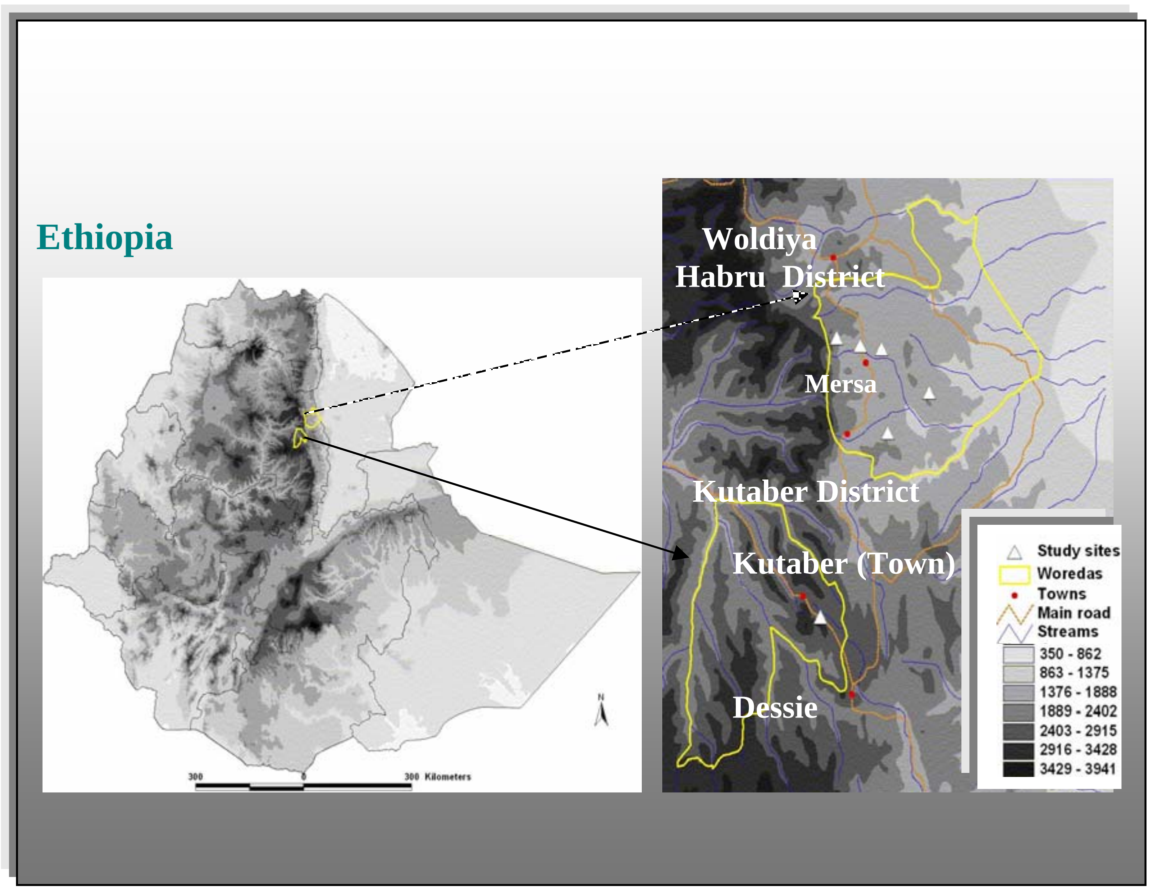

Figure 1-2: Study Sites

Table 1-1: Distance of the Study Sites from Urban Centers

	Alasha	Mersa Zuria			G irana	Habru-Ligo
		Menentela	Kulie	Buhoro		
Distance from District Town (in km)	7	4	7	8	15	20
Distance form Major Towns (in km)						
Dessie	12	94	97	98	75	85
Woldiya		20	25	20	50	60

The village with closest proximity to an urban center is about 4 kilometre from a reference district town and the farthest village is 20 kilometre away from the nearest district town. Proximity to major towns is also considered. The major towns that are taken as references are Dessie and Woldiya. Dessie is the capital of South Wollo Zone (one of the eleven Zone administrations of the Amhara State) and has an estimated population of 169,000. Woldiya is the capital of North Wollo Zone with an estimated population of 43,000. The two towns are 120 kilometre apart along the main Addis Ababa – Mekele road. District towns include Kutaber and Mersa.

One of the villages covered by the study called Alasha is located in Kutaber district some 12 kilometre from Dessie. The nearest district town to Alasha is Kutaber with an estimated population of 5,000. Two major attributes of the village compared to other survey areas in terms of location are i) it is the nearest village to major urban centers, and ii) it is located in the highland plateau with cold climate.

The other study site, Mersa Zuria area, includes three villages intercepting the district town Mersa on either side of the Dessie-Woldiya road. Mersa has an estimated population of 6,500. The villages have easy access to the market primarily due to their proximity to the major Addis Ababa-Mekele road via Mersa and Woldiya. Besides, the villages are nearer to the district town, Mersa, and the Zone town Woldiya. Among the three villages, Buhoro has significant access to irrigation partly due to availability of tributary rivers that can be easily developed by the local farmers for irrigation.

The third study site is Girana. It is located about 7 kilometres east of the Addis Ababa-Mekele road. There is a gravel road linking the village to the major highway. The major attribute of the village is that it has some tributaries which enable to irrigate a significant part of land. Moreover, there is weekly open market in the village attracting people from many other rural areas. The village has a potential of being upgraded to township.

Among the villages covered by the study, Habru-Ligo has the farthest distance from both urban centers and major roads. Even worse, people in this village have no access to feeder road that is accessible by vehicle. Individuals have to travel a minimum of three hours on difficult terrains to work on their land. About 25 to 30 percent of the land possessed by the villagers is irrigable.

1.3 DATA COLLECTION

Due to absence of a complete list of households in each Peasant Association (PA) of the study sites (the lowest administrative unit of the rural areas), a cluster sampling technique is used for the survey. Each PA is divided into small and fragmented sub-villages called '*got*'. Each sub-village was randomly selected. Households in the selected sub-villages were listed. From the complete list, some 55 to 75 households were randomly selected for the study depending on the size of the population in the clusters of each PA. The number of households that are covered by the study in all villages after netting out those with missing observations for some important variables is 252.

Maximum possible caution has been taken to ensure the quality of the data during the survey. The enumerators were largely teachers from the survey areas and university students who were on vacation during the survey period.

Figure 1-3: Enumerator on Duty

The population in the villages under study is homogenous on some important sociological variables such as ethnicity, and religion. Given the diverse ethnic composition and religion, and agro-ecological features of the country in general and the Amhara regional state in particular, this data cannot be representative of the situation in the regional state. However, for the study sites and villages in other regions with similar socio-economic pattern, the study based on this data could have significant policy implications. In particular, given the low rate of urbanization and poor rural-urban network, this study may give a rough approximation to the patterns of livelihood, migration, and education in the country in relation to distance of rural activities from urban centers.

Chapter Two

The Impact of Location and Education on Crop Choice and Rural Livelihood: Evidences from Villages in Northern Ethiopia

2.1. *INTRODUCTION*

As it has been argued in the General Introduction, rural livelihood, migration and human capital formation are among the critical elements of rural-urban linkages whose interaction catalyzed by proximity of rural activities to urban centers ensures rural transformation. In this chapter, we emphasize the role of location and education in augmenting rural income through crop choice using data from villages in North Eastern Ethiopia.

While location theory which dealt with crop choice dates back to the 19th century owing to von Thünen, there has been an apparent neglect of the role of location in recent crop choice models which rather focus on uncertainties. The structural causes of the uncertainties might be found in locations of agricultural activities in relation to markets, and level of education.

One of the most critical factors which challenge the transformation of rural agriculture is the incapability of rural peasants to form appreciable surplus due to subsistent and sometimes declining level of incomes. It has been widely argued in the received literature that various forms of uncertainties contribute to the subsistent nature of most rural economies. Rural households in general face different kinds of risks. Among others, as Dercon (1996) indicated, income risks would be critical if they imply consumption fluctuations as households may end up with low risk activities which results in lower returns. In developing countries where different kinds of risks are rampant, households usually invest their wealth in staple crops whose technology they know best.

Uncertainties associated with crop prices have been identified as major factors that put a rural household in high return cash crop versus risk diversification options. Fafchamps (1992) argued that since staple crops, which have low income elasticity, account for a large share of households' total consumption, they minimize risk from volatile prices by ensuring self sufficiency in staple crops.

There are at least three major routes through which risk affects crop choice in the Ethiopian context. First, households usually stick to the production of crops which they traditionally have been familiar with, mostly staple crops. Second, most cash crops unlike staple crops cannot be used for home consumption during periods of significant negative price shocks. Third, some cash crops have a relatively longer gestation period than staple crops.

However, even under stable and high prices for cash crops, households' decision to engage in the production of cash crops which have more value at the market by shifting resources, most importantly land, from the production of staple crops which give more security to the household against falling prices depends on cost of transportation and readiness to adopt new techniques of production. Cost of transportation depends on the distance of the particular plot from the market, most importantly urban centers. For instance, logs and lumber of eucalyptus have established markets in urban centers of Ethiopia. However, households living far form urban centers do not grow eucalyptus trees even on their marginal land which is rarely used for staple crop production because eucalyptus growers near to urban centers outbid in the market. It might even be practically be difficult to transport such logs due to absence of feeder roads accessible by vehicle.

In relation to decisions to produce cash crops, the technical know-how could matter. To that end, individuals with formal education could be motivated to adopt the techniques that are required to produce cash crops quickly. It could also reduce the risk-averse behaviour of individuals towards the production of cash crops. Thus, education may explain household's decision to allot a particular plot for the production of cash crop through increased awareness about such new techniques of production, making them less risk averse, and breaking the long held tradition of producing a common staple crop.

Hence, agricultural households who operate plots far form urban centers and those who have less formal education would allot their plots for less valued staple crops. Thus, one of the routes through which location and education determine rural livelihood is their impact on the household's crop choice for a given plot of land.

Decisions by households to allot all or most of their plots to the production of less valued staple crops would result in a subsistent economy with meagre surplus. This phenomenon is likely to occur in the agricultural communities operating far from urban centers. This leads to the argument that it is likely that incidence of poverty increases with distance away from urban centers.

The recent literature on crop choice does not consider location explicitly. In the case of education, regression results of the determinants of crop choice in Tanzanian villages show insignificant impact of education of the head of the household on crop choice (Dercon, 1996). A related study by Fafchamps and Quisumbing (1999) using data from Pakistan indicated that "education has no significant effect on productivity in crop and livestock production." This study attributes the impact of education on household income through labor reallocation to non-farm activities. However, with better specification of the model, it might be possible to get a significant and positive coefficient for education in a crop choice model.

This chapter using a better model specification attempts to look into how location of an agricultural activity in relation to markets which are usually urban centers and education of an individual play a pivotal role in affecting the production of high value cash crops based on an Ethiopian case study. While location affects crop choice through reduced cost of transportation,[1] education does so through technological readiness towards producing high valued but risky crops. It further shows that level of per capita income improves with proximity to urban centers and with level of education.

The remaining part of the chapter is organized as follows. Section 2 summarizes the literature on crop choice and on the theory of location. Section 3 highlights the mode of livelihood in Ethiopia in particular in the villages under study. It summarizes households' income diversifying strategies and crop choices across households in relation to their proximity to urban centers. Section 4 presents a simple theoretical framework to demonstrate the impact of location and level of education on crop choice more tractable. This section considers an agrarian household who operates on Thünen type of environment maximizing profit by allocating land among staple and cash crops. The household is assumed to make consumption and production decisions recursively. Section 5 deals with the econometric analysis. This section attempts to empirically verify the impact of proximity to urban/market centers and education on crop choice and rural income. For the crop choice model where the dependent variable is proportion of land allotted for cash crop production, fractional logit model that synthesizes generalized linear model (GLM) and quasi-maximum likelihood estimation (QMLE) procedures is employed. Determinants of rural income have been estimated using OLS. Finally, section 6 concludes.

2.2. Location and Crop Choice

Crop choice model traces back to the 19th century when von Thünen established the importance of location in shaping the duality of rural-urban economy. At the center of his argument was the location of a particular agrarian activity in relation to urban center. As Samuelson (1983) presented, Thünen portrayed his 'Isolated State' as a town surrounded by homogenous agricultural land where crops could be grown. The production of a particular crop is determined by the distance of the plot from the urban center where

[1] Distance of an agricultural activity from urban centers/markets also affect the level of risk associated with price through information asymmetry. We assume here cost of transportation in a broader context.

heavy-to-transport crops (vegetables) can bid up the land rent in the inner ring while easy-to-transport crops (grains) are grown at the outer annulus of the rings.

Samuelson (1983) in his stripped-down model presented Thünen's model by assuming a homogenous labor that can freely move between town and countryside; a homogenous land except along distance; identical (homothetic) preference at all income levels where their consumption involves a city-produced good and a country-produced good. The technology in cloth production uses only labor with constant returns to scale[2]. The production function for each of the farm goods is concave in labor and land inputs fulfilling the neoclassical conditions[3]. He used prices of city-produced goods and country-produced goods melting with distance to derive the balance of trade relations between the two goods. He showed in each step the various implications of the Thünen's model such as crop choice, labor/land intensity, relative wages, and utility wages. He inferred that items with the steepest cost gradient (typically vegetables) outbids grains for plots of land located nearer to urban centers "even if vegetables are much more land/labor intensive."[4]

Nerlove and Sadka (1991) worked in line of Thunen's theory and emphasized the role of "the spatial dimension in economic equilibrium and growth and the pivotal role of transport costs." They argued that falling costs of transportation are sufficient to ensure labor mobility from the rural based agrarian sector to urban based industrial sector.

Another intensive work in the area is the book by Fujita and Thisse (2002). They have used a bid rent which they defined as a surplus that can be generated from using a unit of land for an activity at a particular location to determine the type of crop that an individual

[2] Samuelson (1983) in his model (what he called 'iceberg model') noted well that town formation is consistent with increasing returns (as well as specialization and division of labor) in some activities. He assumed for his model that the town is so large that economies of scale are exhausted entailing perfect competition.

[3] The production function is assumed to be first-degree-homogenous where the law of diminishing returns, constant returns to scale, and Innada conditions are fulfilled.

[4] There are arguments which claim that the association of intensity of cultivation with proximity to towns was at the center of in Thünen's theory. This, however, was considered as confusion by Hall (1966) as quoted in Samuelson (1983). The general rule of Thünen's theory as argued by Hall is consistent with that of Samuelson.

wants to raise. They considered a profit maximizing farmer who optimally decides to produce a particular item which ensures that, given the bid rent and the market rent of land, any different allocation of land would not bring in improvement in profit. At the minimum, the bid rent should be equal to the market rent of land.

Fujita and Thisse (2002) also identified that it is not necessarily true that only heavy to transport goods are produced in the most inner circle. Rather, it is determined by the slope of the bid rent function where costs of transport and land intensity of the crop could matter. They also observed in other settings that location with the same distance may not necessarily specialize in producing a particular crop. That is, it likely that different crops could be raised on plots for a given distance.

Recent literature on crop choice models emphasizes uncertainties. Fafchamps (1992) employed 'a model of crop portfolio choice under multivariate risk' and he argued that in developing countries, the best mechanism to ensure food security even in the presence of food markets is food self-sufficiency. As such, larger farmers tend to allot a larger proportion of their land for the production of cash crops than small farmers. He argued that thin and segregated rural food markets due to high transport costs and low agricultural productivity force rural farmers to face volatile prices which are highly correlated to their own produces. Households tend to insure themselves from price risks by targeting food self-sufficiency since staple crops account for major share of their consumption and have low income elasticity.

Dercon (1996) argued that crop choice is one of the insurance strategies of rural households which are used to mitigate the adverse impact of income uncertainties in the absence of complete credit and insurance markets. Rural households use these insurances in the form of 'risk-management strategies' and 'risk-coping strategies.'[5] In agricultural households, risk-managing strategies are carried out by diversification of income. Households diversify income by engaging themselves in different activities such as crop

[5] Risk-management strategies refers to the efforts of a household to minimize the risk itself while risk-coping strategies are ex-post responses of a household to minimize the impact of the risk on consumption through intertemporal adjustments of consumption and social risk-sharing schemes [Dercon, 1996].

production and livestock farming, and by cultivating different crops even on the same plot. Using data from villages in Tanzania, he found that wealthier farmers allot larger proportion of land for the production of risky crops.

Moreover, Kurosaki and Fafchamps (2002) showed that price and yield risks affect crop choice. They also argued that households tend to respond to consumption price risk. They used data from the Pakistan Punjab to support their claims.

In the Ethiopian case, Daniel (2003) has demonstrated how tenure insecurity, investment irreversibility, and liquidity constraints affect crop choice by farmers. He in particular considered a dynamic stochastic programming model to elucidate how a typical agricultural household allots his plot for the production of staple crops and a cash crop namely coffee. Using the Ethiopian Household Survey data, he empirically showed that tenure status and resource constraints are important determinants of land related investments in coffee trees.

However, none of the above works explicitly considered the impact of location on crop choice. These models could be improved by incorporating transportation cost and information asymmetry. On the other hand, the economic literature that considers location does not take uncertainty issues into account, either.

2.3. Location of Agricultural Land and Crop Choice in Selected Villages of Ethiopia

Ethiopia has about 77 million people growing at about 2.8% annually. About 85% of the population makes a living from land intensive subsistent agriculture accounting for 45% of GDP. The country exhibits one of the lowest rates of urbanization where only 15% dwells in urban centers. As a result, arable land size per household decreases making the land issue critical in transforming the Ethiopian economy.

Land size in the country remains at about 1 hectare per household. This is equivalent to a mere 0.2 hectare per head with an average rural household size of 5. Endowed with such small land size, households generally tend to ensure that their plot is allotted for the production of staple crops [CSA, 2005].

According to the national data from CSA, in 2005, 84.3% of rural households in Ethiopia, excluding nomadic areas, live on crop and livestock production. About 84% of the total production of major crops is accounted by cereals and about 11% of total production comes from pulses. That means about 96% of the total crop production is staple crop. If we exclude the production of *teff*[6] which is both staple and cash crop, the share of the purely staple crops is still as high as 79%. Pulses which are predominantly cash crops have a share of less than 5% in the total production of major crops [CSA, 2005].

Such meagre share of cash crop production in Ethiopia could be largely attributable to fragmented markets, low demand form the urban centers, and poor transport networks connecting to market centers. Ethiopian farmers focus on the production of staple crops except for coffee that has already established international market implying a well functioning distribution system. It might be difficult to empirically illustrate the association between location and crop choice at a national level due to absence of nationwide data on major variables. However, the own survey data from six villages in North Eastern Ethiopia demonstrates the association between location and crop choice and the resulting variation in level of income. Following is the pattern of livelihood in villages that are covered by this study.

2.3.1 Location, Land Size, and Crop Choice

As it has been indicated in the General Introduction, the villages under study were selected according to their distance from towns which are major market centers for their agricultural produce. The six villages (Alasha, Buhoro, Menentela, Kullie, Girana, and

[6] *Teff* is an indigenous grass growing in Ethiopia which is used to make Ethiopian staple bread called '*Injera*'.

Habru-Ligo) are found at average distances of between 4 to 20 kilometres from district towns, and 12 to 98 kilometres from major towns. Buhoro, Menentela, and Kullie are adjacent and we refer to them as Mersa Zuria for this analysis.

According to the data collected form the villages, it appears that for villages nearer to towns, land size per household tends to increase with distance from urban centers. But beyond a certain distance from a town, land size tends to decline with distance. The average land size per household ranges from 0.61 hectare in Alasha to about 1 hectare in Mersa Zuria. Although Alasha and Kulie have similar distance from district towns, per capita land size in Alasha is lower than in Kullie and even less than that of Menentela which has the shortest distance from district town. This might be partly due to the fact that Alasha is located near to major urban center, Dessie. The pattern is similar in term of per capita land size where Alasha has the lowest with 0.13 hectare and Mersa Zuria has the highest with 0.27 hectare. Girana and Habru-Ligo have a roughly equal size of per capita land which is about 0.14 hectare.

One explanation for this could be that for villages nearer to urban centers, the economic rental value of land by virtue of being nearer to urban centers dominates the impact of migration on land size. On the other hand, for villages very far form urban centers, low level of out migration tends to dominate contributing to a declining per capital land size.

Table 2-1: Location and Land Size by Village

	Distance from District Town (in km)	Distance form Major Towns (in km)		Land Size per Household (in hectare)	Proportion of Land Allotted for Cash Crop and Eucalyptus (%)
		Dessie	Woldiya		
Alasha	7	12	-	0.613	7.9
Mersa Zuria				1.020	18.2
Menentela	4	94	20	0.822	12.2
Kulie	7	97	25	1.000	9.4
Buhoro	8	98	20	1.160	28.3
Girana	15	75	50	0.666	19.9
Habru-Ligo	20	85	60	0.643	0.9

In terms of land allocation, Buhoro has the maximum proportion of land allotted for cash crop with 28% while Habru-Ligo has the least share which is less than 1%. Major cash crops produced are sugarcane, fruits (orange, papaya, agoova), coffee, and vegetables. The staple crops include sorghum of various variety, and *teff* in villages other than Alasha. *Teff* is used both as a cash crop and staple food due to its high value in urban markets as it is the major staple for the urban population. During periods of poor harvest of staple crops, households usually sell their *teff* and buy other cheaper staple crops such as sorghum for household consumption. The important attribute of *teff* compared to other cash crops is that it can be used as staple crop. However, since *teff* has low productivity, households in the study areas allot only a small portion of their land for the production of this crop unlike other regions which are endowed with large land size and specialize in the production of the crop on a large scale. Households in Alasha area produce wheat, barley, oats, and beans.

2.3.2 Patterns of Income

In terms of income, Mersa Zuria is relatively affluent with per capita income of 1830 Birr.[7] This is well above the national average per capita income, which is about 1300 Birr recorded in 2005 [NBE, Annual Report 2006]. It appears that their access to the market as a result of their proximity to both urban centers and major road helped them to diversify marketable economic activities. Buhoro with a relatively better access to irrigation scheme is specialized in cash crop production. Unlike other villages, 47.5% of its income comes from cash crops. The peasants' involvement in the production of high value cash crops in the area is witnessed by the fact that about 48% of their income comes from 28% of their land. Kullie and Menentela, which do not have significant irrigable land earns a significant portion of their income from commercial livestock farming. About 24% of the income of households in Menentela area and 26% of the income of households in Kullie is accounted by livestock farming.

[7] Birr is the Ethiopian currency. During the survey in 2006, one USD was roughly equivalent to 9 Birr.

Table 2-2: Sources of Income of Households by Village

	Per capita income (in Birr)	Sources of Household Income and their Contribution to Total Income (%)						
		Staple crops	Cash crops	Eucaly-ptus	Wage	Remittance from Abroad	Remittance from Towns	Sale of Animals
Alasha	934	53.7	2.9	18.3	1.6	2.1	1.6	12.8
Mersa Zuria	1830	31.2	23.7	9.6	5.3	7.6	2.6	16.8
Menentela	1545	35.3	0.8	10.4	6.7	15.1	5.0	24.0
Kulie	1079	47.5	0.6	3.7	8.4	8.3	0.0	25.5
Buhoro	2298	22.5	47.5	11.2	3.1	2.3	2.0	8.7
Girana	1087	45.6	20.3	0.1	6.3	14.8	0.6	3.7
Habru-Ligo	520	86.3	3.8	0.1	1.8	2.2	0.0	3.2

Habru-Ligo has the least per capita income (about 520 Birr) among the villages covered by the survey. A typical rural farmer in Habru-Ligo earns just 23% of what a typical farmer in Buhoro earns. Though the village has irrigable land, it is not used for cash crop probably because of the fact that it is located far from urban centers and is not accessible by vehicle. One has to travel for about two to three hours on foot to get a feeder road accessible by vehicle.

The impact of poor rural-urban linkage in terms of distance and access to road is witnessed by the situation in Habru-Ligo that peasants in the village failed to invest in livestock on commercial basis even if the village is relatively endowed with suitable conditions for animal husbandry. Households raise cattle, goats and sheep mainly as a buffer stock.

The other interesting point in terms of diversification of activities is that villages nearer to urban centers allot some plots of land for fast growing trees, in particular eucalyptus. This partly depends on the type of slope and soil fertility of the plot of land possessed by peasants. In Alasha area, most hilly and marginal land which is held by peasants privately is covered by eucalyptus forests. Logs attract demand from urban centers. They are partly used for construction and serve as a source of energy. About 18% of the household income in Alasha area comes from the sale of logs of eucalyptus. The income from this source accounts for 10 and 11% of the total income of households in Menentela and Buhoro, respectively.

On the other hand, in Habru-Ligo, even though there is a relatively higher proportion of hilly land that could be used for growing trees, households are not encouraged to do so because of high transportation cost to sell in urban areas where it is needed for construction.

Interestingly, the difference in terms of forest coverage between villages nearer to urban centers and those far from towns such as Habru-Ligo is striking. Habru-Ligo is almost becoming barren losing its natural forests and bushes. On the other hand, areas nearer to urban centers are being covered by commercial trees. Other villages such as Buhoro and Girana have a sort of agro-forest where orange, banana, pawpaw, and other trees of permanent crops dominate.

The other major source of income is remittance from abroad. Income from this source accounts for about 15% of the total income of households in Menentela and Girana areas. Almost all remittance from abroad comes from migrant workers in the Gulf countries. Two factors seem to be important to migration decisions to the Gulf at least for the villages under the survey. The first is information. In most cases, the demonstration effect is crucial. If for some reason someone or some group succeeded sometime in the past by migrating to the Gulf, then, other family members back in the village would be better off. This triggers others to send their children.

The second important factor in terms of migrating abroad is household income. The cost of migration to the Gulf is high in particular by the standard of rural life. It costs up to ten thousand Birr for an individual to travel to the Gulf countries. This figure is roughly three times the annual average income of a household in Habru-Ligo and the same as the annual average income of a household in Buhoro area. The risk of being deported adds to the cost. Hence, wealth status of the household is crucial to decide on sending a member of a household abroad. It can be observed that income from cash crops enabled some households in Girana area to send their children to the Gulf countries which otherwise would have not been possible.

In general, looking at the data, it appears that patterns of economic activities and the associated income of rural households have a strong association with the relative location of those economic activities in relation to urban centers. The overall living standard in the rural areas covered by this study tends to improve with proximity to urban centers.

2.4. Theoretical Framework on Location, Crop choice and Rural Income

2.4.1. Background

We portray a Thünen type of environment where rural households make a living from income that is generated from their farming activities. Households dwell and operate at a certain distance from urban centers. Normally, each household consists of labor force that jointly maximizes utility so that overall welfare is improved in the household. Collective labor time is optimally allocated between agricultural activities and off-farm income generating activities, most importantly employment in the urban centers. However, to make the analysis tractable, the household is assumed to be populated by one individual.

Peasant-operated agricultural activities involve mainly crop production and animal husbandry. Crop production, which is the major mainstay of rural households, involves various items of product whose technology of production may differ. However, for this study, the sources of income from the agricultural sector are restricted to two major activities, namely, production of stable crops and production of cash crops. In fact, about 74% of the income of households in the villages covered by the survey comes from crop productions.

The household produces staple and cash crops by combining land and other inputs such as oxen. Part of the staple crop and a significant portion of cash crop have to be sold to purchase industrial goods for consumption. A household that does not produce sufficient staple crop and therefore falls short of home consumption has to purchase from the market using the proceeds from the sale of the cash crop.

The decision to produce a particular item depends on the relative distance of the activity from the town. Moreover, unlike the Thünen's rings, the land surrounding the town needs not to be uniform so that villages at same distance from the town could specialize in particular crop.

In what follows, we attempt to analyze how location and level of education affects the decision of a household to allot a plot of land for either a less risky staple crop or a more risky but high value cash crop.

2.4.2. Production Technologies and Costs

The declining per capita land holding challenges the production of staple crops. As a result, households rationally decide to invest in high value crops that maximize income per unit of land. The cash crops are preferred not by the virtue of giving high yield per unit of land but by the virtue of having high value in the market, most importantly in urban centers. However, households consider investment in cash crops as risky either because they have little technical know-how to produce such crops, or they anticipate that price may decline to the extent that it will affect their subsistence since only little can be used for home consumption, or both. Some cash crops such as coffee are not consumed for nourishment while some others such as vegetables are perishable. The staple crop on the other hand gives more security to the household against very low prices for agricultural products as the household can survive on it.

The production of the two crops requires factors such as land and labor. Quality of labor in terms of education is assumed to be important in affecting the household's decision to allot a particular plot for either a staple crop or a cash crop. This implies that a particular knowledge about how to produce and sell a cash crop induces a household to decide what portion of land has to be allotted for the production of cash crop. It is assumed for the sake of simplicity that labor intensity is not binding for both cash and staple crop production. But the know-how of a unit of labor about the production of a particular crop and about the information on potential markets can make a difference in deciding on the portion of land that has to be allotted for the production of the particular crop.

The household is assumed to possess a unit labor and a unit plot of land that can be allotted for the production of cash crops and staple crops. Let l^c and l^s represent the proportions of land that have to be allotted for the production of cash crops and staple crops, respectively at period[8] so that $l^c + l^s = 1$. Using l^c portion of land, the household produces q^c units of cash crop to be sold at price p^c in urban centers. The remaining portion of land ($l^s = 1\text{-}l^c$) is used to produce q^s units of staple crop. Part of this crop will be consumed at home and any surplus is sold at the market at a price of p^s.

The production function of the two types of crops that relate the output per labor q^i to a fraction of a unit of land l^i[9] is, therefore, given by:

$$q_t^c = A^c f\left(l^c\right)$$

$$q_t^s = A^s g\left(l^s\right) \qquad (2.1)$$

where A^c and A^s are the levels of technology required to produce the cash crop and staple crops, respectively. The production functions are assumed to fulfill the standard conditions:

$$f'\left(l^c\right) > 0\ , \quad f''\left(l^c\right) < 0\ ; \qquad g'\left(l^s\right) > 0\ , \quad g''\left(l^s\right) < 0.$$

where $f'\left(l^c\right)$ and $g'\left(l^s\right)$ are the first order derivatives of the production functions with respect to land under cash crop, and staple crop, respectively; $f''\left(l^c\right)$ and $g''\left(l^s\right)$ are

[8] Normally, for a given producer, the production function involves time. Decisions on factor inputs and actual production have time lags. For convenience and in the spirit of static model, we dropped the time subscript and ignored the possible lags involved between inputs and outputs. We merely assume that the decisions are made at a given period *t*.

[9] Practically, some cash crops such as coffee, orange, and pawpaw have maturity period of two to five years. There are also some crops such as vegetables and oilseeds with a maximum maturity period of one year. Daniel (2003) noted this issue and has taken the opportunity cost of land in terms of yield of annual crops as a result of longer maturity period of coffee trees into account in his model. However, it is customary in the area under study that the land under permanent cash crops can at the same time be used for the production of annual crops until the cash crops grew to a full-fledged tree. Thus, it is not harmful to continue the analysis without considering the opportunity cost of land due to long gestation period of permanent crops.

the second order derivatives of the production functions with respect to land under cash crop, and staple crop, respectively.

In words, the marginal productivity of land both in the production of staple and cash crops is positive in the sense that a unit increase in proportion of land that is assigned to the production of cash crops and staple crops increases the yield of the crops but at a decreasing rate. That is, there is a diminishing returns to land allotted for each crop.

It is innocuous to consider the technology which is required to produce staple crops, A^s, as a numéraire to which the technique required to produce cash crops, A^c, can be compared. Thus, A^s is set to unity so that $q^s = g\left(l^s\right)$.

It is assumed that the decision by an individual to produce cash crop also depends on the technical know-how of the individual about the production of the particular cash crop. An individual might be a quick innovator in terms of acquiring new technology if he/she has some formal education. Appealing to the growth theory which relates technology to human capital (Jones, 2002 and 2004), the technological parameter in the production function of the cash crop can be given by:[10]

$$A^c = A_0^c e^{\psi E} \tag{2.2}$$

where A^c_0 is some indigenous knowledge of the technique, E is level of education (say in years of schooling), and ψ is a parameter.

Given the prices of cash crop and staple crops, the total monetary value of these crops at period t can be given by:

$$y = A_0^c e^{\psi E} p^c f\left(l^c\right) + p^s g\left(l^s\right) \tag{2.3}$$

[10] The adoption of the technology once it is available is assumed to evolve exponentially according to $A^c = A_0^c e^{gt}$ where g is the rate of innovation and t is time required to acquire the technique. The rate of growth of technology is assumed to be a function of education over time, $g = \psi E$.

The household incurs production costs for each crop. For simplicity, let us assume that costs of production of each crop are proportional to land allotted to the production of the crops. Let w^c and w^s represent costs of production of cash crops and staple crops, respectively, per unit of land. If we ignore the possibility of the existence of economies of scale in the production of the two types of crops, the associated cost of production of cash and staple crops are given by $w^c l^c$ and $w^s l^s$, respectively.

The household also incurs transportation costs for both crops. We further assume that direct cost of transportation per standardized unit of each crop per unit distance is the same. However, the cost of transportation for each crop could vary depending on the amount of crop that the household wants to sell. In this regard, the household usually sells small portion of the staple crop because most of the staple crop produced is used for home consumption. If we ignore the small proportion of cash crop that is used for home consumption (that is almost all cash crop is sold) and if n portion of staple crop is marketable, then, the total transportation cost of cash crops and staple crops with k unit cost of transportation per unit distance per unit crop is, respectively, given by $kq^c r$ and $knq^s r$ where r is the distance between the area of production to market/urban centers.

The household also incurs another cost due to the perishable nature of each crop. We define an index that measures the degree of the perishable nature of each crop in connection to transporting the surplus to the market. Let r be the distance of the plot (place of economic activity) from the market place and $r^i_{\max}$ denote the maximum distance of the i^{th} crop beyond which the crop cannot be sold at the market due to its perishable nature. Then, the index for the i^{th} crop is given by:

$$r^{*i} = \frac{r}{r^i_{\max}} \tag{2.4}$$

where:

$$r^{*i} = \begin{cases} 0 & if \ r = 0 \\ 1 & if \ r \geq r^i_{\max} \end{cases} \qquad \text{so that} \quad r^*_i \in [0,1].$$

If the crop which is produced at distance *r* is perishable, then it loses a value of r^{*i} monetary units per unit of crop sold. The household has to pay that much amount in transport cost assuming the technology allows for facility that 'avoids' the loss either in the form of fast transportation or preservation facilities. If almost all cash crops produced and *n* fraction of the staple crop are intended to be sold at their respective prices, and if all staple crops are not perishable, then the associated total cost incurred can be summarized by:

$$C = \left(q^c + nq^s\right)kr + r^{*c} p^c q^c + w^c l^c + w^s l^s \qquad (2.5)$$

Given the revenue function in Equation (2.3) and the cost function in Equation (2.5), the profit π of the household is, therefore, given by:

$$\pi = A_0^c e^{\psi E} f\left(l^c\right)\left(p^c - kr - r^{*c} p^c\right) + g\left(l^s\right)\left(p^s - nkr\right) - w^c l^c - w^s l^s \qquad (2.6)$$

2.4.3. The Problem of the Household

The household is assumed to make consumption and production decisions recursively. Thus, profit is maximized for a given choice variable which is the proportion of land that has to be allotted for the production of cash crop.

$$\max_{l^c} \pi = A_0^c e^{\psi E} f\left(l^c\right)\left(p^c - kr - r^{*c} p^c\right) + g\left(l^s\right)\left(p^s - nkr\right) - w^c l^c - w^s l^s \qquad (2.7)$$

Applying the first order derivatives on Equation (2.7) with respect to the choice variable $i^c{}_t$, the first order condition emerges:

$$\frac{d\pi}{dl^c} = A_0^c e^{\psi E} f'\left(l^c\right)\left(p^c - kr - r^{*c} p^c\right) - g'\left(l^s\right)\left(p^s - nkr\right) - w^c + w^s = 0$$

Upon rearrangement, the first order condition gives rise to the important profit maximization condition of land allocation decision. That is:

$$p_t^c A_0^c e^{\psi E} f'\left(l_t^c\right) = \left[A_0^c e^{\psi E} f'\left(l_t^c\right)\left(kr + r^{*c} p_t^c\right) + w^c\right] + \left[g'\left(l_t^s\right)\left(p_t^s - nkr\right) - w^s\right] \tag{2.8}$$

The right hand side of Equation (2.8) is the value of marginal product of land in the production of cash crop. The first term of the right hand side of the equation which is in the square bracket is the marginal cost of producing and selling cash crops. The term in the second square bracket shows the opportunity cost of production of cash crops at the net margin. In general, this condition says that an optimum allocation of the available plot of land between cash crop and staple crop should ensure that the value of marginal product of the particular plot of land in the production of cash crops equals the foregone value of the marginal product of the plot of land in alternative use (for staple crops) net of marginal costs of production in the alternative use plus direct marginal costs**.**

Given our assumptions, it can be shown that the second order derivative of the profit function with respect to plot of land allotted for the production of cash crops is negative.

$$\frac{d^2\pi}{d\left(l^c\right)^2} = A_0^c e^{\psi E} f''\left(l^c\right)\left(p^c - kr - r^{*c} p^c\right) + g''\left(l^s\right)\left(p^s - nkr\right) < 0$$

By the assumption of diminishing returns to scale, $f''\left(l^c\right)$ and $g''\left(l^s\right)$ are negative. The household produces cash crop if his optimization condition ensures that the unit profits are greater than unit costs so that $p^c > \left(kr + r^{*c} p^c\right)$ and sells his staple crop if $p^s > nkr$. This implies that the second derivative is negative. Thus, the sufficient condition for maximization of profit is met.

It can be noted that the second order derivative becomes positive if r^{*c} is unity, that is if $r \geq r^c_{max}$. Nonetheless, at $r^{*c} = 1$, the household has no incentive to produce any cash crop as it would intuitively mean that all cash crop that has to be transported will be spoiled before it reach the market!

Upon specialization of the functional forms of the above conditions, it is possible to derive a demand function for the proportion of land that is allocated to cash crops l^c, as:

$$l_i^c = f\left(r^c, r^{*c}, E\ , p^c, p^s, w^c, w^s, n, k\right) \tag{3.9}$$

where the various variables are as defined above.

2.4.4. Comparative Static Analysis

The direction of the impact of changes in the various exogenous variables over time or variations across households can be demonstrated using the framework of comparative static analysis. In particular, it is important to see the direction of the impact of variation in location in relation to urban centers and level of education on land allocation decision.

The first order condition can be re-written in the form of an implicit function *F(.)* with endogenous variable l^c, and exogenous variables and parameters as it appears in Equation (2.10).

$$\begin{aligned} &F\left(l^c; r, r^{*c}, E, p^c, p^s, w^c, w^s, k, n\right) \\ &\quad = A_0^c e^{\psi E} f'\left(l^c\right)\left(p^c - kr - r^{*c} p^c\right) - g'\left(l^s\right)\left(p^s - nkr\right) - w^c + w^s = 0 \end{aligned} \tag{2.10}$$

By totally differentiating the implicit function with respect to the endogenous and the exogenous variables, we have:

$$\begin{aligned} dF = &\left\{A_0^c e^{\psi E} f''\left(l^c\right)\left(p^c - kr - r^{*c} p^c\right) + g''\left(l^s\right)\left(p^s - nkr\right)\right\} dl^c \\ &+ \left\{k\left[A_0^c e^{\psi E} f'\left(l^c\right) - ng'\left(l^s\right)\right]\right\} dr \\ &+ \left\{A_0^c \psi e^{\psi E} f''\left(l^c\right)\left[p^c - kr - r^{*c} p^c\right]\right\} dE + \ldots = 0 \end{aligned}$$

The change in proportion of land that is allotted for the production of cash crop, l^c, for a unit change in various exogenous variables can be determined. To start with, holding other exogenous variables constant, the change in l^c for unit variation in location across households in relation to markets (urban centers) is given by:

$$\frac{dl^c}{dr} = \frac{k\left[A_0^c e^{\psi E} f'\left(l^c\right) - ng'\left(l^s\right)\right]}{J}$$

where $J = \left\{A_0^c e^{\psi E} f''\left(l^c\right)\left(p^c - kr - r^{*c} p^c\right) + g''\left(l^s\right)\left(p^s - nkr\right)\right\}$.

Basically, *J* is the second derivative of the profit function with respect to the proportion of land allotted for cash crop production which is shown to be less than zero. In the numerator, $f'\left(l^c\right)$ and $g'\left(l^s\right)$, which are the marginal productivities of land that is used in the production of cash crop and staple crop, respectively, are positive by assumption. It can be fairly assumed that the marginal product of land in cash crop production $\left(A_0^c e^{\psi E} f'\left(l^c\right)\right)$ is greater than the *n* fraction of the marginal productivity of the same plot of land for the production of staple crop, $\left(ng'\left(l^s\right)\right)$. This implies that the term in the numerator is greater than zero. Hence, we have:

$$\frac{dl^c}{dr} = \frac{k\left[A_0^c e^{\psi E} f'\left(l^c\right) - ng'\left(l^s\right)\right]}{J} < 0$$

That is, a unit variation in location across plots in relation to markets in the direction away from such markets leads to a decline in proportion of plot of land that is allotted for the production of cash crops.

The other important variable which is believed to affect the allocation of land for cash crop production by households is education. Once more, assuming other exogenous variables to be held constant, the impact of the variation in level of schooling on proportion of land that has to be allotted for cash crop production can be shown to be positive. That is:

$$\frac{dl^c}{dE} = \frac{-A_0^c \psi e^{\psi E} \left\{ f'\left(l^c\right)\left[p^c - kr - r^{*c} p^c \right] \right\}}{J} > 0 \, ,$$

As it has been shown already, J is less than zero. In the numerator, the term in the square bracket is also shown to be positive. That is, in order the household to engage in the production of cash crop by diverting some plots of land, the unit price p^c should be greater than the unit costs associated with transport. In fact, p^c should also be enough to cover other costs of production so the transportation cost is the minimum to which the unit profit has to be compared with. With the negative sign that multiplies the whole numerator, the overall expression becomes positive.

The result can be interpreted as that an increase in years of schooling by a unit time, say one year, or a unit variation in level of education among individual farmers tends to bring about a difference in proportion of land allotted for cash crops in favor of production of cash crops.

Similarly, the direction of the impact of the index for the perishable nature of a cash crop can be shown to be negative. The higher the index (i.e. the more perishable the crop is), the less proportional land to be allotted for the production of the particular crop. That is:

$$\frac{dl^c}{dr^{*c}} = \frac{p^c A_0^c e^{\psi E} f'\left(l^c\right)}{J} < 0$$

The direction of the impact of change of or variation in other exogenous variables and parameters can be derived in a similar fashion. Accordingly, changes in unit costs of production of cash crops w^c, prices of staple crops p^s, and rate of cost of transportation per unit distance traveled k, can be shown to reduce the proportion of land allotted for the production of cash crops. The derivative of the optimum size of land under cash crop with respect to w^c, p^s, and k can be shown to have a negative sign:

$$\frac{dl^c}{dw^c} = \frac{1}{J} < 0\,; \quad \frac{dl^c}{dp^s} = \frac{g'\left(l^s\right)}{J} < 0\,; \quad \frac{dl^c}{dk} = \frac{r\left[A_0^c e^{\psi E} f'\left(l^c\right) - ng'\left(l^s\right)\right]}{J} < 0$$

On the other hand, increases or variation in unit cost of production of staple crop w^s, price of cash crop p^c, and high proportion of marketable surplus of the staple crops n tend to increase the size of the proportion of land that has to be allocated for the production of cash crops. Given the assumptions we made so far, inspection of the various terms in the following derivatives confirms the indicated signs:

$$\frac{dl^c}{dw^s} = \frac{-1}{J} > 0\,; \quad \frac{dl^c}{dp^c} = \frac{-A_0^c e^{\psi E} f'\left(l^c\right)\left(1 - r^{*c}\right)}{J} > 0\,; \quad \frac{dl^c}{dn} = \frac{-kr}{J} > 0$$

2.4.5. Recovering Household Income

Once the household rationally decides on the proportions of land that have to be allocated for high value cash crops and staple crops, then, maximized level of income from activities on crop production will be given as a function of optimally allocated size of plots for each crop. Let y_r be the maximized level of income; l^{*c} and l^{*s} be land allocated for cash and staple crops, respectively; x be a vector of other exogenous factors. Then, household income is given by:

$$y_r = f\left(l^{*c}, l^{*s}, x\right) \tag{2.11}$$

Some variables such as distance from urban centers may have a dual impact on income through land allocation decisions. Such variables may affect the size of total land available for the household. We have for instance observed in the data that per capita land size increases with distance away from urban centers up to a certain level and tends to decline beyond that level probably due to low rate of out migration. Other variables such as access to irrigation scheme may also have a direct effect on income for households who have similar crop choice.

2.5. ECONOMETRIC ANALYSIS

2.5.1. Background

The theoretical framework suggests that a household's decision to allot a plot of land to cash crop production in an attempt to maximize household income (with ultimate goal of maximizing utility) is by and large a function of, among others, distance from the market (usually urban centers), level of education, and prices. There are, however, other factors which are deemed to be important in affecting crop choice. These include access to irrigation scheme, climatic conditions, and wealth of the household. Some cash crops such as sugarcane are water intensive and its production presupposes availability of irrigation scheme. Areas with irregular rainfall may not specialize in cash crop production. Moreover, wealthier households are highly likely to afford relatively higher initial investments in cash crops.

The other important route through which access to irrigation, and climatic conditions along with wealth determine crop choice is risk perception. Crop choice could depend on ex post risk management factors that affect the degree of shifting a risk which can be approximated by the number of crop seasons within a given period and wealth of the household. The degree of shifting risk largely depends on the type of climate and whether a household has access to irrigation scheme[11]. In some cases, cold climate makes it difficult to harvest more than once within a year. For instance, Alasha, one of the villages in our survey area is characterized by cold climate and only one major crop season is possible. A rather intermittent incidence of rainfall adds to the problem. On the other hand, in lowland areas such as Girana, it is possible to plant crops throughout the year as long as the plot is irrigable.

[11] Ray (1998) argues that irrigation is one of the means that reduces the erratic nature of rainfall. It is also possible to argue that production turnover within a year highly depends on availability of irrigation scheme which in a way affects the degree of shifting land from a production of a risky cash crop to fast growing staple crop. It has been observed in one of the survey areas of this study called Girana that households who faced low price for onions immediately shift the land for the production of *teff* and maize.

For given prices p^c and p^s, and costs, the estimable model is summarized by:

$$l^c = f\left(r_i, AR, E, DI, DC, W, DR\right) \qquad (2.12)$$

where r_i = distance of the plot from market centers, AR = access to road, E = level of education of the agent, DI = dummy for access to irrigation, DC = dummy for climate, W = wealth of the household, and DR = dependency ratio. It is expected that *r,* and *DR* would affect l^c negatively while other variables except *DC* affect it positively. The impact of climate on allocation of land for cash crop depends on the particular cash crop. But in the Ethiopian context and in the spirit of this discussion, areas with cold climate tend to specialize less on cash crops.

In this section, an attempt is made to econometrically verify the assertion that proximity to urban centers and education influences crop choice by households and the associated difference in income across households. A fractional logit model has been employed to estimate the proportion of land allotted for cash crop. A function of rural household income has been estimated using land under cash crops and staple crops along with other variables as explanatory variables. The estimation makes use of the survey data collected for this study.

2.5.2. Estimation Technique

In the crop choice model, the dependent variable is land under cash crop in proportion to total land size. The explanatory variables include distance from urban centers, access to roads linking to urban centers, total land endowment, level of education of the head of the household, a dummy for climate, and a dummy for whether a household possesses irrigable land. Size of own plot, and size of land used under share cropping arrangements are also considered. One can argue that land under such arrangements may not be used in the production of cash crops since production of such crops involves a long gestation period.

Obviously, OLS procedures are not appropriate when the dependent variable is a ratio bounded between 0 and 1. Running OLS on a fractional dependent variable would entail similar problems as it does in the linear probability model for strict binary cases [Wooldridge, 2002]. One of the drawbacks of this approach is that predicted values of OLS estimates would not necessarily lie in the [0,1] interval. The other important advantage of using fractional logit model over OLS is that the first accounts for possible non-linear relationship in the model.

A common approach to model dependent variables which are bounded between 0 and 1 is a logistic transformation where the log-odds ratio is modelled as a linear function of a set of independent variables. Unfortunately such procedure does not account for data that includes the limits 0 and 1. Moreover, it is not possible to recover the predictions for the dependent variable without some simplifying assumptions. In our case, though a value of 1 is rare, there are a number of households who do not allot their plots for cash crop at all. One way out could be to proceed with such transformation by giving an extremely small number for values equal to zero and a near unity number for values of 1. This is, however, arbitrary which may lead to undesirable results [Wooldridge, 2002].

Papke and Wooldridge (1996) based on the results of Gourieroux, Monfort, and Trongen (1984) and McCullagh and Nelder (1989) suggested as an alternative the Generalized Linear Model (GLM) that makes use of quasi-maximum likelihood estimation procedures.

The notion of the GLM is that a regression model can be decomposed into a random component with expected value and variance of the dependent variable, a systematic component that is predicted by covariates, and a link function that relates the systematic component to the random component. For classical regression models, the random component is assumed to be distributed normal and the link function is an identity in the sense that the random and systematic components are identical [McCullagh and Nelder, 1989].

What makes GLM more relevant is that the normality assumption on the distribution of the random component could come from any function of the exponential family, and the link function could be any monotonic differentiable function [McCullagh and Nelder, 1989].

In our case, we have the dependent variable $l^c{}_i$ and the vector of the various explanatory variables **x**, where $0 \le l^c \le 1$. Then, for all i:

$$E\left(l_i^c\right) = x_i\beta \qquad (2.13)$$

In this case, the random component, $E\left(l_i^c\right)$, is expected to have a value of μ so that $0 \le \mu \le 1$. And also, unlike the linear regression model, the random component could have a distribution different from normal. It might rather have a binomial distribution given that the mean of a binomial distribution, which is in the exponential family, falls between 0 and 1.

More importantly, the link function cannot be assumed to be identity because the systematic component ($x_i\beta$) does not ensure the condition that the random component, $E\left(l_i^c\right)$, lies between 0 and 1. Hence, the link function that relates $E\left(l_i^c\right)$ and ($x_i\beta$) could be given by:

$$E\left(l_i^c \mid x_i\right) = G\left(x_i\beta\right) \qquad (2.14)$$

where G(.) is a link function satisfying the condition that $0 \le G(.) \le 1$.

Gourieroux, Monfort, and Trongen (1984) showed that pseudo-maximum likelihood estimators (PMLE) or quasi-maximum likelihood estimators (QLME)[12] are consistent as long as the likelihood function is in the linear exponential family and given that the link function under (2.14) holds.

[12] Quasi-maximum likelihood estimators, also known as pseudo-maximum likelihood estimators, are methods which maximize probability distributions which do not necessarily contain the true distribution.

The question is what specifically should be the linear exponential family and the link function? Papke and Wooldridge (1996) suggested the random component to be Bernoulli for its being more attractive for that it is easy to maximize the likelihood function; and as a member of the linear exponential family, its quasi- maximum likelihood estimator is consistent.

For the link function, one can find differentiable functions that ensure the condition $0 \leq G(.) \leq 1$. However, McCullagh and Nelder (1989) suggested that the canonical link function for a binomial distribution is the logit function.

Thus, if we choose the special case that $l_i^c \sim Bernoulli$ with a logistic link function, we have:

$$G(x_i\beta) \equiv \Lambda(x_i\beta) = \frac{e^{x_i\beta}}{\left[1+e^{x_i\beta}\right]} \tag{2.15}$$

The Bernoulli likelihood function is given by:

$$f\left(l_i^c \mid x_i;\beta\right) = \left[\Lambda(x_i\beta)\right]^{l_i^c}\left[1-\Lambda(x_i\beta)\right]^{1-l_i^c}, \text{ where } l_i^c \in [0,1].$$

This can be transformed to give:

$$L(\beta) = l_i^c \log\left[\Lambda(x_i\beta)\right] + \left(1-l_i^c\right)\log\left[1-\Lambda(x_i\beta)\right], \tag{2.16}$$

The QMLE procedure yields a consistent estimator with a conditional assumption on the variance. The assumption is that:

$$\operatorname{var}\left(l_i^c \mid x\right) = \sigma^2 G(x_i\beta)\left[1-G(x_i\beta)\right] \text{ for some } \sigma^2 > 0 \tag{2.17}$$

The limitation, though, is that such an assumption on the variance for this particular mix of a Bernoulli distribution of random component with a logistic link function to hold is restrictive as argued in Papke and Wooldridge (1996).

By synthesising the GLM results and that of the quasi-maximum likelihood estimations, Papke and Wooldridge (1996) suggested the likelihood function to be Bernoulli with asymptotically robust inference for the conditional mean parameters if the assumption on the conditional variance fails in estimating fractional dependent variables. They applied the Bernoulli likelihood function with logistic link function to estimate participation rate in 401(k) pension plans and claimed that the results showed better functional specification compared to OLS estimates.

The other model we considered in this section is the incomes function of rural households. The estimable model is given by:

$$y_r = f\left(L_i^c, L_i^s, N, O, DI, E_h, DR\right) \qquad (2.18)$$

where y_r = household per capita income from crop production, L^c_i = land under cash crop, L^s_i = land under staple crop, N = labor, O = number of oxen, DI = dummy for availability of irrigable land, E_h = education level of the head of the household, and DR = dependency ratio.

We have also re-estimated the incomes function of the households using per capita income from all sources as dependent variable and by including dummies for rural enterprise and participation in food for work program. For the estimation of the incomes function, ordinary least squares (OLS) technique is used after testing for possible simultaneity problem.

2.5.3. The Data and Estimation Results

For the estimation purpose, survey data from six villages in four sites of North Eastern Ethiopia were used. The villages have different attributes in terms of distance from major and small towns, access to road, access to irrigation scheme, and climatic condition. [The background of each village is discussed in the General Introduction.] Appendix 2.A shows variables that are used in the estimation of crop choice model and household income function.

In the crop choice model, distance from town is approximated by the distance in kilometre between what is thought to be 'centroid' of the village to the nearest district town. Distance from road is the distance in kilometre of the village from the nearest road accessible by vehicles. We defined access to road as the reciprocal of the distance in kilometre from the road accessible by vehicle.

The dummy variable for availability of irrigation scheme takes a value of 1 if the village has access to irrigation facilities (modern or traditional) at a significant scale and 0 otherwise. The dummy for climate takes on a value of 1 if the village has cold (*dega*) climate (which is associated with high land areas) and 0 if it has moderate (*woina-dega*) climate. In this case, only Alasha has cold climatic conditions.

Per capita cash income and per capita value of livestock are also included to capture the impact of wealth on crop choice. Dercon (1996), Kurosaki and Fafchamps (2002) used value of livestock as a proxy for liquid wealth which in turn is intended to capture the impact of liquidity constraints. In our case, per capita value of permanent cash income include pensions, permanent remittances, and salaries from long-term off-farm employments. Value of livestock is the sum of the average market price of cattle, goats, sheep, and camels.

Livestock ownership may have two opposing impacts on crop choice. On one hand, livestock serve as buffer stock against risk in which case it favours the allocation of more land for cash crop production. On the other hand, livestock farming might be a competing activity to cash crop production. The relative importance of the two effects depends on village specific factors such as distance from urban centers. To try to disentangle the two effects, we used an interaction variable of distance (r) form urban centers and value of livestock VLS so that the interaction variable is denoted by $VLS \times r$.

For the educational attainment of the head of the household, years of schooling by level (primary, junior secondary and senior secondary levels in which the head has attended some classes) were considered. The maximum years of schooling of the heads of the households were 11 years. A dummy was used for each level where a value of 1 is given if the head had some education of the particular level and 0 otherwise. The base outcome is ‘never attended any of these levels’.

Own land is the size of plot in hectares that belongs to the household. Size of land under sharecropping arrangements is also included. Size of plot a household took from other households (LSC1), and size of plot which a household gave away for sharecropping arrangements (LSC2) are considered.

One possible problem associated with the estimation procedure is the issue of simultaneity. One of the variables that might potentially be endogenous is access to irrigation since irrigated plot size (a measure of demand for irrigation) could at the same time be affected by the type of crop that a household would prefer to grow. In our case, the potential simultaneity problem may not arise since we used dummy for whether a household has some plots of land that is accessible to irrigation irrespective of whether the plot is irrigated during the survey period. Most households in three of the six villages do have more access to irrigation schemes but do not necessarily irrigate their plots depending on the season and the type of crop.

The other potential source of endogeneity problem in the model is the liquid asset. The permanent cash income can be thought of as exogenous because pensions, remittances, and compensations for long term off-farm activities may not be expected to be affected by crop choice decisions. However, the simultaneity problem may arise in the case of value of livestock. Dearcon (1996) for example claimed to have found simultaneity between crop choice and value of livestock. On the other hand, Kurosaki and Fafchamps (2002) argued that liquid assets and livestock are predetermined alluding that these variables can be taken as exogenous.

In our case we applied Hausman test of simultaneity to check whether value of livestock is exogenous[13]. The instruments used were total land size, number of oxen, and labor. The test does not support the null that value of livestock is endogenous. [See footnote 11]. In this case, it is not compelling to opt for the use of the methods of instrumental variables since proceeding with such procedure while the simultaneity case is not supported would lead to inefficient though consistent estimates [Pindyck and Rubinfeld, 1998; Gujarati, 2003]

A total of 252 households are used for the estimation of both crop choice model and household income function. For the crop choice model, we applied a generalized linear model with a logit link function where the dependent variable is assumed to be distributed Bernoulli. We also estimated the model using ordinary least squares for comparison. Estimates along with their marginal effects are reported in Appendix A Table 2.4.

Results for Crop Choice Model

In most cases, GLM and OLS results are not in divergence both in terms of magnitude of the coefficients and their statistical significance except the variable dependency ratio for which difference terms of statistical significance is observed.

The results for crop choice or land allocation decision model show that proximity to town, access to road, education of the head, liquid wealth, and access to irrigation scheme are important variables to induce a household to allocate land for production of cash crops. Rural households under study who operate nearer to urban centers tend to allot more land for the production of cash crops while those households who operate far from

[13] We estimated an auxiliary regression where per capita value of livestock was regressed on total land, labor, and oxen. The result (with t-ratios in parentheses) is:

$$\underset{(3.68)}{PCVL = 848.03} + \underset{(3.50)}{719.36Land} + \underset{(5.46)}{349.80Oxen} - \underset{(-4.07)}{304.89Labor}$$

$$R^2 = 0.22$$

The crop choice model was re-estimated by including the residual of the auxiliary regression along with the per capita value of livestock (Wooldridge 2002). We found that the coefficient of the residual term was not statistically significant both in the GLM estimates (Z = -0.42) and the OLS (t = -0.94) indicating that the existence of simultaneity is not supported.

urban centers tend to allocate much of their land for the production of staple crops (grains). This might be due to the fact that rural peasants nearer to urban centers have more advantage in terms of transportation cost and information about the market. It appears that the results lend support for our argument that for a crop choice, location of agricultural economic activity in relation to urban centers matters.

The significance of distance in the regression model has an implication beyond the straight forward location-crop choice argument. Such difference in income generating activities and in the associated level of income with minor differences in location show the existing meagre demand from urban centers in that only those farmers who operate plots nearer to urban enclaves scramble the market. This might suggest that rural development that is not paralleled by urban development may not be sustainable.

The significance of the variable 'access to road' (with expected sign) may indicate that availability of road reduces cost of transportation to the market and as a result households tend to allot more land for the production of high value crops.

Not surprisingly, dummy for availability of irrigation scheme is significant and positive. Irrigation may have two impacts. First, most cash crops which have high demand in the urban market require a sustainable supply of water. As it has been indicated in Section 2.3, major cash crops that are produced include sugarcane, and fruits whose production is water intensive. Secondly, availability of irrigation scheme gives households the opportunity to produce more than once within a year. This in turn secures them to shift into the production of staple crops with low gestation period during a risk of falling prices of cash crops such as vegetable. For example, in Girana area, if price of onion falls significantly, then, households make use of their opportunity of having access to irrigation scheme to shift the plot for fast growing varieties of staple crops such as *teff* and maize.

In the case of liquid asset, estimation results without the interaction variable (VLS×r), value of livestock was found to be insignificant while permanent cash income had positive and significant coefficient. Upon the introduction of the interaction variable, both permanent cash income and value of livestock were significant the latter having negative coefficient. The interaction variable itself has positive and significant coefficient.

It can be shown from the coefficients of value of livestock and interaction variables that within about 18 kilometres radius from market centers, the rivalry effect of cash crop production and livestock farming dominates[14]. Beyond 18 kilometres radius, the role of livestock as a buffer stock against risk dominates in that households with more livestock tend to allot land for cash crop. In fact the village that is found beyond this particular distance is Habru-Ligo. One explanation for positive association between cash crop production and value of livestock in the remote village could be that the village has significant land that is not arable but which can be used for livestock farming. Hence, this activity does not necessarily compete with crop production in terms of land use.

In general, education of the head is positively associated with a higher probability of allocating more land for cash crops. Some education of primary and junior secondary levels by the household head has positive impact. However, additional schooling to senior secondary schooling does not have significant influence on the household's decision to allot more land to cash crops.

The negative sign of the dummy for climate shows that highlanders of the villages under survey do not allot much land to cash crop compared to lowlanders. In this case, the only village with cold climate is Alasha. In this village, there is usually one crop season per annum as the land has to stay under cold weather conditions for a significant period of the year. Thus, households minimize risk by producing staple crops. The other reason for allotting relatively lower plot of land for cash crops is that fruits known to the region are not adaptable to such climate. Seedlings for fruit items that could grow under that kind of cold climate such as apple and peach trees are not introduced to the area.

[14] We calculated the threshold distance (= 18 km) by differentiating the land allocation equation with respect to value of livestock and set to zero. We used the slope coefficients of the GLM estimates for this purpose.

The coefficients and slopes for total own land, and land under sharecropping arrangements are not statistically significant. However, their direction could be important. Land leased out in the form of share cropping arrangements is significant only at 10% level of significance.

Lastly, dependency ratio (proportion of members of a household below the age of 10 and above the age of 65 to the active labor force) is found to be significant only at 10% level in the case of GLM estimation but significant at 5% in the case of OLS estimates. It might indicate that households with more dependent family members are more risk averse and hence do not tend to allot more land for cash crop as they prefer food security.

Results for Incomes Function

In the estimation of the rural income function, the dependent variable is annual per capita income in Birr from agricultural activities, in particular cash and staple crop production. On the side of the explanatory variables, size of land under cash crop and staple crops are used separately.

Since variables which affect the proportion of land allocated for cash crop may affect current income, the error term in the incomes function may be correlated to land allocated for cash and staple crops upon omission of these variables. Hausman test has been conducted to check for possibility of existence of simultaneity problem. In the auxiliary regression, proportion of land under cash crop was regressed on distance from urban centers, access to road, dummy for climate, dummy for access to irrigation scheme, cash income, and level of education of the head of the household.[15] The coefficient for the residual of the auxiliary regression was not significant at 5% level in the incomes function indicating that there is no statistical support for the existence of simultaneity between current income and land size allotted for cash crop [See Table 2-6). This might

[15] Upon testing for exclusion restriction, cash income which is independent of income from crop production was insignificant in the income function where only crop income is used as dependent variable (See Table 2-5).

be due to the fact that current income is materialized one period after the land allocation decision is made.

Head counts are used for oxen. In the case of labor, a sort of adult equivalent labor is used. Household members aged 16 and above are given a weight of 1 while those in the age of 10 to 15 are given a weight of 0.5. Some variables which were used as determinants of land allocation decision are also used in estimating the income function. The rationale of including the variables which were used as determinants of land allocation decision (dummy for irrigation scheme, and education) is to see their direct effect on income apart from their impact on it through land allocation decision.

We applied OLS technique to estimate the income function. Results are summarized in Appendix A Tables 2.5 to 2.10. The Ramsey RESET test did not detect functional misspecification except in one case of the four different specifications. That is, the null that there are no omitted variables was not rejected at 1% level of significance. The null for constant variance under the Breusch-Pagan test for heteroscedasticity was rejected at 5% level. However, there was little change in the standard errors between the OLS and robust estimates causing no change in significance of coefficients at 5% level.

Coefficients of the variables entering the regression equation have the expected sign. It can be observed that the coefficient for the land under cash crop was greater than that of the land under staple crop. It might be an evidence for our argument that value of marginal product of land as it is used for cash crop is greater than the value of marginal product of land when it is used under staple crop.

It is apparent from the results that the significance of the dummy for irrigation scheme and level of education of the household head, which were included in the land allocation decision equation, in the income function lends support for the co-existence of direct and indirect impacts on income.

2.6. CONCLUSIONS

In this chapter, an attempt has been made to investigate the interaction of some of the elements of rural-urban linkages namely, rural livelihood, location and human capital formation in Ethiopia. In particular, it has been emphasized that proximity to urban centers and access to road enable farmers to get relatively higher prices for their crops at the market due to better access to information and reduced cost of transportation so that they respond by allotting a larger portion of their land for the production of high value cash crops. Moreover, the role of education on crop choice through its impact on revealing the innovative ability of farmers is emphasized.

In general, it has been observed that households' diversification strategies of sources of income depend on their relative location to urban centers. Households who have access to irrigable land located nearer to urban centers complemented with access to road towards market centers tend to allot more land for cash crop. Moreover, households who live near to urban center with access to road but who do not have irrigable land tend to invest in commercial livestock farming and fast growing trees such as eucalyptus to be sold in urban centers. Interestingly, this has been translated into uneven level of per capita income among villages: a typical household in the richest village nearer to urban center has a per capita income more than 4 times that of a typical household who lives in the village far from urban centers.

Estimation results show that distance from urban centers, level of education of the household head, access to road, availability of irrigation scheme, and climatic conditions affect households' decision to allot a plot for the production of a particular crop. It has been observed that while the purely liquid assets tend to encourage households to allot their plots for the production of high valued cash crops, the impact of livestock as wealth on crop choice depends on the location of the activities. In villages nearer to urban centers, crop and livestock production appear to be rival activities. But as the location of these activities deviates away from urban centers, the role of livestock as an insurance scheme tends to dominate encouraging the production of cash crops.

Estimation results of income functions of rural household show that size of plots under cash crops and staple crops are significant. More importantly, the coefficient of land under cash crop is by far greater than that of land under staple crop.

In conclusion, encouraging township, enabling rural households to get access to road and better information networking, expanding purposeful education, developing irrigation schemes, introducing new varieties of high yield cash crops including for cold climate zones might help rural households better cope up with shocks and enable them to create surplus that would serve as a basis for agrarian transformation.

Appendix A

Table 2-3: List of Variables Used in the Estimation

Variable	Mean	Standard Deviation	Min	Max
Land under cash crop (ratio to the total)	0.12	0.15	0	1
Town-Distance	11.86	5.51	4	20
Distance from Road	3.39	3.80	1	10
Access to Road (inverse of distance)	0.69	0.39	0.1	1
Dummy Irrigation	0.42	0.50	0	1
Dummy Climate (=1 if Dega)	0.29	0.46	0	1
Education - Head				
Years of Schooling	2.06	2.99	0	11
Primary (1-6)	0.43	0.50	0	1
Junior Secondary (7-8)	0.06	0.23	0	1
Senior Secondary (9-12)	0.03	0.17	0	1
Total Own Land in hectare	0.72	0.39	0	2.5
Land Leased in for share cropping (LSC1)	0.21	0.38	0	3
Land Leased out for share cropping (LSC2)	0.02	0.10	0	0.75
Dependency Ratio	0.77	0.80	0	4
Permanent Cash Income (per capita)	30.92	157.57	0	1600
Value of Livestock (per capita)	1220.42	1349.76	0	9250
Per Capita Income (logs)	6.68	0.85	0.37	8.77
Land under cash crop	0.11	0.14	0.00	0.50
Land under staple crop	0.72	0.41	0.09	2.25
Labor	2.33	1.02	1	7
Oxen	1.61	1.25	0	9
Cattle (other than oxen)	2.47	2.47	0	12
Dummy Rural Enterprise	0.19	0.40	0	1

Table 2-4: GLM Estimation of Land Allocation Decisions

***Dependent Variable**: Share of Land Allotted to Cash Crop*							
	GLM Estimates				OLS Estimates		
	Coefficient		Slope				
Distance-Town	-0.180	[-5.92]***	-0.013	(-6.22)	-0.011	(-4.12)	[-4.50]
Access to Road	1.689	[5.64]***	0.125	(5.42)	0.091	(3.20)	[3.21]
Dummy Irrigation	0.787	[2.51]**	0.062	(2.56)	0.067	(3.02)	[2.66]
Dummy Climate	-1.585	[-3.78]***	-0.094	(-3.97)	-0.140	(-4.47)	[-3.41]
Cash Income	0.0009	[3.21]***	7×10^{-5}	(2.89)	0.0002	(3.07)	[2.33]
Livestock (Value)	-0.0005	[-3.08]**	-4×10^{-5}	(-3.08)	-4×10^{-5}	(-2.82)	[-3.56]
VLS×r	5×10^{-5}	[3.21]***	3.4×10^{-6}	(3.26)	3.5×10^{-6}	(2.33)	[3.11]
Education-Head							
Primary (1-6)	0.391	[2.43]***	0.030	(2.31)	0.032	(1.86)	[1.95]
Junior Sec. (7-8)	0.904	[2.65]**	0.094	(1.94)	0.103	(2.94)	[2.43]
Senior Sec.(9-12)	0.398	[0.97]	0.035	(0.83)	0.048	(0.98)	[1.15]
Total Own Land	0.185	[0.89]	0 .014	(0.91)	0.013	(0.59)	[0.58]
LSC1	-0.206	[-1.07]	-0.015	(-1.05)	-0.038	(-1.62)	[-2.01]
LSC2	0.817	[1.80]*	0.061	(1.79)	0.144	(1.69)	[1.59]
Dependency Ratio	-0.243	[-1.89]*	-0.018	(-1.85)	-0.022	(-2.14)	[-2.09]
Intercept	-1.375	[-2.48]**	-		0.201	(3.55)	[3.44]
N	252						
R^2						0.39	
$\bar{R}^2$						0.35	
Joint Stability					F(14,237):	10.59	21.48
Heteroscedasticity					χ^2 (1) =	26.50	

***** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level.*
Figures in brackets are t-ratios and those in square brackets are robust t-ratios.

Table 2-5: Testing Exclusion Restriction

Dependent Variable: Crop income	
Labor (logs)	-0.304
	(2.29)*
Oxen	0.286
	(8.31)**
Dummy Irrigation	0.864
	(6.63)**
Dummy-Climate (highland=1)	0.555
	(3.01)**
Access to Road (Inverse of distance)	-0.183
	(1.06)
Education-Head	0.028
	(1.87)
Dependency Ratio	-0.286
	(4.23)**
Cash Income	-0.000
	(0.67)
Intercept	5.785
	(33.18)**
Observations	250
R-squared	0.42

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2-6: Testing for Endogeneity (Residuals Obtained from Crop choice model)

Dependent Variable: Crop income	
Labor (logs)	-0.297
	(2.24)*
oxen	0.217
	(6.34)**
Dummy Irrigation	0.705
	(5.70)**
Dummy Climate	0.597
	(3.38)**
Access to Road	-0.132
	(0.76)
Level of education	0.024
	(1.65)
Dependency ratio	-0.249
	(3.70)**
Land under cash crop	0.934
	(2.30)*
Land under staple crop	0.521
	(3.76)**
Residuals	-0.113
	(0.23)
Intercept	5.405
	(29.13)**
Observations	250
R-squared	0.49

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2-7: OLS Results of Rural Income from Crop Production

Dependent Variable: Per capita income from crop production (in logs)		
	OLS Estimates	WLS Estimates
Land under cash crops	0.870	0.870
	(2.14)*	[2.44]*
Land under staple crops	0.509	0.509
	(4.35)**	[4.81]**
Level of Education-Head	0.034	0.034
	(2.21)*	[2.23]*
Labor (in logs)	-0.303	-0.303
	(2.51)*	[2.32]*
Oxen	0.236	0.236
	(6.12)**	[6.61]**
Dummy Irrigation	0.400	0.400
	(3.84)**	[3.92]**
Dependency Ratio	-0.257	-0.257
	(3.99)**	[4.00]**
Intercept	5.604	5.604
	(35.90)**	[28.90]**
N	250	
R^2	0.45	
$\bar{R}^2$	0.43	
Ramsay's RESET Test	F(3, 239) = 0.58	

Table 2-8: OLS Results of Rural per Capita Income (from all sources)

Dependent Variable: Rural Per capita income (in logs)		
	OLS Estimates	WLS Estimates
Land under cash crops	1.349	1.349
	(4.59)**	(3.65)**
Land under staple crops	0.413	0.413
	(3.74)**	(3.89)**
Level of Education-Head	0.032	0.032
	(2.51)*	(2.28)*
Labor (in logs)	-0.575	-0.575
	(5.13)**	(5.16)**
Oxen	0.154	0.154
	(5.10)**	(4.38)**
Dummy Irrigation	0.312	0.312
	(3.27)**	(3.25)**
Dummy Rural Enterprise	0.327	0.327
	(3.54)**	(3.24)**
Dummy Food for Work	0.062	0.062
	(0.72)	(0.66)
Dependency Ratio	-0.326	-0.326
	(5.52)**	(5.60)**
Intercept	6.397	6.397
	(38.79)**	(43.72)**
N	252	
R^2	0.48	
$\bar{R}^2$	0.46	
Ramsay's RESET Test	F(3, 239) = 5.27	

Absolute value of t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2-9: OLS Results of Rural Per Capita Income with Aggregate Land

Dependent Variable: Rural Per capita income (in logs)		
	OLS Estimates	WLS Estimates
Total Land (in logs)	0.263	0.263
	(3.17)**	(3.80)**
Level of Education-Head	0.044	0.044
	(3.34)**	(3.08)**
Labor (in logs)	-0.603	-0.603
	(5.21)**	(5.24)**
Oxen	0.184	0.184
	(6.19)**	(5.21)**
Dummy Irrigation	0.503	0.503
	(5.83)**	(5.81)**
Dummy Rural Enterprise	0.345	0.345
	(3.50)**	(3.31)**
Dummy Food for Work	0.053	0.053
	(0.62)	(0.55)
Dependency Ratio	-0.356	-0.356
	(6.15)**	(6.02)**
Intercept	6.874	6.874
	(43.35)**	(44.74)**
N	249	
R^2	0.44	
$\bar{R}^2$	0.42	
Ramsay's RESET Test	F(3, 237) = 1.67	

Table 2-10: OLS Results of Rural Per Capita Income: Land being Instrumented

Dependent Variable: Per capita Household Income (in logs)			
Covariates	Coefficients	t-ratios	Robust t-ratios
Land under cash crop(Estimated)	1.13	(2.13)	[3.11]
Land under staple crop (Estimated)	0.46	(3.42)	[3.22]
Labor	-0.10	(-2.35)	[-2.47]
Oxen	0.16	(4.12)	[4.21]
Dummy for Irrigation	0.36	(3.20)	[3.67]
Distance from Town	-0.03	(-3.15)	[-3.31]
Access to Road	0.32	(2.20)	[2.56]
Education - Head			
Primary (1-6)	0.02	(0.27)	[0.28]
Junior (7-8)	0.17	(0.86)	[0.79]
Secondary (9-12)	-0.06	(-0.23)	[-0.43]
Dummy for Rural Enterprise	0.31	(0.89)	[3.30]
Dummy food for Work	0.09	(3.04)	[1.01]
Intercept	6.11	(24.00)	[23.72]
N		252	
R^2		0.49	
$\bar{R}^2$		0.47	
F(12, 239)		19.28	29.43
RESET: F(3, 236)		1.28	

Figures in brackets are t-ratios and those in square brackets are robust t-ratios.

Chapter Three

Determinants of Rural-Urban Migration in Northern Ethiopia

3.1. INTRODUCTION

Though Ethiopia is characterized by low rate of urbanization by the standard of developing countries, which caused sluggish rural transformation, rural-urban migration is still considered as an alarming sign of social crisis in urban centers. At the same time, there is apparently little or no research work at empirical level on rural-urban migration in the country. One of the main reasons for the absence of rigorous empirical work in the area could be the difficulty of obtaining data on the major determinants of rural-urban migration due to geographical 'censorship' of such data on *ex ante* and *ex post* migration lines.

This chapter attempts to expose the low rate of long run rural-urban migration in Ethiopia despite the large segment of the rural population that has to be transformed in the face of ever declining per capita land size, and show that education can serve as a means of smooth rural-urban migration. In the empirical analysis section of the chapter, the earnings of migrants and the underlying income differential that is thought to be the major determinant of migration decisions are estimated by accounting for the potential selectivity bias. The estimated income differential along with distance from major towns and level of education are ultimately used to estimate the migration decision model.

To draw a lesson for developing countries such as Ethiopia, it is worth noting that development has occurred in the now affluent nations as societies changed their mode of productions from rural based agriculture to urban based industrial economy. At the heart of such transformation lies rural-urban migration. The more palliative steady rural-urban migration in terms of reducing population pressure in pre-industrial Europe got its momentum following the industrial revolution. The labor intensive industrial establishments induced long term industrial growth and created enough jobs that could absorb the rural surplus labor. This led to a decline in the share of rural population of Western Europe [Bhattacharya, 1993].

As Ghatak et al (1996) argues, rural-urban migration helps to reallocate resources, most importantly labor, from less productive, usually agriculture, to vibrant sectors such as manufacturing industry. It also improves efficiency in both traditional and modern sectors in particular in the prevalence of redundant labor in the agricultural sector and relatively high real wages in the modern sector.

Regardless of such historical merits that rural-urban migration had, policy makers in developing countries are fearful of this phenomenon. This is partly due to the undesirable consequences of migration following the mismatch between urban jobs created and new migrants. As Bhattacharya (1993) argued, in early 1950s, industrialization in developing countries was favoured not only to ensure growth but also to change the rural-urban population balance. In this regard, the role of rural-urban migration has been emphasised as a positive phenomenon in relieving population pressure in the countryside of developing countries. After the realization of the prevalence of inequality and poverty despite gains in growth in 1960s, the rural-urban migration came to be considered as both a cause and symptom of underdevelopment in developing countries.

One of the most cited theories in the migration literature that has predictions of unintended results of rural-urban migration is that of Harris and Todaro (1970). The Harris-Todaro model argues that individuals' migration decisions are determined by rural-urban income differentials net of cost of migration and probability of finding jobs at destinations. The most important prediction of the model is that the equilibrating condition of the process of rural-urban migration is unemployment in the urban centers and as such migration is a disequilibrium phenomenon. This follows their basic assumption that urban wages are rigid and are set too high. Thus, development schemes that target on reducing urban unemployment might end up with an even higher level of unemployment rate in urban centers which compromise welfare.

The alternative suggestion to the Harris-Todaro prescription is expanding rural development schemes. This, however, was challenged by other studies in that such rural development schemes, if they succeeded to raise rural income, would ease liquidity constraints and encourage rural-urban migration [Ghatak, et al, 1996].

The Harris-Todaro model has been extended in a number of directions ranging from models which relaxed labor market assumptions to Stark's argument which shifted the focus of analysis from individual to collective family based decisions of migration as a strategy of diversifying risk. A good survey of the literature is found in Greenwood (1997), Lucas (1997) and Ghatak, Levine, and Price (1996).

Fields (1975) attempted to extend the Harris-Todaro model by considering i) a more general job-search behaviour where an individual residing in rural areas can have high probability of finding urban jobs through networking, ii) an urban traditional sector that augments the probability of finding job, iii) a case of preferential treatment of educated migrants by employers, and iv) a relatively lower involuntary labor turnover unlike the case of Harris-Torado model where the maximum possible rate of turnover is assumed. With these considerations, the model predicts that the resulting level of unemployment in urban sector is much lower than what is predicted by the standard Harris-Todaro model.

Stark (1991) has shifted the focus of rural-urban migration in a number of directions. One of the central arguments in Stark's theory of migration is that migration though effected by an individual could be a result of group decision such as a family. Various intra-family exchanges such as remittances are thus intended integral parts of the migration decision.
The second point of his argument is that individuals may not migrate even under significant wage differential or they may do so in the absence of meaningful wage differential, and yet this does not imply irrationality. This has rather something to do with risk-pooling strategy of a household and relative deprivation. In the third line of argument, Stark stressed the role of imperfect and incomplete markets in triggering rural-

urban migration in developing countries. That is, constraints in capital, commodity, or financial markets tend to hinder entry to a specific labor market.

On the empirical side, Ghatak et al (1996) citing a number of works argued that there is some support for the Harris-Todaro hypothesis that wage differential is one of crucial determinants of rural-urban migration. However, there is no support for many of the assumptions. The available labor market data do not support the existence of clear distinction between the pure ‘capitalistic’ and ‘traditional’ sectors. It is not the case that the wage rates in the formal sector are higher than those in the informal sector. More importantly, wages in the manufacturing sector are not necessarily higher than rural wages; and developing countries are not necessarily characterized by high urban unemployment.

In another study, Hoddinott (1996) argued that the wage curve that characterizes the urban labor market in Africa is not different from that of the developed countries. Using data from Côte d’Ivoire, he claimed to have found that higher level of unemployment depresses urban wages.

There is evidence from India that about half of migrants move to urban centers in a pre-arranged job. This is mostly dominated by older, better educated people and those who seek to be engaged in non-manual jobs [Banerjee, 1991).

Lucas (1985) using data from Botswana has found that education increases probability of migration to urban centers through increased expected wages at destinations. It appears that the youth tend to respond to the so-called ‘bright light.’ It is usually argued that it is because those young migrants have a relatively longer time horizon in maximizing expected net earnings.

In the Ethiopia case, given the population pressure on depleted, and declining plots of land which otherwise would serve as a means of substance for the rural poor, gearing research efforts towards smooth rural-urban migration might be indispensable. However, there is little or no study on migration in Ethiopia at the empirical level. This is partly due to the censorship of data on the most important variables such as income of migrants and non-migrants. For instance, the income which a migrant would have earned had he/she not migrated, and the earnings which a non-migrant would secure if he/she migrated cannot not be observed. This chapter attempts to model the determinants of rural-urban migration in Ethiopian by using data collected on both migrants and non-migrants from some villages. The analysis gives a particular emphasis to the role of education in inducing smooth rural-urban migration.

In what follows, section two briefly assesses the patterns of migration in Ethiopia. In section three, an attempt is made to derive the theoretical underpinnings of the decision to migration in special reference to Ethiopia. In particular, it shows how individuals' migration decision could be motivated by differences in preferences of goods that are consumed in urban and rural areas as a result of introduction of education. In section four, an empirical analysis is presented. It has been attempted to estimate the earnings function of the migrants and non-migrants, and the migration decision equation using the Nakosteen and Zimmer (1980) approach by accounting for potential selectivity bias. Section five concludes.

3.2. Patterns of Migration in Ethiopia

3.1.1. The National Pattern

In general, rural-urban migration in Ethiopia has been relatively low for so long. The fact that only 15 percent of the 77 million people of the country dwell in urban centers witnesses the sluggishness of the rural-urban migration. The most populous regional states Oromia, Amhara and Southern Ethiopia which account for 85% of the total population have urbanization rate of only 10.3, 8.3, and 7.1 per cent, respectively. The capital, Addis Ababa, accounts for about 30 per cent of the total urban population of the nation.

According to the 1999 Labor Force Survey of the Ethiopian Statistical Agency (CSA, 2000), 19.9% of the Ethiopian people were internal migrants. For the five years period prior to 1999, only about 4.3% of the population have migrated. These figures include rural-rural, rural-urban, urban-urban, and urban-rural migrations which account for 37.6%, 23.5%, 23.2%, and 15.7% of all migrations, respectively.

In terms of relieving the population pressure in rural areas, the rural-urban migration rate can be shown to be insignificant. Given the total number of migrants and the 23.5 per cent share of the rural-urban migration in all forms of migrations, rural-urban migrants in proportion to the rural population over the five year period prior to 1999 is calculated to be 1.2 per cent. This can be roughly translated as only some 0.23 per cent of the rural population tend to migrate to urban centers annually. This figure contrasts with the 2.7 per cent annual growth rate of the rural population of the country. About 17 per cent of the rural migrants and 16.8 per cent of urban migrants were destined to the capital, Addis Ababa.

The pattern of migration for the country is explained by characteristics such as age, sex, and education. About 69% of migrants are in the range of 15 to 64 years of age which is basically the category of the active labor force. In the urban areas, 29.3 per cent and 17.2 per cent of the migrants are those who migrated in search of work, and for education, respectively. However, as high as 29 per cent of the migrants of this age group in rural areas changed their original village of residence due to marriage arrangements.

Migrants in the age range of 0 to 14 years accounts for 29% of the total migrants. But as high as 58% of the migrants in this age group are those who migrated along with families. This is normally what is expected since children under this age group are dependent on their families.

As it can be shown in Fig 3.1, the proportion of migrants by age category (number of migrants in a given age group in proportion to total number of migrants of all ages) increases with age and then tends to decline after the age range of 30-34. The within age group migration rate, which is calculated as the total migrants of each age group divided by the total population of the same age group, tends to follow a similar pattern to the proportion of migrants. However, the age specific migration rate for older people is still higher. The important point is that the movement of the older people is not dominated by motives of work. Results of the 1999 labor force survey shows that about 67% of migrants of age 65 and above changed their place of residence mainly to live with relatives, to return to their original home, to live with relatives, and in some cases due to health problems. Among the migrants of this age group, those who moved seeking job account only for 3.4 per cent.

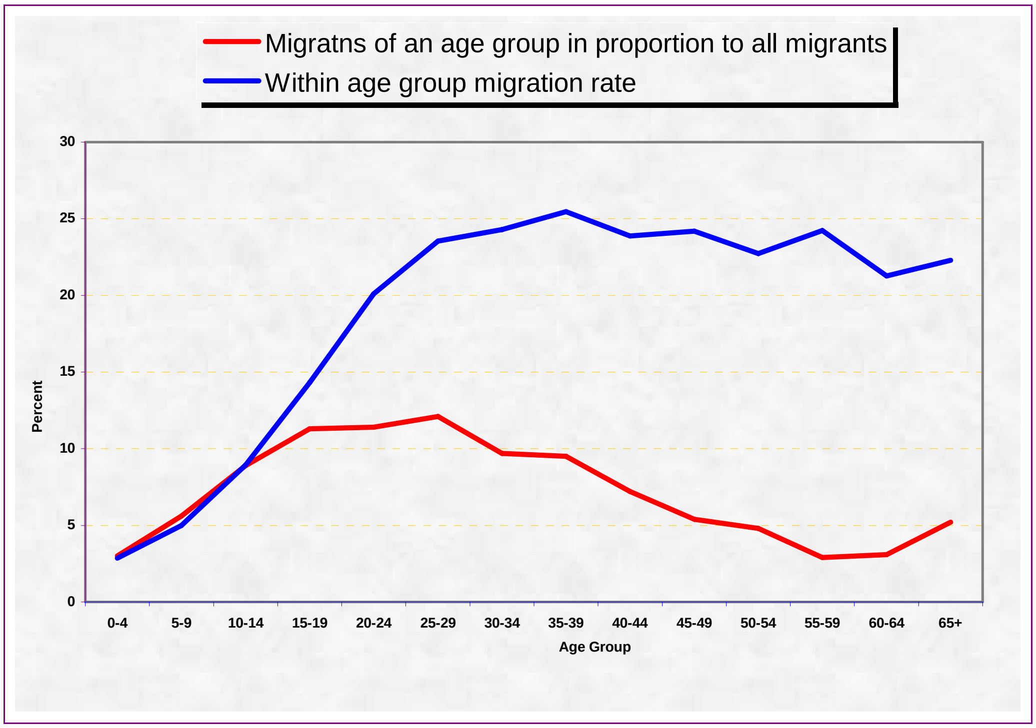

Figure 3-1: Migration by age group

Source: Author's calculations using the 1994 population census report of Ethiopia.

In the overall migration phenomenon, it appears that women are more mobile than men. Over the five years period prior to 1999, the share of female and male migrants in the total population was 4.6 and 3.9 per cent, respectively. About 56 per cent of the recent migrants of the middle age group were females. This does not mean, however, that females have more economic incentives to migrate than men. As it has been pointed out earlier, the seemingly large proportion of female migrants is due to marriage arrangements. About 50 per cent of the female migrants moved to their current locations due to marriage arrangements while only 3 per cent of the male migrants changed their place of residence for marriage reasons. By the account of other reasons of migration such as education, job search, and job transfer, the proportion of male migrants is dominant.

Table 3-1: Percentage Distribution of Recent Migrant Population by Broad Age group, Sex and Main Reason for Migration: National - 1999

Age Group and Sex		Education	Marriage	Search for work	Job Transfer	Along with family	Returned back to home	To live with relatives
All ages	Total	9.0	13.2	17.4	5.1	24.5	10.4	8.2
	Male	10.8	1.4	22.2	8.8	23.4	14.1	8.3
	Female	7.5	23.0	13.4	2.1	25.4	7.4	8.2
0 – 14	Total	8.9	0.8	7.3	0.3	58.0	5.8	10.8
	Male	7.7	0.1	9.1	0.5	60.1	5.2	9.3
	Female	10.1	1.5	5.5	0.1	56.0	6.4	12.2
15 – 64	Total	9.2	18.7	22.0	7.3	10.6	12.2	6.6
	Male	12.4	2.1	28.7	12.8	6.8	18.0	7.2
	Female	6.6	31.8	16.7	2.9	13.6	7.6	6.1
65+	Total	0.6	0.7	3.8	0.6	8.2	20.4	33.2
	Male	1.1	0.5	4.7	1.2	5.7	24.5	31.8
	Female	0.0	0.9	3.0	0.0	10.5	16.5	34.5

Source: CSA, Ethiopian National Labor Force Survey, 1999.

Generally educated people are more mobile. In the 1994 population census, about 51 per cent of the total recent migrants were literate. This contrasts with only 21% literacy rate of the non-migrants during the same period. The migration rate for the illiterates was 0.8 percent and this rate progressively increases with education. Among individuals with primary, junior secondary, senior secondary and tertiary levels of education, the migration rate were 2.1 per cent, 3.5 per cent, 6.0 per cent, and 16.2 per cent, respectively.

Among those individuals in the age group 15-64, the major reason for migration is job search. By the account of this reason of migration, male are dominant. The earning differential between the urban and rural sectors is believed to be a major catalyst of rural-urban migration at least for those who migrate looking for jobs. In the country, about 55 of GDP is accounted by the non-agricultural sectors. It can be roughly approximated that the per capita income of citizens engaged in non-agricultural sectors is about 7 times higher than the per capita income of citizens who eke their livelihood from agriculture. Such differences trigger a net movement of people from rural to urban centers.

3.1.2. Patterns of Migration in the Villages under Study

The migration pattern in the villages under study in relation to the various migration characteristics is more or less similar to the national pattern. It is observed that rate of rural-urban migration has an inverted u-shape trend with age. In general, men and those individuals with better education dominate the rural-urban migration.

The rate of rural-urban migration among villages significantly varies with distance from major urban centers. The migration rate in Alasha area which is the nearest village to a major town has a total migration rate of 10.4% while Habru-Ligo which is the farthest village from urban centers has a migration rate of 2.5%.

The major migration characteristic that influence the pattern of migration significantly is education. In all villages combined, those individuals who are illiterate accounts for only 4.6% of the total migrants. Individuals with primary, junior secondary, senior secondary, and tertiary levels of education account for 24.1, 21.8, 29.9, and 19.5 per cent of the total number of migrants, respectively.

The strong association between education and migration becomes even clearer when the migration rate among the groups by education level is considered. The migration rate for illiterate is only 0.6%. On the other hand, this rate for educated individuals progressively increases from 4.1% for those with primary level of education to 94.4% for those who have tertiary level of education. This figure excludes individuals who moved to urban areas exclusively for education purpose and are currently enrolled.

The other form of migration that has been a major source of livelihood in the villages is international migration. As it has been indicated in Section 2.3, households send young members of their family to Gulf countries. In general, some 70 individuals (8.4 per cent of the sample of the study area aged 18 to 64) migrated to these countries. In particular, in Girana area about 18 per cent of the total individuals in the sample in the age range of 18 to 64 migrated to Gulf countries. About 77% of the total migrants to the Gulf countries are girls.

The remittance from these migrants is significant. For sending households, remittance from abroad accounts for about 38 per cent of the household income. For some households this figure reaches as high as 92 per cent. The remittance is usually used to smooth consumption, to acquire real assets such as houses; for investments in mills, transportation, and retail trade activities.[16]

However, such financial gains from international migration in particular Gulf countries could not be achieved without cost. Besides the high transportation cost which is about two fold an average annual income of a household in the villages, migrants have to drop of their education. The opportunity cost of migration in these particular areas in terms of human capital formation is significant. The data shows that 57% of the total migrants have only primary level of education. Only 11% of the migrants have completed general education. Since the majority of the migrants are girls, they have been victims of early drop out in this regard.

The other associated problem in terms of education is the demonstration effect of migration. High returns to international migration for uneducated menial workers

[16] Similar studies show that Ethiopia secures about 212 million USD annually in the form of remittance from migrants working in Gulf countries [Berhanu et al, 2004].

compared to low compensations for even highly trained workers at home induce students to consider education as a temporary leisure time work. They anticipate dropping out and eventually to migrate. This may compromise the quality of education even while they are at school.

3.2. THEORETICAL FRAMEWORK: MIGRATION DECISIONS IN RESPONSE TO DIFFERENCES IN EXPECTED UTILITY

A given household might compare utilities in different locations [Stark, 1991; Aroca and Hewings, 2002]. We consider an individual who contemplates between moving to urban centers and staying in rural areas. The individual compares not only expected incomes in the places of destination and reservation income at places of origin but also the type of goods he prefers to consume in maximizing his utility. Suppose that the utility in rural area is a function of a composite of goods x_r and cultural values that can be considered as 'status good', g_r. The variable g_r represents the mode of life such as weddings, traditional beliefs, child-rearing, traditional savings and insurance schemes (such as *iqqub* and *iddir* in the Ethiopian case) and association to a place where one is born and grown up. Thus, the utility is given by:

$$u_r = u_r\left(x_r, g_r\right) \tag{3.1}$$

The individual faces a budget constraint. Assume that each basket of commodities is bought for a price p_{xr}. However, the 'cultural' good g_r does not have explicit price. To enjoy the rural 'status' good, or cultural values, one has to claim a certain rank in the society. An individual has to put an effort to accumulate wealth that would be enough to cover lavish festivals such as wedding, charity, lending to neighbours during unfavourable circumstances to get a status of benevolent. Let us assume that all of these activities claim the household to possess wealth beyond what is required for decent life. Anyone who is not able to pay for such traditional values has to bear a kind of relative deprivation. Someone who affords to pay for such values can enjoy cultural values paying out the equivalent of relative deprivation. Let us denote this price by p_{qr}. The budget constraint is therefore given by:

$$p_{gr} g_r + p_{xr} x_r \geq W_r \qquad (3.2)$$

where W_r is wealth. To simplify matters, we can assume that wealth equals rural income, y_r.

Maximization of utility represented by Equation (3.1) subject to the budget constraint (3.2) gives demands for x_r and g_r. Substituting these ordinary demands back into the utility function, we have:

$$V_r = V_r \left(x_r^* \left(p_{xr}, y_r, p_{gr} \right), g_r^* \left(p_{xr}, y_r, p_{gr} \right) \right) \qquad (3.3)$$

If the individual were to migrate, he would maximize his utility by consuming composite goods x_u and public goods, g_u, that are very rare in rural areas. The public goods might include electricity, tap water, hospitals, asphalt roads, public TV channels, and cinemas.

Moreover, the preferences for public goods require some level of sense of 'modernity' which in turn can be thought of being a function of education. The knowledge endowment of a migrant is critical not only as an input to the potential return in terms of income but also as a means to assimilate to the relatively complex urban life. In rural areas, it is believed that the minimum requirement for even visiting a town is ability to read. Education changes the individual taste in favour of urban life. An individual with some level of education begins to consider some rural cultural values as backward.

Suppose that a parameter B captures the level of such 'modernity' and also the degree of information that an individual has about the urban labor market. The utility with the parameter, B, which is related to demand for public goods is given by:

$$u_u = u_u\left(x_u, Bg_u\right) \tag{3.4}$$

The individual buys the commodities x_u and g_u from the market at their corresponding prices. However, the migrant is expected to contribute to the government in taxes so that public goods would be available. Given the price of each commodity and the tax contribution, the migrant would face a budget constraint:

$$p_{xu}x_u + \left(t_u + p_{gu}\right)g_u \geq W_u \tag{3.5}$$

where p_u = price of ordinary goods, p_{gu} = price of public goods, t_u = tax contribution for the constriction of public goods, and W_u = wealth of a migrant at destination.

We further assume that urban wealth equals current earnings weighted by the probability of getting job, π. Assuming that earning is a function of the level of education, E, and cost of migration is mainly a function of distance, *r*, we have:

$$W_u = y\left(E\right)\pi - C_m\left(r\right) \tag{3.6}$$

The individual would maximize the utility represented by Equation (3.4) subject to the budget constraint represented by Equation (3.5). Accordingly, the demands for ordinary and public goods would be:

$$x_u^* = x_u^*\left(p_{xu}, p_{gu}, t_u, y_u\left(E\right), \pi, C_m\left(r\right); B\right) \tag{3.7}$$

and

$$g_u^* = g_u^*\left(p_{gu}, t_u, p_{xu}, y_u\left(E\right), \pi, C_m\left(r\right); B\right).$$

Substituting Equations (3.7) into (3.4), we get the indirect utility:

$$V_u = V_u\left(x_u^*, g_u^*\right) = V_u\left(p_{xu}, p_{gu}, t_u, y\left(E\right), \pi, C_m\left(r\right); B\right) \tag{3.8}$$

Let's define an expression for the difference in utility in the two locations as:

$$\begin{aligned}\Delta V &= V_u\left(x_u^*(.), g_u^*(.)\right) - V_r\left(x_r^*(.), g_r^*(.)\right)\\ &= V_u\left(p_{xu}, p_{gu}, t_u, y_u(E), \pi, C_m(r); B\right) - V_r\left(p_{xr}, p_{gr}, y_r\right)\end{aligned} \tag{3.9}$$

Let us further define a function $M^* = f$:

$$M^* = f(.) = f\left\{\left[y(E) - y_r\right], \left[\left(p_{xu} + p_{gu} + t_u\right) - \left(p_{xr} + p_{gr}\right)\right], \pi, C_m(r); B\right\} \tag{3.10}$$

where $M^* = f : \mathbb{R} \to \mathbb{R}$ is a monotonic transformation of *ΔV* and could be thought as a propensity to migrate of an individual.

We assume that the individual migrates if *ΔV* >0. By implication, an individual decides to migrate if $M^* = f(.) > 0$. In Equation (2.11), $\left(y(E) - y_r\right)$ represents the income differential which is commonly believed to be the most important determinant of migration decision. The term $\left[\left(p_{xu} + p_{gu} + t_u\right) - \left(p_{xr} + p_{gr}\right)\right]$ represents difference in cost of living in the two places. It may be assumed that prices are the same in the two places. However, as mode of life changes when an individual migrates from rural area to urban center, the composition of goods would be different implying that the migrant would face different prices. In particular, households in rural areas enjoy 'lower' prices for staple crops since they produce it themselves. Cost of transportation could also increase prices at destination. Probability of securing job at destination, π, cost of migration, *C(r)*, and the parameter *B* which can be proxied by level of education, *E*, directly enter the function of migration decisions.

In general the income differential, education, and probability of finding a job at destination encourage migration. On the other hand, cost of migration and differences in cost of living discourage migration decisions.

3.3. ECONOMETRIC ANALYSIS

3.3.1. The Model

As it has been discussed in the preceding section, an individual's decision to migrate is associated with differences in utility that the individual expects to derive in rural and urban areas. The underlying utility function in both areas and their differences are assumed to be continuous. Let M^*_i represent the propensity of an individual *i* to migrate. The individual decides to migrate if M^*_i is positive and decides to remain in the original place of residence if $M^*_i < 0$. The propensity to migrate is a function of factors that affect the difference in the underlying utility such as income differential, education, and cost of migration. The individual's migration decision model is given by:

$$M_i^* = w'\gamma + u \qquad (3.11)$$

where w = vector of independent variables, γ = a set of parameters, and u = random error term.

Letting M to be the discrete response variable representing whether an individual has migrated or not, this can be related to the propensity of migration according to:

$$M = \begin{cases} 1 \ if \ \ M_i^* > 0 \\ 0 \ if \ \ M_i^* \le 0 \end{cases} \qquad (3.12)$$

The discrete choice variable M assumes a value of 1 if the individual has moved to urban areas and a value of '0' otherwise. Empirical analysis of the model should account for individual, household and location (geographic) attributes. On the side of the predictors represented by the vector **w**, we include income differential, distance from the nearest town, level of education, age, square of age, an index of relative deprivation, and dummy for sex.

Calculating earnings differential is not straightforward. The earnings outcome for migrants depends on the outcome of migration. For non-migrants, the income which they would have earned had they migrated is not observed. Similarly, the income the migrants would have earned had they stayed in their original location is missing. Thus, earnings is incidentally truncated both from the migrants and non-migrants point of view [Heckman, 1979; Nakosteen and Zimmer, 1980].

A common procedure is to estimate an earnings function for migrants and non-migrants at their respective locations and use the models to predict what each group would earn in each alternative location. That is, the estimated earnings function for migrants can be used to predict the expected levels of earnings of non-migrants. By the same procedure, the estimated income function of non-migrants in their location can be used to predict the level of income of the migrants in rural areas had they not migrated.

The estimation of the earnings of the migrants and non-migrants in their respective places requires going beyond ordinary least squares due to the possible existence of self selection which may result in biased estimates. The fact that some individuals migrate while others do not could be an indication for the existence of important differences between the two groups of individuals in terms of viewing benefits [Greenwood, 1975]. This may lead to a suspension that there could be self selection where the sample could no more be considered as random threatening the validity of inferences that are made about the underlying population based on the regression results. In particular, Heckman (1979) argued that the earnings of the migrants do not give a reliable estimate of the income that the non-migrants would have earned had they migrated resulting in “a biased estimate of the effect of a random ‘treatment’ of migration”.

In this case, the migration decision might be a result of self-selection while OLS technique on the earnings functions of migrants implicitly assumes that individuals who operate out of agriculture specifically in urban centers represent a random sample of the entire population of origin. When this problem exists, the model will be mis-specified as though a relevant variable was omitted [Nakosteen and Zimmer, 1980; Ghatak et al, 1996, Greene, 2003].

Thus, estimation of the earnings of a sample of migrants must take such incidental truncation of the income of the migrants on a positive net benefit and that of the non-migrants on non-positive net benefits into account [Greene, 2003]. To mitigate this problem, it is required to apply the Heckman procedure of selection model.

Following the argument by Nakosteen and Zimmer (1980) and our framework in section 2.3, suppose that an individual generates an income of y_r from rural based economic activities and an income of y_u from urban based economic activities.

The incomes function of an individual in rural areas and the earnings function of a migrant in urban areas can respectively be given by:

$$y_r = x'\theta + \varepsilon_1$$
$$y_u = z'\gamma + \varepsilon_2 \qquad (3.13)$$

But we know that migration decisions are determined by income differential (y_u-y_r) and costs of migration. At the same time, the earnings outcome is dependent on the outcome of migration decisions. Hence, the earnings and migration decision equations can simultaneously be given as:

$$y_r = x'\theta + \varepsilon_1$$
$$y_u = z'\beta + \varepsilon_2 \qquad (3.14)$$
$$M = w'\gamma + u$$

Given the fact that we only observe y_u if $M^*_i > 0$, we can derive for migrants as:

$$\begin{aligned} E\left(y_u / M^* > 0\right) &= E\left(y_u / u > -w'\gamma\right) \\ &= z'\gamma + \rho\sigma_{\varepsilon_2}\left[\phi\left(w'\gamma/\sigma_u\right)/\Phi\left(w'\gamma/\sigma_u\right)\right] \\ &= z'\gamma + \beta_\lambda \lambda_i\left(\alpha_u\right) + \upsilon_1 \end{aligned}$$

where $\beta_\lambda = \rho\sigma_{\varepsilon_2}$, $\alpha_u = -\left(\frac{w'\gamma}{\sigma_u}\right)$, $\lambda\left(\alpha_u\right) = \phi\left(w'\gamma/\sigma_u\right)/\Phi\left(w'\gamma/\sigma_u\right)$, $\phi(.)$, and $\Phi(.)$ are the standard normal population density function (pdf), and the standard normal cumulative density function (cdf), respectively. The function $\lambda_i = \phi(.)/\Phi(.)$ is termed as the inverse Mill's ratio. It is assumed that $\varepsilon_1 \sim N(0,\sigma), \varepsilon_2 \sim N(0,\sigma)$, $u \sim N(0,1)$ and $corr(\varepsilon_1, u) = \rho$. The application of the Heckman procedure is necessitated if it is found that ρ is statistically significant (that is, ρ ≠ 0) [Greene, 2003, Nakosteen and Zimmer, 1980].

3.3.2. Data and Estimation Results

As it has been indicated in the previous section, one of the most important determinants of migration decisions is the income differential. Given the actual earnings for migrants, the level of income that would have been earned at areas of destination by non-migrants has to be determined so that the difference in earnings of an individual between what is actually earned at place of origin and the expected income that can be earned at destinations can be calculated. At the same time, given the actual income of non-migrants, the level of income of migrants that would have been earned at place of origin had they not migrated has to be estimated so that the difference in earnings between what is actually earned in urban centers and what would have been earned at places of origin can be calculated. This requires estimation of rural income and urban earnings functions of the non-migrants and migrants, respectively.

In the rural income function, the dependent variable is annual per capita income in Birr. The explanatory variables consist of per capita land size, labor, oxen, cattle, dummy for access to irrigation, dummy for access to road, dummy for rural enterprise, and the level of education of the head. One major problem of estimation is that while migrants are individuals whose income has to be compared with non-migrant individuals, rural income and most of its determinants are household specific. What has been adopted is to consider each member of a household as an individual entity whose income is the average per capita income of the household. Accordingly, some household specific explanatory variables such as land, oxen, and, cattle are used in terms of per capita values. We also used these covariates by level in the regression.

The share of household resource among each member of the household greatly differs by age and sex [Deaton, 1997]. We did not opt for this method because some of the covariates in particular inputs such as land and oxen need to be apportioned where doing so might not be intuitive. Using the average per capita income could give a fair approximation of what a member of a household earns in comparison to what individuals of other household earn. Moreover, in measuring their status, members of a household usually consider what they earn at a household in comparison to neighbouring households rather than the share each member of the household gets.

For the estimation of earnings of migrants, a logarithm of annual earnings of migrants in Birr was used as a dependent variable. The explanatory variables include level of education, and age (proxy for experience), square of age and sex (a value of 1 is given if the individual is female and 0 otherwise).

The data used for the empirical part of this chapter is the own survey data from the villages that are discussed in the general introduction and section 3.2.2. Households were asked about their income by source and factors of production about whether any member of the household has currently migrated out.

Sending families were also asked about some demographic and socio-economic information of the migrant including the income and type of job of the migrant. Since the survey was conducted during school vacation, it was possible in most cases to directly interview migrants whose profession is teaching. For individuals who migrated to nearby town, it was not difficult to trace migrants and get information as required. However, it was not possible to get data on the income of some of the female migrants who usually change their original place of residence due to marriage arrangements.

In some cases, individuals got employment in the public sector as civil servant but they are still working in rural areas. These include teachers, nurses, health assistants, and rural development agents. In this case, it might be difficult to categorize such migration as rural-urban or rural-rural. Basically, such workers have initially migrated to urban centers seeking non-agricultural formal jobs and as such they are employed in urban centers by the government. Moreover, for the purpose of this study, the most important issue is the change of sector by individuals from agriculture to other formal sectors. Hence, such migrants are categorized as rural-urban migrants.

For the estimation of rural income and earnings of migrants in urban areas, both full information maximum likelihood (FIML) and Heckman two-step estimation procedures are used. There were no major differences in the two results both in terms of coefficients and z-ratios [Compare Tables 3-4 and 3-6; and Tables 3-8 and 3-9 in Appendix B].

The selection model is instrumented by major variables that are expected to determine the migration decision of an individual. Accordingly, distance from major urban centers, age square of age, sex, level of education, rank of the household in terms of asset position, square of the rank in asset holding, and per capita land size were used. The incomes functions of both migrants and non-migrants have been estimated by progressively dropping out some of the instruments [See Tables 3-7 and 3-10]. In particular, upon the test of exclusion, distance from major urban centers had a perverse sign (positive) in the rural income function unlike that of the distance from district towns. It was not, however, significant in the earnings function of the migrants. [See Tables 3-2 and 3-3].

In the case of the rural income functions, all variables except labor were significant with expected signs. The incomes equations are similar to what has been estimated in the preceding chapter. Unlike the model in the previous chapter, however, per capita values of some of the determinants of income are used in this case. Moreover, in the previous chapter, land entered the regression as total land size under cash crop and staple crop separately. In this case, actual per capita total land size is used.

In the earnings function of the migrants, level of education, age, and sex of the migrant were statistically significant with expected signs. The square of age was dropped from the regression since it was not significant with an unexpected sign. Its introduction has changed the significance and direction of the age variable. One possible reason could be that all migrants in the survey were below the age of 45 where diminishing returns to skill associated with retirement could not be an issue.

The coefficients of the major variables in the earnings equations of the migrants and non-migrants have opposite signs but similar magnitudes at one decimal place. The variables with similar magnitude are distance from urban centers, age, and level of education. The differences in magnitude of other coefficients in the two regressions are not significant. From the migrants' perspective, distance from major urban centers has a negative and significant coefficient while age and level of education have positive and significant coefficients. Inferences about the migration decision will be made once the migration decision equation is re-estimated by incorporating the income differential.

The important point that has to be raised is the selectivity issue. The result on the existence of selectivity bias is not unequivocally confirmed by the estimation of the earnings functions. In the estimation of the earnings of the non-migrants, the null for independent equations was not rejected in one of the models where all candidate instruments were used implying that the earnings of the non-migrants is not an outcome of self selection compared to migrants. However, in the case of the estimation of the earnings function of the migrants, the null for independent equations was rejected at 5 per cent level. This may partly support the appropriateness of the application of the Heckman procedure.

The next step in estimating the migration decision equation is calculating the difference in earnings of individuals in places of origin and destination. Using the estimated incomes function of non-migrants, the reservation level of income of migrants has been predicted. Similarly, using the estimated earnings function of migrants, the expected income of non-migrants which they would earn if they were to migrate is predicted. That is, the earnings function for migrants provide both the counter factual values for migrants and the expected income for non-migrants at destination constituting estimated urban income for both migrants and non-migrants. The estimated rural income that comprises of the counterfactual values for non-migrants and estimated reservation income for migrants constitute rural income.

Denoting the estimated urban income and rural income by $\hat{y}_u$ and $\hat{y}_r$, respectively, the income differential can be calculated as:

$$\Delta\hat{y} = \hat{y}_u - \hat{y}_r \qquad (3.15)$$

Using the simple income differential $\left(\hat{y}_u - \hat{y}_r\right)$ in the migration decision equation could be tricky. Individuals who contemplate to migrate to urban centers do not necessarily consider only nominal wage rates at destination. As migration theory dictates, one of the factors that enter in the calculus of expected income is probability of finding job. Harris-Todaro (1970) considered the proportion of filled jobs to the total urban labor force (or simply urban employment rate) as perceived probability of getting job in urban areas. Following their approach, the employment rates by educational status is used as perceived probability of getting job for this analysis. Thus, assuming that there is no unemployment in rural areas irrespective of labor productivity issues, the difference in expected income is calculated as:

$$\Delta y = \pi\hat{y}_u - \hat{y}_r = \left(1-u\right)\hat{y}_u - \hat{y}_r \qquad (3.16)$$

where π = probability of securing job in urban areas, and u = rate of unemployment.

The Ethiopian national labor force survey shows that urban unemployment rate for active labor force with no formal education, primary level of education (1-8 grades), secondary level of education, and tertiary level education were, respectively, 16.7%, 23.1%, 33.9%, and 12%.

In most cases, the income differential without accounting for urban unemployment is positive for both migrants and non-migrants. Only few migrants have negative income differentials. This might pose a question that if individuals who did not migrate so far have positive income differential in favor of urban expected income, why then they did not migrate? The reason could be that probability of finding job and cost of migration play a key role in migration decisions. To this end, after accounting for rate of unemployment in urban areas, the number of individuals with negative income differential increases except for those who have a tertiary level of education.

This result may lead also to another point that individuals in rural areas once introduced to a certain level of education may still prefer to work in urban areas even if rural economic activities gets them better earnings. This might be due to the fact that education changes their perception so that they prefer urban public goods to rural cultural values.

The migration decision equation is estimated by including the incomes differential using binary probit model. [Results are reported on Table 3-11 of Appendix B]. Other explanatory variables include distance from major towns, level of education, per capita land size before migration, rank of the household in the village in terms of asset, age, and sex (female = 1). It has been found that differences in income adjusted for probabilities of finding job are significant and positive. It seems that the result supports the hypothesis that individuals migrate to urban areas in response to earnings differential.

The significance of education in the migration model may witness that besides its impact on migration decisions through income, it also causes changers in preferences. That is, individuals with little or no education tend to stay in their original places even if they face significant differences in income for cultural reasons. On the other hand, individuals with some level of education may not necessarily prefer to stay in rural areas even if their earnings from agriculture is higher than the expected income in urban areas. Education can also serve as a means to narrow the information gap about the labor market at destination.

Distance which is intended to capture costs of migration and information gap has a negative and significant sign. In general, households nearer to major urban centers tend to send some members of the household to urban areas than those who are very far form urban centers.

3.4. CONCLUSIONS

In this chapter, it has been argued that even if the merit of rural-urban migration is contentious in developing countries, the fact that a large segment of the society of these countries still resides in rural areas necessitates for a policy that targets on permissive migration to enhance rural transformation. By taking the Ethiopian case as a reference, the pressure of the seemingly alarming rural-urban migration is felt because it mainly flows to a few destinations, usually the capital city. The reality is that the long term resultant of the rural-urban migration is only 15 per cent of urbanization rate.

It has been demonstrated that a relatively educated individuals in rural areas migrate to urban centers not only because education gives them a means to secure higher earnings at destinations but also because it induces them to develop a preference for urban public goods instead of rural based traditional ways of life.

Following Nakosteen and Zimmer (1980), earnings of migrants have been estimated by accounting for the selectivity bias and are used to predict the expected income that non-migrants would have earned had they migrated. Similar procedures were used to estimate the reservation income of migrants at origin. It has been found that education explains much of the differences in earnings among the migrants.

The migration decision function has been estimated using logit and probit models where income differential, distance from major urban centers, level of education, age, sex, deviations of the household asset from the village level average asset, and per capita land size were used as explanatory variables. It has been found that income differential and level of education encourages migration while distance from major urban centers which may serve as proxy for costs of migration and level of information asymmetry tend to decrease the probability of migration of an individual.

Probability of migration increases with age but tends to decline for old ages. This seems to justify the fact that individuals with old age expects low return to migration in terms of discounted net present value while the youth have longer time period that gives them higher expected return in net present value.

The role of education in fostering smooth rural transformation by inducing rural-urban migration is worth emphasizing. Education in general induces rural individual to migrate to urban centers. Two outcomes may emerge as a result of education in terms of migration. One of the outcomes is that the urban sector in particular the public sector may not be able to grant jobs to the overwhelming large number of educated migrants. The other outcome is the possibility of self selection in term of migration where only those who are inherently competitive could migrate. It can be argued that for a country with low urbanization rate where education is largely an urban phenomenon, it does not matter if the urban sector fails short of absorbing the rural educated migrants. It is not a problem either, if only the most competitive educated individuals from rural areas migrate leaving average individuals behind with some level of education. The benefit of making education a rural phenomena is i) to change the preference or taste of rural youth and induce them to aspire a different mode of life including self-employed businesses in the form of rural enterprise, and ii) to assist the relatively visionary individuals reveal their talents and maximize their number from the large rural pool than from the few urban enclaves.

In conclusion, rural-urban migration is desirable and inevitable. The challenge is how to avoid outcomes that make rural-urban migration a signal of malfunctioning of the linkages. The desirable features of rural-urban migration can be achieved through education and used as a means of ensuring smooth rural-urban migration. This requires making sustainable education a rural phenomenon.

Appendix B

Table 3-2:Testing for Exclusion Restriction

Dependent Variable: Per capita rural income of non-migrants	
Labor (logs)	-0.609
	(13.14)**
Land (logs)	0.335
	(12.05)**
Oxen	0.131
	(8.37)**
Dummy - irrigation	0.330
	(7.46)**
Dummy Climate	1.647
	(6.78)**
Access to Road	1.052
	(14.04)**
Level of education	0.008
	(1.76)
Cattle	0.032
	(4.23)**
Dependency ratio	-0.269
	(11.18)**
Distance from major towns	0.027
	(7.57)**
Intercept	4.122
	(12.04)**
Observations	1487
R-squared	0.49

Absolute value of t statistics in parentheses; significant at 5%; ** significant at 1%*

Table 3-3: Testing for Exclusion Restriction

Dependent Variable: Urban Income of Migrants	
Level of education	0.124
	(6.00)**
Age	0.022
	(1.98)
Sex (Female =1)	-0.397
	(-2.30)*
Distance from major towns	0.001
	(0.41)
Constant	6.304
	(19.39)**
Observations	64
R-squared	*0.51*

*Absolute value of t statistics in parentheses; * significant at 5%; ** significant at 1%*

Table 3-4: Earnings of Non-migrants (FIMLE Results) - per capita covariates

Dependent Variable: Per capita income (in logs)		
	Regression Equation	Selection Equation
Per capita land size (in logs)	0.454	
	(15.02)**	
Labor (in logs)	-0.010	
	(0.25)	
Per capita oxen	0.466	
	(6.00)**	
Per capita cattle	0.146	
	(3.84)**	
Distance from district town	-0.029	
	(5.92)**	
Access to road	0.497	
	(7.87)**	
Dummy for climate	-0.240	
	(3.65)**	
Dummy rural enterprise	0.355	
	(8.18)**	
Dummy access to irrigation	0.322	
	(6.66)**	
Level of Education-Head	0.029	
	(4.67)**	
Distance from major towns		0.004
		(2.16)*
Age		-0.173
		(4.22)**
Age-square		0.003
		(3.83)**
Sex (Female = 1)		0.179
		(1.31)
Asset (Relative)		-2.27×10^{-5}
		(0.31)
Asset square		-4.28×10^{-8}
		(2.04)*
Per capita land size		0.725
		(0.82)
Level of education		-0.136
		(7.59)**
Intercept	7.215	4.462
	(60.49)**	(7.99)**
λ	0.093[0.0817]	
N	1260	
Censored	87	
Uncensored	1173	
Wald $\chi^2(10)$	1208.73	
LR test of indep. eqns.($\rho = 0$)	$\chi^2(1) = 1.15$	

Absolute value of z statistics in parentheses and value under square bracket for λ is standard error.
* significant at 5%; ** significant at 1%

Table 3-5: Earnings of Non-migrants (FIMLE Results) –covariates by level

Dependent Variable: Per capita income (logs)		
	Regression Equation	Selection Equation
Land (logs)	0.361	
	(11.09)**	
Labor (logs)	-0.345	
	(7.65)**	
Oxen	0.150	
	(7.98)**	
Cattle	0.030	
	(3.41)**	
Distance from district towns	-0.042	
	(8.44)**	
Access to road	0.481	
	(7.17)**	
Dummy Climate	-0.381	
	(5.44)**	
Dummy Rural Enterprise	0.370	
	(8.13)**	
Dummy irrigation	0.340	
	(6.62)**	
Education - head	0.026	
	(3.92)**	
Distance from major towns		0.008
		(4.94)**
Age		-0.225
		(6.13)**
Age squared		0.004
		(5.96)**
Per capita land size		-0.472
		(0.63)
Constant	6.830	3.890
	(63.53)**	(7.87)**
λ	0.064 [0.129]	
N	1260	
Censored	87	
Uncensored	1173	
Wald $\chi2(10)$	998.53	
LR test of indep. eqns.($\rho = 0$)	0.21	

Absolute value of z statistics in parentheses
* significant at 5%; ** significant at 1%

Table 3-6: Earnings of Non-migrants (Heckman Two-Step Estimation Results)

Dependent Variable: Per capita income (in logs)	Regression Equation	Selection Equation
Per capita land size (in logs)	0.455	
	(15.04)**	
Labor (in logs)	-0.012	
	(-0.28)	
Per capita oxen	0.465	
	(5.97)**	
Per capita cattle	0.145	
	(3.81)**	
Distance from district town	-0.029	
	(-5.83)**	
Access to road	0.495	
	(7.83)**	
Dummy for climate	-0.245	
	(-3.72)**	
Dummy rural enterprise	0.355	
	(8.19)**	
Dummy access to irrigation	0.324	
	(6.69)**	
Level of Education-Head	0.029	
	(4.60)**	
Distance from major towns		0.0046
		(2.34)*
Age		-0.176
		(-4.30)**
Age-square		0.003
		(3.90)**
Sex (Female = 1)		0.197
		(1.46)
Asset (Relative)		-1.98×10^{-5}
		(-0.27)
Asset square		-3.79×10^{-8}
		$(-1.86)^{+}$
Per capita land size		0.563
		(0.64)
Level of education		-0.136
		(-7.58)**
Intercept	7.208	4.509
	(60.26)**	(8.07)**
λ	0.187(1.48)	
N	1260	
Censored	87	
Uncensored	1173	
Wald $\chi^2(10)$	1199.75	

Absolute value of z statistics in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%

Table 3-7: Earnings of Non-migrants (FIMLE Results) with Fewer Instruments

Dependent Variable: Per capita income (in logs)		
	Regression Equation	Selection Equation
Per capita land size (in logs)	0.453	
	(15.00)**	
Labor (in logs)	-0.010	
	(0.23)	
Per capita oxen	0.469	
	(6.04)**	
Per capita cattle	0.147	
	(3.86)**	
Distance from district town	-0.030	
	(6.02)**	
Access to road	0.499	
	(7.89)**	
Dummy for climate	-0.239	
	(3.58)**	
Dummy rural enterprise	0.354	
	(8.16)**	
Dummy access to irrigation	0.321	
	(6.65)**	
Level of Education-Head	0.030	
	(4.73)**	
Distance from major towns		0.009
		(5.07)**
Age		-0.235
		(6.26)**
Age-square		0.004
		(6.09)**
Sex (Female = 1)		0.382
		(3.08)**
Constant	7.219	4.172
	(60.54)**	(8.14)**
λ	0.0425[0.113]	
N	1260	
Censored	87	
Uncensored	1173	
Wald $\chi^2(10)$	1212.71	
LR test of indep. eqns.($\rho = 0$)	$\chi^2(1) = 0.13$	

Absolute value of z statistics in parentheses and value under square bracket for λ is standard error.
* significant at 5%; ** significant at 1%

Table 3-8: Earnings of Migrants (Results of Heckman Estimation)

Dependent Variable: Per capita income (in logs)		
	Regression Equation	Selection Equation
Level of Education	0.169	0.135
	(5.60)**	(6.78)**
Age	0.026	0.163
	(2.39)*	(3.57)**
Sex (female = 1)	-0.473	-0.249
	(2.81)**	(1.64)$^{+}$
Distance from Major Towns		-0.005
		(2.15)*
Age square		-0.003
		(3.24)**
Asset (Relative)		7.78×10^{-5}
		(1.06)
Asset Square		-4.83×10^{-8}
		(2.37)*
Per capita land size		0.720
		(0.82)
Intercept	5.204	-4.735
	(8.20)**	(7.56)**
λ	0.668	
	(2.13)*	
N	1260	
Censored	64	
Uncensored	1196	
Wald $\chi^2(3)$	104.67	

Absolute value of z statistics in parentheses.
* significant at 5%; ** significant at 1%

Table 3-9: Earnings of Migrants (Results of Heckman Two-Step Estimation)

Dependent Variable: Per capita income (in logs)		
	Regression Equation	Selection Equation
Level of Education	0.206	0.135
	(4.58)**	(6.83)**
Age	0.028	0.160
	(2.49)*	(3.47)**
Sex (female = 1)	-0.531	-0.245
	(-2.91)**	(-1.61)
Distance from Major Towns		-0.005
		(-2.12)*
Age square		-0.003
		(-3.14)*
Asset (Relative)		7.0×10-5
		(0.90)
Asset Square		4.22×10-8
		(1.93)+
Per capita land size		0.816
		(0.89)
Intercept	4.304	-4.696
	4.20	(-7.43)**
λ		
N	1260	
Censored	64	
Uncensored	1196	
Wald $\chi^2(3)$	43.89	
LR test of indep. eqns.($\rho = 0$)	$\chi^2(1) = 3.55$	

Absolute value of z statistics in parentheses and value under square bracket for λ is standard error.
+ significant at 10%; * significant at 5%; ** significant at 1%

Table 3-10: Earnings of Migrants (FIMLE Results) with Fewer Instruments

Dependent Variable: Per capita income (in logs)	(1)		(2)	
	Regression Equation	Selection Equation	Regression Equation	Selection Equation
Education	0.131 (6.40)**		0.132 (6.39)**	
Age	0.022 (2.08)*	0.232 (5.53)**	0.022 (2.06)*	0.221 (5.42)**
Sex (Female=1)	-0.504 (-2.84)**	-0.418 (-3.07)**	-0.402 (-2.50)*	
Distance		-0.007 (3.99)**		-0.007 (3.85)**
Age Square		-0.004 (5.36)**		-0.004 (5.25)**
Constant	5.681 (9.91)**	-4.418 (7.63)**	5.715 (10.36)**	-4.051 (7.37)**
λ	0.295[0.215]		0.308[0.224]	
N	1260			
Censored	64			
Uncensored	1196			
Wald $\chi^2(3)$	63.49		66.71	
LR:$\rho = 0$	$\chi^2(1) = 1.79$		$\chi^2(1) = 1.81$	

Absolute value of z statistics in parentheses
* significant at 5%; ** significant at 1%

Table 3-11: Probit and Logit Estimates of Determinants of Migration

Dependent Variable: Migration Decision, M (M=1 if migrated, 0 otherwise

	Probit Estimates		Logit Estimates
	Coefficients	Slopes	Coefficients
Distance	-0.004	-0.00006	-0.008
	(2.05)*		(2.03)*
Income differential	0.525	0.008	0.974
	(2.92)**		(2.72)**
Asset Rank	-0.000	-2.91e-07	0.000
	(0.25)		(0.12)
Rank Square	0.000	2 4.49e-10	0.000
	(1.44)		(1.63)
Age	0.162	0.0023	0.364
	(4.27)**		(4.31)**
Age square	-0.003	-0.00004	-0.006
	(4.06)**		(4.04)**
Sex (female =1)	-0.185	-0.0027212	-0.289
	(-1.32)		(-1.04)
Level of Education	0.113	0.002	0.231
	(5.57)**		(5.23)**
Per capita land size	1.214	0.018	2.625
	(1.17)		(1.32)
Intercept	-4.911		-10.091
	(8.25)**		(8.18)**
N	1590		
Wald $\chi^2(9)$	120.96		132.73
Pseudo R^2	0.35		0.36

Robust z statistics in parentheses
* significant at 5%; ** significant at 1%

Chapter Four

Prospect to Migration as Determinant of Human Capital Formation: Evidence from Ethiopia

4.1. INTRODUCTION

In the preceding chapter, is has been shown based on the available literature that education facilitates smooth rural-urban migration primarily because the urban labor market pays relatively higher wages to educated migrants. The empirical findings also support the arguments. What has been neglected in the literature of rural-urban migration is the feedback effect of migration on human capital formation in rural areas.[17] In this chapter, an attempt is made to demonstrate how prospects of rural-urban migration induce human capital formation in rural areas. This chapter is basically an extension of the previous chapter that is intended to show that while education helps smooth rural to urban migration, prospects of rural-urban migration in turn induces rural household to develop a trust in education; and as such pessimism in returns to education in urban centers discourages the critically needed human capital formation.

While human capital is broadly defined to include schooling, expenditures in medical care, and other related issues such as lectures on punctuality and honesty, education and training are considered to be "the most important investments in human capital" [Becker, 1993].

Education is generally believed to be at the center of social transformation affecting many aspects of human life. Its value is thus beyond direct financial returns. To this end, Weisbrod (1996) forwarded:

> "*Education is, after all, much more than a means of raising productivity or otherwise bringing financial returns. It is also a means of inculcating*

[17] Stark, et al (2004) demonstrated in the international migration settings that prospects of migration to rich nations could induce individuals in developing countries to invest in human capital formation up to a socially optimum level.

children with standards of socially desirable attitudes and behaviour and of introducing children to new opportunities and challenges. In the free society, it helps to develop greater awareness of and ability to participate effectively in the democratic process" [Weisbrod, 1966:16].

One could argue that even in non-democratic regimes, education helps people seek democracy and freedom and identify a civilized means of achieving them. As Weisbrod argued, education increases social welfare through increased social consciousness and 'public spiritedness' in addition to productivity gains through skilled labor.

Freeman (1987) identifies three broad categories of views on human capital with respect to its contribution to economic growth. The human capital view considers education as a productive input where wage premium for educated labor measures its marginal productivity. However, this view is contested by the second view which is referred to as screening or sorting view in that private gains by educated workers do not match the social gain due to signalling one's skills in the market. The third view which is known as fixed coefficient – bottleneck view argues that the role of education has to be considered in that some level of educated labor in various fields of study is required to trigger growth whose shortage causes bottleneck problems.

There is a vast literature that emphasizes the critical importance of human capital formation in the development process of a country. Alfred Marshall as quoted in Becker (1993) described investment in human beings as "the most valuable of all capital." Education in general is believed to be the critical instrument to facilitate societal transformation.

The role of education has been emphasized in terms of increasing individual earnings, and spurring economic growth. In particular, technological transfer which fosters the possibility of developing countries far from the world technological frontier to ensure convergence to rich countries heavily depends on their technological readiness through educating their people (Lee, 2001). Recent literature on endogenous growth theory attempts to endogenize technology either by redefining capital in broader context accounting for human capital (Lucas, 1988; Mankiw, Weil and Romer, 1992) or through R&D which in turn is a function of time allotted on learning new ideas (Romer, 1986, 1990; Jones, 1996, 2004).

As Lee(2001) argued, for developing countries which are far from world technology frontier, adoption rather than production of technology is more plausible to catch up to developed countries. It is usually argued that the role of technology in fostering economic development in low income countries heavily depends on the absorptive capacity of each country. The absorptive capacity of a country is by and large constrained by lack of human capital with the necessary skill. The contribution of other complementary factors such as foreign direct investments to technological transfer depends on a "minimum threshold stock of human capital."

Using cross country regression, Lee (2001) showed the existence of complementarities between technology imports and human capital in terms of technological progress in developing countries. Thus, access to world technology is not enough to exploit what Gerschenkeron (1962- as quoted by Lee, 2001) termed as the 'advantage of backwardness.' It rather requires preparedness in terms of human capital to adopt it at a useably effective scale.

On the empirical front, the results on the role of education on economic growth have been mixed. While education helped South East Asian countries to register a remarkable growth, the same or even higher enrolment ratios could not help African economies to grow[18] at an appreciable rate. This led Pritchett (1997**)** to inquire "where has all the education gone?"

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[18] Stiglitz (1998) argued that the emphasis given to universal education by the governments of East Asian economies was important as education turned out to be a "necessary part of their transformation from agrarian to rapidly industrializing economies."

Some of the explanations for such mixed results could be found in the dimensions of education in that quality of education, field of study, and availability of complementary factors such as openness to technology would be crucial. While most of South East Asian countries train their people in science and engineering at tertiary levels (Stiglitz (1998)[19], most African countries concentrated on primary education. As Stiglitz noted, expansion of tertiary level education is justified not simply because it contributes to increments in private earnings. It is rather justified because it generates positive externality in importing new ideas, that is, technological transfer that would help countries to trigger economic growth. It is also argued that (Lee, 2001) children start to reveal their talent at secondary rather than primary school levels in terms of acquiring skills necessary to adopt the fast changing technological changes.

In terms of private returns of education, it is generally believed that educated people tend to have earnings well above average and the gains are larger in developing countries. For instance, “high school and college education in the United States greatly raise a person’s income even after netting out direct and indirect costs of schooling and after adjusting for the better family backgrounds and greater ability of more educated people.” [Becker 1993].

In the academic debate on education, it appears that the issue is not suspended on whether education has a role in poverty reduction and fostering economic growth. In particular, in African countries whose fortune seems to depend on their natural resources, the mystery of their underdevelopment might be explained by the sheer absence of skill that reveals the mystery of converting the “dead capital” equivalent of De Soto into what he called “live capital.” This magic treasury which Africa failed to claim could be appropriate education. The issue thus is suspended rather on the mechanics how to generate quality education with its magic features of triggering growth in a predominantly agrarian economy.

[19] Nearly 1% of the population of Republic of Korea and Taiwan and about 0.4% of Japan, and Singapore are trained in the filed of engineering at tertiary levels. About 0.5% of the population of South Korea are trained in natural sciences, mathematics and computer science [Stiglitz, 1998].

This chapter argues that a quality education that would be likely to strike growth should be purposeful in its initial investments. Such purposeful investments in education by rural households require optimism on the returns of education. Households take prospects of migration into account in their decision to invest their time and resource in education.

Unfortunately, policy makers in developing countries are still fearful about rural–urban migrations. Pessimism about rural-urban migration is also reflected in the economic literature. As it has been discussed in the preceding chapter, the Harris-Todaro (1970) model of rural-urban migration argues that individuals' migration decisions are determined by rural-urban wage differential, cost of migration, and probability of finding job at destinations. The most important prediction of the model is that the equilibrating condition of the process of rural-urban migration is unemployment in the urban centers. It follows that development schemes that target on reducing urban unemployment might end up with an even higher level of unemployment rate in urban centers which compromises welfare.

One of the immediate policy implications of this model is that rural-urban migration has to be reduced by increasing its opportunity cost. Nonetheless, such policy option could delay the much needed rural transformation and discourage investment in education in the rural areas. Successful rural-urban migration raises agrarian labor productivity by increasing per capita land size,[20] and augments urban demand for agricultural output. Moreover, since households invest in education in anticipation for possibilities of finding a job in the formal labor market outside agriculture, factors which discourage rural-urban migration might compromise the critically needed human capital formation.

An important extension of the Harris-Todaro model which is more relevant to the theme of this chapter is that of Fields (1975). Fields argued that the labor market in urban areas has a preferential treatment towards educated migrants. This makes the level of

[20] Assuming marginal productivity of labor in the agricultural sector is nearly zero as in Lewis (1954), successful migration of some members of a household implies increase in per capita land size which therefore increases labor productivity.

equilibrium unemployment in urban areas much lower than what is predicted by the Harris-Todaro model. If the labor market at destination of migration is discriminating between skilled and unskilled migrants, then, this would induce rural households to invest in human capital formation in a bid to win jobs in the urban areas. That is, prospect of migration to urban centers would serve as an incentive to human capital formation in rural areas.

Such argument, in particular in the case of international migration has been proposed by Oded Stark. Higher probability of migration to affluent nations would encourage individuals in a sending country to invest in human capital formation in anticipation for better earnings abroad. The impact of international migration on welfare in the sending country depends on the level of the probability of migration. Possibilities of excessive out-migration of educated workers would compromise welfare. That is, there is an optimum level of probability of migration beyond which migration would have an adverse impact on the welfare of sending country as brain-drain dominates.[See Stark, et al, 2004].

One of the implicit assumptions of this model is that households exhaust all private returns of education and the difference between the social and private optimum levels of human capital formation is the positive externality which education can generate. However, in developing countries where there is a perception that education does not have significant role in improving agriculture, rural households tend to under-invest in education falling short of even the privately optimum level of human capital.

This fact has been recognized by the Ethiopian policy makers. In the education and capacity building strategy document of Ethiopian government, it has been argued that there is a long-held belief among the society that a member of a household that has some level of education has to work outside agriculture preferably as a civil servant. It further argues that there is no trust by the society in the fact that education helps individuals in the agricultural sector to improve their living standard through innovation and gains in productivity within the sector. This is partly due to the fact that for long time in the past, the government has been the sole employer of educated citizens where there was limited supply of education [FDRE Education and Capacity Building Strategy and Policy, 2005].

Asymmetric information about the formal labor market due to low urbanization rate contributes to the problem of under-investment in education. Under such conditions, prospect of rural-urban migration remains to be one of the most effective ways of inducing rural households to invest in education. Unlike the case of international migration, this notion does not imply welfare losses in the origins of migrants because successful migrants would be used in the same economy which is characterized by a significant skill gap.

In this chapter an attempt has been made to show how prospect of rural-urban migration induces a rural household to invest in a level of education i) which would have been achieved only if the household were fully informed to account for all private returns of education, ii) which is socially optimal by accounting for the positive externalities that education can generate.

The notion could be applicable to developing countries with high rural population, and characterized by shortage of skilled manpower. For this analysis, the Ethiopian case has been demonstrated to derive the models and data from some villages in Northern Ethiopia are used to empirically test the arguments.

The remaining part of the chapter is organized as follows. Section two gives a highlight on the location and educational performance of the villages under study in Ethiopia. Section three presents a theoretical framework on how households optimally allocate their time between income generating activities and education and draws some implications of the results of the models. In section four, an econometric analysis is conducted. For the empirical analysis, ordered logit, generalized ordered logit, and binary logit models are applied depending on their appropriateness. Finally, section five concludes.

4.2. LOCATION AND RURAL EDUCATIONAL PERFORMANCES IN ETHIOPIA

Although modern education has been introduced to Ethiopia a century ago, its contribution to overall development remained to be modest until recently. Narrow coverage, early drop outs, and poor quality of education could explain the meagre contribution of education to the development process.

There is a clear indication that primary level enrolment has significantly increased in Ethiopia in recent years. Gross enrolment ratios in 1995 were 29% for primary education. Gross and net primary level enrolment ratios reached 68.4%, and 57.4%, respectively, in 2004. This is, however, a recent phenomenon while still the drop out rate is significant. In the year 2002/03, for instance, it was observed that about 62% male and 60% female students of the first cycle of the primary level of education (grades 1-4) did not continue to the second cycle dropping out in the process throughout the five years. As a result, the relatively better performance in primary education in terms of coverage was not paralleled by increases in secondary school enrolments. Gross and net enrolment ratios in secondary schools (grades 9-10) in 2004 were 22.1% and 9.8%, respectively.

A significant part of these figures is accounted by an overwhelming urban enrolment while performance in rural education in some regions in particular remains to be dismal. In 2004, about 69% of the total enrolment was accounted by rural areas while the balance (31%) by urban areas. Weighted by the share of the population (85% is rural), urban enrolment is 2.6 times (156%) higher than in rural areas. What is rather striking is the rural-urban disparity at secondary level of education. Secondary school enrolment (grades 9-10) in urban areas accounted for 96% of the total secondary school enrolment in the country. This is 4 times (300%) higher than rural enrolment. The implication is that given the low urbanization rate, students who complete village levels of education in rural areas have to travel long distances to join the schools of the next levels which are found in urban centers. Under such a situation, only few rural students can succeed in completing their education.

The other important aspect that requires closer attention in Ethiopian education system is quality and filed of study. Though this is an important area of research in itself which will not be addressed in this dissertation, it is generally possible to say that in recent years, there are clear indications that expansion of education compromised quality. For instance, pupil per teacher ratio in the primary school level has increased from 33 in 1995 to 65 in 2004. For the same level, pupil per classroom ratio has also increased from 47 in 1995 to 74 in 2004 [MOE, Education Statistics Annual Abstract, 1996 and 2004 issues].

In terms of field of study, there are encouraging achievements in the new educational policy that technique and vocational fields are replacing the general academic based curriculum that was in place until mid 1990s. With the current attempt to expand universities from only two to more than ten in recent years, the focuses on engineering fields might be encouraging. This, however, is not observed in private colleges which usually focus on low cost business related fields with much pressure on fields of some professions such as accountancy.

It can be argued that performances in education are related to proximity to urban centers since the latter signifies prospect of migration and access to secondary schools. It is however difficult to account for nationwide comparisons in terms of education with respect to proximity to urban centers which may serve as center of information about the formal labor market. Here, some selected villages are considered to show the pattern of educational performance over distance from urban centers.

As it can be seen from Table 3.1, enrolment ratios in the study areas generally tend to decrease with distance from urban centers. The difference is noticeable for relatively remote areas such as Habru-Ligo where secondary school enrolment ratio is only 4% in comparison to 28% in Mersa Zuria area.

All villages have schools of primary level of education. The nearest school for second cycle of the primary level of education for Habru-Ligo is found in Girana which is not a town in itself. The nearest secondary school levels for all villages are urban centers most of them being small district towns with little attraction to rural migrants.

Table 4-1: Location and Educational Performance in Selected Villages in Wollo, Ethiopia

	Alasha	Mersa Zuria	Girana	Habru-Ligo
Distance from District Town (km)	7	7	15	20
Distance from Major Towns (km)	12	20	75	85
Distance to the Next School	7	7	15	10
Highest Grade of Village Level School	6	8	8	6
Enrolment Ratio(%)-Primary	92	97	86	83
Enrolment Ratio (%)- Senior Secondary	25	28	19	4
Share of Girls (%)	47	42	53	63
Level of Education: Stock (percentage from eligible population)				
No formal education	5.8	3.4	21.5	44.3
Primary education	41.2	45.9	51.4	50.6
Junior secondary education	20.3	22.3	14.4	3.2
Senior secondary education	28.5	28.4	10.6	1.9
Tertiary level education	4.1	0.0	2.1	0.0
Cumulative Migration Rate (to urban centers)				
Ages 14-65	15.7	6.2	5.1	4.2
All ages	10.4	4.3	3.1	2.5

In terms of stock of human capital, the share of individuals with no formal education increases from 3.4% of the population in Mersa-Zuria to 44.3% in Habru-Ligo. It is apparent to observe that the overwhelming majority of those who have some formal education have stagnated at primary levels in the villages far from urban centers. In Habru-Ligo, about 50% of the respondents have some primary level of education. However, the sustainability issue is still a major concern as the stock with secondary school level of education is stagnated at a figure as low as a mere 2% in villages such as Habru-Ligo.

The share of individuals with tertiary level of education in general is very low. Even though tertiary level of education heavily depends on secondary school enrolments, it also depends on personal abilities to pass to this level in particular in the face of high grade requirements to join the limited number of higher learning institutions.

An interesting aspect worth mentioning is the increase in the share of girls in the overall enrolment with distance from major towns. Girls account for 42% of the total enrolment in Mersa-Zuria and as high as 63% in Habru-Ligo. In fact, there are years when this figure reach 70% in Habru-Ligo. It might be logical to consider girls' participation as a positive development for educating the mother would have some important implications. The problem, though, is that as closer analysis shows, this is just an indication for the fact that those rural households at relatively remote areas do not consider education seriously. When households are urged to send some of their children to school by the government, they prefer to send their daughter to school only for the sake of fulfilling their 'obligations'. Primarily, boys are needed in the farm which is usually far from their place of residence (as far as three hours journey on foot) while girls can assist at home after school. Upon completion of the village level education, boys usually tend to resist dropping out while girls are forced to marry even before completing the primary level of education, a 'good' reason enough to tell the government agents for dropping out form school.

The data supports this argument in that in all villages, men have higher level of education than women. In Alasha, the highest years of schooling for women and men are 14 and 17, respectively. The median years of schooling for women in the area is 5 years while that of men is 6 years. In Habru-Ligo, the mean years of schooling for women and men are 1.4 and 1.2, respectively. The highest level of years of schooling for women in the area is 6 while that of men is 11.

Lastly, it is apparent from the table that cumulative migration rate decreases with distance from urban centers. This is more or less consistent with the pattern in both stock of human capital and current enrolment ratios. This might reflect a number of implications. One possibility is that individuals from villages with a relatively higher level of educational achievements tend to migrate. The other possibility is that high probability of migration that has been made possible by the virtue of being nearer to urban centers triggers high level of school attendance. The subsequent sections address such simultaneous nature of interaction between education and migration.

4.3. THEORETICAL FRAMEWORK: INVESTING IN EDUCATION

4.3.1. Background

The analysis is based on the assumption that households' decision on the allocation of their time endowment is associated with utility maximization. In particular, decisions to allocate time on human capital formation compromises current consumption as labor time that would have been used to generate income for current consumption would be diverted to it. The household is assumed to have at least a head that is too old to go to school and at least one school age member of a household, typically, a child, so that the minimum total time available for the household is that of the head and the child.

It is also assumed that the household anticipates living for two periods. In the first period, the household optimally decides on the amount of time that has to be shared between income generating activities and education. Investment in education starts commencing returns in the second period.

The household is represented by the head. It is assumed that the head of the household attempts to maximize joint utility in both periods. Parents could be altruistic towards their children in the sense that they also do care about the welfare of their children (Becker, 1981) though such altruism may not be the same for all members of a household depending on sex and age. Parents may also be characterized by selfish *quid pro quo* behaviour towards their children (Parish and Willis, 1993). The head of the household attempts to maximize the total income of the child in the second period either on a purely altruistic basis or in an effort to maximize remittance or any transfer from the child or for both reasons.

It is also assumed that the rural households perceive that education has little or no role in agriculture. Such perception may arise due to the fact that the externality that can be generated by educated farmers is not visible to traditional peasants due to change in patterns of consumption and the form of wealth by educated farmers. The ideal wealth status of the rural households is large number of cattle, and large stock of cereals in showy traditional barns. They also appreciate traditional clothes made by local weavers sometimes dyed in perfumed butter which do not require soaps and detergents for washing. In addition, they prefer an extended family. When a farmer is exposed to education, his perception towards the form of wealth that he wants to hold, and his patterns of consumption change. The educated rural household prefers liquid cash to cereal stocks, high-valued few livestock to a herd of cattle, manufactured goods to traditional goods, and a small family size to an extended family.

Moreover, unless the peasants have exposure to modern farming packages, the role of education in traditional agriculture could be dismal in particular in terms of generating positive externality. In the areas under study, only about 4 per cent of the respondent households applied some modern fertilizer to their plots, and almost none has used pesticides, and commercial high yielding selected seeds. At a national level, fertilizer was applied on about 26 per cent of the total land cultivated in the year 2004. This magnitude might not be considered small. However, its implication to the perception of rural households towards modern inputs has to be considered with caution. First, the magnitude that is applied to some of the plots could be insignificant. For instance, about 40 per cent of the respondents who applied fertilizer to their farm in the villages under study bought less than 5 kg. Second, the sale of fertilizer to peasants is usually tied to other conditions such as credit and access to irrigation. Given the blanket policy by the Ethiopian government to use fertilizer at a significant scale, individuals are given priorities to benefit from rural credit schemes and irrigation facilities if they buy fertilizer whose supply is monopolized by the government.

In 2004/05, the proportion of land where selected high yielding variety seeds and pesticides are applied on was, respectively, 3.2 per cent and 12 per cent. In the same year, the land cultivated using irrigation was only 1.1 per cent of the total cultivated land [CSA, 2005]

According to Becker (1993), education has little role in traditional agriculture. It is also difficult to demonstrate to traditional peasants that they can be modern farmers through education. As a result, rural households may not be able to fully account for private returns of education that can be generated by its ability to increase productivity in the agricultural sector.

On top of this, asymmetric information about the labor market may result in underestimation of the return from education even in the formal labor market in urban centers. Thus, low perception about the role of education in the agricultural sector coupled with asymmetric information about the labor market could result in sub-optimal decision on the investment in education.

One of the reasons for low enrolments and high rate of drop-outs from school even before promoting to higher levels in rural areas of developing countries is the subsistent nature of the economy which forces households to attach a high discount rate on future streams of income. For a household that struggles with current challenges of food security issues, income that can be accrued through education only after more than a decade might be luxury.

Lastly, the overall economy is assumed to be characterized by a significant skill gap in the sense that educated migrants with appropriate skill can be absorbed without compromising urban wages. Low level of urbanization and low share of the industrial sector in the overall economy could serve as a basis for expansion to accommodate skilled migrants.

In what follows, an attempt is made to formally derive the demand for human capital (schooling) in a two period utility maximization framework.

4.3.2. Household Preferences and Constraints

The household's preference is such that lifetime utility, *U*, is divided into two periods: the present and the future. Assuming a separable additive utility function, the household's current utility level is a function of current consumption c_1 and the level of utility in period 2 is a function of consumption in period 2, c_2. The household's preference with the subjective discount factor $\alpha \in [0,1]$, is given by:

$$U = u(c_1) + \alpha E u(c_2) \tag{4.1}$$

where $u : \Re_+ \rightarrow \Re$ is an increasing, concave and continuously differentiable function; *E* is the expectation operator.

In maximizing its utility, the household faces a number of constraints. One of these constraints is income constraint in both periods. In period one, the household income endowment which is current income y_1 plus initial wealth endowments, ω_1, should cover the desired level of consumption c_1, replenishment to wealth in the form of liquid cash or and hoarding of cereals, s_1, and investment in human capital and other income generating activities such as permanent crop and livestock i_1. The budget constraint in period one can be given by:

$$c_1 + i_1 + s_1 = y_1 + \omega_1 \tag{4.2}$$

Let us assume that investment is made exclusively in human capital formation. Let investment in human capital in terms of monetary value at period t be related to time spent on education, E_t, in the same period according to:

$$i_t = \phi E_t \tag{4.3}$$

where ϕ is a constant representing marginal cost of education. Assuming that h_1 and h_2 are stocks of human capital in period 1 and 2, respectively so that E_1 is the difference in stocks of human capital in the two periods ignoring depreciation, it is possible to write:

$$h_2 = h_1 + E_1 = h_1 + \phi^{-1} i_1 \tag{4.4}$$

Rearranging Equation (4.4), we get the relation:

$$i_1 = \phi\left(h_2 - h_1\right) \tag{4.5}$$

In period two, the resources available are income y_2, which is a return to human capital formation made in period one, and returns to savings from period one (y_1+ω_1-c_1-i_1). It is also assumed that returns on savings held at the end of period one bears a return at a rate of r. Thus, the budget constraint in period two is given by:

$$c_2 = y_2 + \left(1 + r\right)\left(y_1 + \omega_1 - c_1 - i_1\right) = y_2 + \left(1 + r\right)s_1 \tag{4.6}$$

The other important constraint is time. The typical rural household involves both in consumption and production decisions. Generally, the household makes different income generating activities and allocate its resources, most importantly, labor to each activity depending on their expected return. Even in the households where there are many children, the need for diversification of income generating activities and the hierarchical nature of the activities each child has to pass through (shepherd or goatherd, cattle herder, farmer) makes rural labor time critical. Suppose for this analysis that the household expects that its consumption might be augmented if it invests its time resource in education.

Assume that the household has L amount of time net of leisure that can be divided into labor time and education. Assume further that part of the total time available can only be used on activities other than education while part of it can be used for investment in human capital. In reality, a household usually comprises of school age children, individuals who are already late for education due to their age, and dependents. Thus, time available for work and schooling could be expressed in child units. That is, the household's problem in terms of investing in education in particular beyond village levels can be understood as how many children to send to school. In deciding to send children at least up to village level grades, children's time available for work after classes could be taken into account. For example, Assefa and Bedi (2004) estimated that rural children who attend school contribute about 38 hours of work per week to the household.

The household has to forego its current consumption if part of its time in labor units (child) is allotted for schooling. However, in period two, the child will be independent of the household. By then, in pure economic sense, the head of the household (who will be in retirement) expects income from the child only if the expected income of the child is greater than the average income of the village. This rarely happens if the child gets engaged in agricultural activity in the same community with a declining per capital land holding. An informed head of a household foresees that the child's income would be higher than the average village level income if the child migrates to urban centers and that this requires a minimum level of schooling.

Hence, the household tries to allocate the total available time net of leisure to income generating activities and schooling. The overall time resource available in both periods could be decomposed as:

$$T - l \equiv L = \ell + h_2 \qquad (4.7)$$

where T = total time, l = leisure time, L = total time net of leisure, ℓ = labor time, h_2 = total time allotted for schooling in period one plus h_1 [See Equation (4.4)]. In period 1, it is assumed that the relevant time on education for the period is E_1 so that the respective time constraint will be:

$$T_1 - l_1 \equiv L_1 = \ell_1 + E_1 \qquad (4.8)$$

where other variables are period one values of what has been defined in Equation (4-7).

4.3.3. The Production Functions

In reality, the household may engage in both farm and off-farm activities. Let us assume for the analysis that the household allots the available time for labor on the farm and schooling. The current income is assumed to be a function of labor time where land is a fixed factor of production.

Output in monetary terms in the first period as a function of labor time is given by:

$$y_1 = f\left(\ell\right) = f\left(L - E_1\right) \tag{4.9}$$

In period two, the head of the household maximizes the overall income of the child. This is consistent with the altruistic approach to parents' attitude towards their children. In the pure *quid pro quo* basis, the household head expects a certain constant fraction of the income of his child in the form of remittance. This constant portion of the expected income from human capital would be proportionally higher if the overall base income is higher. Thus, the head of the household just considers the total income which can be earned by his child.

The expected income from a unit of human capital in the second period depends on two factors. The first is the probability of migration which in turn is a function of the probability of finding a job in urban centers. The second is the level of awareness of the household about the positive returns to education in agricultural activities at origin. Let $p_m \in [0,1]$ represent the probability of migration, and $\rho \in [0,1]$ represent the measure of the perception of the household towards the benefit of education in rural agriculture.

The expected total income in the second period is earnings from using human capital h_2 with a probably of p_m, labor income from raw labor l_2 (which does not affect the total time available at period 1) and returns to savings in the first period. An individual who is assumed to possess h_2 level of human capital as the only input with probability of migration p_m expects income $p_m f(h_2)$. The individual has $(1-p_m)$ probability of operating on the agricultural sector where human capital can augment raw labor by increasing productivity. Suppose that education augments labor according to:

$$y_{agr} = e^{\rho\psi h_2} f\left(\ell_2\right) \tag{4.10}$$

where y_{agr} = output from the agricultural sector, ψ = constant, ℓ_2 = labor time in period 2.

Thus, expected income from using human capital in the formal labor market and in the agricultural sector can be given by:

$$y_2 = p_m f\left(h_2\right) + \left(1 - p_m\right) e^{\rho\psi h_2} f\left(\ell_2\right) \tag{4.11}$$

Adding returns to savings in period one on returns to human capital y_2, we arrive at the total income I_2:

$$\begin{aligned} I_2 &= y_2 + \left(1+r\right)s_2 \\ &= p_m f\left(h_2\right) + \left(1 - p_m\right) e^{\rho\psi h_2} f\left(\ell_2\right) + \left(1+r\right)\left[f\left(L - E_1\right) + \omega_1 - c_1 - \phi E_1 \right] \end{aligned} \tag{4.12}$$

4.3.4. The Problem of the Household

The household maximizes his utility, with respect to the choice variables s_1 and E_1 which by substitution can be summarized by:

$$\begin{aligned} \max_{s_1, E_1} \Big\{ & u\left[f\left(L - E_1\right) + \omega_1 - s_1 - \phi E_1 \right] \\ & + \alpha \left[p_m f\left(h_2\right) + \left(1 - p_m\right) e^{\rho\psi h_2} f\left(\ell_2\right) + \left(1+r\right)s_1 \right] \Big\} \end{aligned} \tag{4.13}$$

One of the first order conditions of the problem gives the standard marginal conditions for intertemporal utility maximization. That is, an optimum utility maximization decision should ensure that the marginal utility of consumption in the first period equals the discounted marginal utility of consumption in the second period.

$$u'(c_1) = \alpha E\left[u'(c_2)(1+r)\right] \tag{4.14}$$

More important to this analysis which is emerged from the optimization problem is the condition:

$$\alpha u'(c_2)\left\{p_m f'(h_2) + (1-p_m)\rho\psi e^{\rho\psi h_2} f(\ell_2)\right\} = u'(c_1)\left[f'(\ell) + \phi\right] \tag{4.15}$$

This condition says that at the optimum, the discounted marginal utility obtained from consumption that is expected to be available through human capital formation in the second period should equal to the marginal utility foregone as a result of shifting labor time that would have been used to increase consumption through income in the first period to human capital formation, plus income diverted to cover costs of education.

An important implication of this condition emerges when low perception coefficient of the role of education on agriculture is assumed. In the limiting case where ρ tends to be zero, households invest in education only if they believe that there would be a prospect of migration. In this case, there is no a perceived way of diversifying risk of human capital formation once a considerable time very long enough for agrarian household who discount the future heavily is spent. The implication is that unless households have full information about the high probability of finding job in urban areas which would compensate for the relatively high opportunity cost, they would prefer not to engage in such uncertain ventures.

The second source of under-investment in human capital from the societal point of view emanates from the fact that households do not account for positive externalities that education can generate.[21] Let the social return to human capital formation is given by:

[21] Stark et al (2004) have used this notion to derive the optimum levels of human capital form the private and social planner point of view in the presence of prospect of international migration by maximizing net earnings.

$$y_2^s = g_u\left(\overline{h}_2\right) + g_r\left(\overline{h}_2\right) \qquad (4.16)$$

where $\overline{h}_2$ = community level economic-wide human capital as in Stark et al (2004), $g_u(.)$ and $g_r(.)$ are the positive externalities generated in the urban or formal sector, and agricultural sector, respectively. It is assumed that there is positive externality generated by education in the agricultural sector in that average productivity in the community increases as a result of learning new techniques of production from the demonstration of the educated neighbors.

Suppose that $g_r\left(\overline{h}_2\right) = e^{\rho\xi\overline{h}_2}\left(\overline{\ell}_2\right)$ where $\overline{\ell}_2$ is community level average labor time and ξ is some constant measuring the rate of return of the positive externality of education. Adding the social return components to Equation (4.11), and maximizing the social welfare counterpart of Equation (4-13) on behalf of the social planner, the condition in Equation (4.15) becomes:

$$\begin{aligned}\alpha u'(c_2)\left\{p_m\left[f'(h_2) + g_u'\left(\overline{h}_2\right)\right] + (1-p_m)\rho\left[\psi e^{\rho\psi h_2} f(\ell_2) + \xi e^{\rho\xi\overline{h}_2}\left(\overline{\ell}_2\right)\right]\right\} \\ = u'(c_1)\left[f'(\ell) + \phi\right]\end{aligned} \qquad (4.17)$$

It appears from Equations (4.15) and (4.17) that for the same opportunity costs of time allotted for human capital formation and private direct costs, the private marginal benefits are lower than the benefit that could be gained by the society (social return). This implies that without some kind of policy intervention, the private optimum level of human capital formation would be lower than the socially optimum level of human capital formation even under the assumption of perfect information about the formal labor market and role of education in agriculture.

Translating this condition to a diagram as shown in Figure 3.1, $MB|_{\rho=0,\, p_m=p_m^0}$ represents the marginal benefit of the rural household who conceives that education has little or no role in increasing agricultural productivity at a given probability of migration p_m^0. Thus, *h** is the optimum level of human capital form the household point of view. However, the marginal benefit that a rural household would get is higher by the amount attributable to the benefit of education in increasing productivity in the agricultural sector. The new marginal benefit is represented by the curve $MB|_{\rho=1, p_m=p_m^0}$.

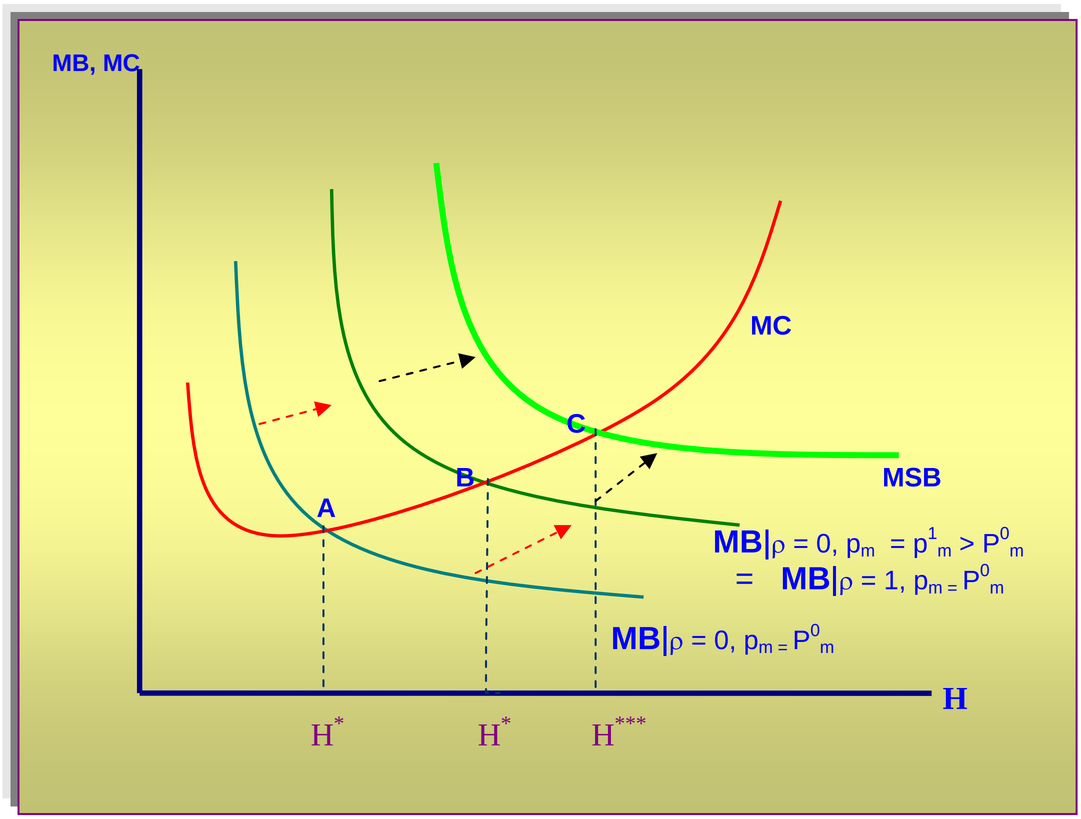

Figure 4-1*: Optimum levels of human capital from the private and social point of view*

The problem of the policy maker is to induce the household to invest in education at a level *h*** by increasing the prospect of migration from p_m^0 to p_m^1. For a given level of probability of migration, increasing awareness of the household about the role of education in agriculture would have the same result so long as the effort can ensure that ρ sufficiently approaches 1. However, while inducing the household through prospect of migration is incentive based, campaigning for increased awareness would be preaching and compulsory education might have even less impact. As Easterly (2002) argued, people respond to incentives. As he puts it, “If the incentive to invest in the future are not there, expanding education is worth little. Having the government force you to go to school does not change your incentive to invest in the future…”

By the same argument, rural household can be induced to invest in the socially optimum level of human capital h^{***} where the marginal social benefit (MSB) crosses the marginal cost curve by setting the appropriate level of probability of migration. Given the existing skill gap, low share of the industrial sector, and low rate of urbanization, the process continues where employment of the first generation of migrants in the process pushes the economy to higher level with even higher capacity of employment until net rural-urban migration rate tends to be zero.

Thus, using the probability of migration as a policy instrument would help to induce individuals to invest in optimum levels of human capital which they could achieve if they were to have full information about the labor market, full perception of the role of education in agriculture, and as though they were to account for positive externalities they can potentially generate.

4.3.5. A Closer Look at the Impact of Probability of Migration on Human Capital Formation

It is more appealing to look into the implications of low probability of rural-urban migration in particular under the assumption that the perception coefficient ρ is very low and households do not account for the positive externalities education can generate. To make the analysis tractable, let us consider the implications of the assumption about the perception of individuals about the role of education in agriculture. At this level, the various functions that are developed in the preceding optimization process need to be specialized. It is assumed for simplicity that household income y follows logarithmic specifications, and cost of human capital formation is a linear function of years of schooling. It is also assumed that alternative uses of labor time do not involve direct costs. Let us further assume that the household makes the production and utility maximization decisions recursively.

Income functions in period one and two, and the associated cost function are given by:

$$\begin{aligned} y_1 &= f(\ell) = \theta \ln \ell = \theta \ln (L-h) \\ y_2 &= f(h; p_m) = p_m \beta \ln h + (1-p_m)\rho\psi \ln h \\ C &= \phi h \end{aligned} \qquad (4.18)$$

where *h* is total time allotted for human capital formation, and θ, β, γ, κ are parameters.

The recursive optimization assumption allows maximizing the net earnings function which can be given by:

$$\pi = p_m \beta \ln h + (1-p_m)\rho\psi \ln h + \theta \ln (L-h) - \phi h \qquad (4\text{-}19)$$

Applying the first order condition on the net earnings functions represented by Equation (4-19), the expression for *h* becomes:

$$h^2 - \left\{ \frac{(\theta + \phi L)(1+r) + \left[p_m \beta + (1-p_m)\rho\psi \right]}{\phi(1+r)} \right\} h + \frac{L\left[p_m \beta + (1-p_m)\rho\psi \right]}{\phi(1+r)} = 0$$

(4.20)

The roots of Equation (4.20) are given by:

$$h^* = \frac{B}{2} \pm \frac{\sqrt{B^2 - 4\Omega}}{2}$$

where $B = \frac{(\theta + \phi L)(1+r) + \left[p_m \beta + (1-p_m)\rho\psi \right]}{\phi(1+r)}$ and $\Omega = \frac{L\left[p_m \beta + (1-p_m)\rho\psi \right]}{\phi(1+r)}$.

Basically, the quadratic expression in Equation (4.20) has two roots. It can be shown with the help of simulations that the optimum level of human capital formation *h**, say in years of schooling, given the constraints, is:

$$h^* = \frac{B}{2} - \frac{\sqrt{B^2 - 4\Omega}}{2} \qquad (4.21)$$

Given the optimum level of human capital formation as represented by Equation (4-21) with arguments of probability of migration p_m and the perception coefficient ρ, the implications of changes in these arguments can be demonstrated. To start with the analysis, suppose that the household has some awareness of the positive private return to education in the agricultural sector. In this case, even if the individual's expectation about the probability of migration is low, he would still consider investing some of his time net of leisure in education.

Proposition 4.1. *As long as the awareness coefficient is sufficiently large ($\rho > 0$), even if probability of migration is too small ($p_m \to 0$), rural households tend to invest in education.*

The proof can be shown by evaluating the limit of the privately optimum level of human capital formation as probability of migration approaches zero. That is:

$$\lim_{p_m \to 0} h^* = \lim_{p_m \to 0} \left\{ \left[\frac{(\theta + \phi L)(1+r) + \left[p_m \beta + (1-p_m)\rho\psi \right]}{\phi(1+r)} \right] \right.$$

$$\left. - \sqrt{\left[\frac{(\theta + \phi L)(1+r) + \left[p_m \beta + (1-p_m)\rho\psi \right]}{2\phi(1+r)} \right]^2 - L\left[p_m \beta + (1-p_m)\rho\psi \right]} \right\}$$

$$= \frac{(\theta + \iota L)(1+r) + \rho\psi}{2\phi(1+r)} - \sqrt{\left[\frac{(\theta + \phi L)(1+r) + \rho\psi}{2\phi(1+r)} \right]^2 - \frac{L\rho\psi}{\phi(1+r)}}$$

Let $A = \frac{(\theta + \phi L)(1+r) + \rho\psi}{2\phi(1+r)}$ and $G = \frac{L\rho\psi}{\phi(1+r)}$. Then the purpose is to show that:

$A - \sqrt{A^2 - G} > 0$.

Upon rearrangement, we have $A > \sqrt{A^2 - G}$. Squaring both sides gives:

$$A^2 > A^2 - G$$

Thus, $\frac{(\theta + \phi L)(1+r) + \rho\psi}{2\phi(1+r)} - \sqrt{\left[\frac{(\theta + \phi L)(1+r) + \rho\psi}{2\phi(1+r)} \right]^2 - \frac{L\rho\psi}{\phi(1+r)}} > 0$.

A corollary to proposition 4.1 is that when a rural household does not believe that education would help him to increase productivity in his agricultural activity, then, pessimism in the prospect of migration would entail under-investment in human capital formation.

Proposition 4.2*: If $\rho \to 0$, then, pessimism on the prospect of migration by rural households eventually leads to a cease of purposeful human capital formation in rural areas.*

This can easily be shown by taking the double limits of the expression for the optimum level of human capital formation. That is:

$$\lim_{p_m \to 0}\left[\lim_{\rho \to 0} h^*\right] = \lim_{p_m \to 0}\left\{\lim_{\rho \to 0}\left[\left(\frac{(\theta+\phi L)(1+r)+p_m\beta+(1-p_m)\rho\psi}{2\phi(1+r)}\right)\right.\right.$$

$$\left.\left. - \sqrt{\left(\frac{(\theta+\phi L)(1+r)+p_m\beta+(1-p_m)\rho\psi}{2\phi(1+r)}\right)^2 - L\left(p_m\beta+(1-p_m)\rho\psi\right)}\right]\right\}$$

$$= \frac{(\theta+\phi L)(1+r)}{2\phi(1+r)} - \sqrt{\left[\frac{(\theta+\phi L)(1+r)}{2\phi(1+r)}\right]^2} = 0$$

As it has been argued above, one possible policy intervention in terms of ensuring rural education in an effort to increase rural agricultural productivity is creating awareness of rural households that education would help them improve their welfare even while they are operating in the agricultural sector. The problem with this approach is that firstly, it might be difficult to demonstrate for them about the benefit of education in their agricultural activities because they inherently believe that education is irrelevant for agriculture for reasons discussed in the previous section. A more serous obstacle is that without a significant out-migration, education might have little impact on rural income in the face of declining per capita land size. Thus, a policy might be geared in such a way that it ensures some competent individuals would successfully migrate, and relatively educated non-migrants would benefit form productivity gains through both education and increased per capita land size. Thus, even in the extreme case where rural households do not believe that education is critically important for agriculture, that is $\rho \approx 0$, prospect of migration eventually ensures human capital formation in rural areas.

Proposition 4.3: *Leaving aside the positive externalities that would be generated by increased levels of education, assuming that the 'local' socially optimum level of human capital formation is the one that an economy would have if it were that* $\rho \to 1$*, then even in the extreme case where* $\rho \to 0$*, not only private (and thus social) returns to education increases with probability of migration but also the difference between the individually and socially optimum levels of human capital formation tends to decline. In the limiting case when* $p_m = 1$*, the privately optimum level of human capital equals the socially optimum level of human capital.*

The proof makes use of the fact that i) the derivative of the optimum level of human capital with respect to probability of migration is positive, and ii) the derivative of the difference between the privately and socially optimum levels of human capital formation with respect to probability of migration p_m is negative.

Evaluation of the derivatives is complicated by the presence of square roots. To simplify matter, let us assume that direct marginal cost is zero.[22] Under this assumption, the solution for the proportion of time allotted for human capital would be:

$$\left(\frac{h^*}{L}\right) = \tilde{h}^* = \frac{p_m\beta + (1-p_m)\rho\psi}{\theta(1+r) + \left[p_m\beta + (1-p_m)\rho\psi\right]}$$

First, as long as $\beta > \gamma$, and $0 \le \rho \le 1$, the derivative of $\tilde{h}^*$ with respect to p_m is positive. That is:

$$\frac{d\tilde{h}^*}{dp_m} = \frac{(\beta - \rho\psi)\theta(1+r)}{\left[\theta(1+r) + p_m\beta + (1-p_m)\rho\psi\right]^2} > 0$$

[22] We used simulation to show that the proposition holds in the presence of positive marginal cost and the result is shown in Figure 4.2.

Second, the derivative of the difference between the socially and private optimum levels of human capital formation with respect to p_m is negative. We note that:

$$\tilde{h}^* |_{\rho=1} = \frac{p_m\beta + (1-p_m)\psi}{\theta(1+r) + \left[p_m\beta + (1-p_m)\psi \right]} \text{ and } \tilde{h}^* |_{\rho=0} = \frac{p_m\beta}{\theta(1+r) + p_m\beta}.$$

Define: $J = \tilde{h}^* |_{\rho=1} - \tilde{h}^* |_{\rho=0}$. Then, it can be shown that:

$$\frac{dJ}{dp_m} = \frac{(\beta-\psi)\theta(1+r)}{(V+X)^2} - \frac{\beta\theta(1+r)}{V^2} = \frac{\beta\theta(1+r)\left[V^2 - (V+X)^2\right] - \left[\rho\psi\theta(1+r)V^2\right]}{(V+X)^2 V^2}$$

where $V = \theta(1+r) + p_m\beta$ and $X = (1-p_m)\psi$. Obviously, $(V+X)^2 V^2 > 0$ and $V^2 - (V+X)^2 < 0$. $\Rightarrow \beta\theta(1+r)\left[V^2 - (V+X)^2\right] < 0$.

Since $\rho\psi\theta(1+r)V^2 > 0$, the nominator is negative. Thus, $\frac{dJ}{dp_m} < 0$.

A simulation has been conducted using some arbitrary numbers for the coefficients underlying the optimum level of human capital in Equation (4.18). The values for the parameters are set so that they are consistent with the assumptions that are made about the parameters. For example, the assumptions that $\beta > \theta$ and $\beta > \psi$ are maintained. The maximum years of schooling was assumed to be 20 years. Values of 0.5, 7, 4, and 0.12 were given to θ, β, ψ and r, respectively.

The result is shown in Figure 4.2. The broken line is simulated assuming that ρ negligibly low ($\rho = 0$) while the upper solid line is simulated assuming ρ is high ($\rho = 1$). If the parameters were empirically estimated, then, the graph would be interpreted as an individual with a perfect knowledge of the role of education in agriculture would invest in at least up to 8 years of education even if probability of migration was too low to induce him to invest in education. On the other hand, a perfect expectation of migration would ensure a higher level of education (some 16 years of education on average) even if ρ tends to 0. Since it is highly unlikely that p_m assumes a value of 1, the interesting implication of the simulation result is that as p_m tends to increase, human capital formation tends to increase as well.

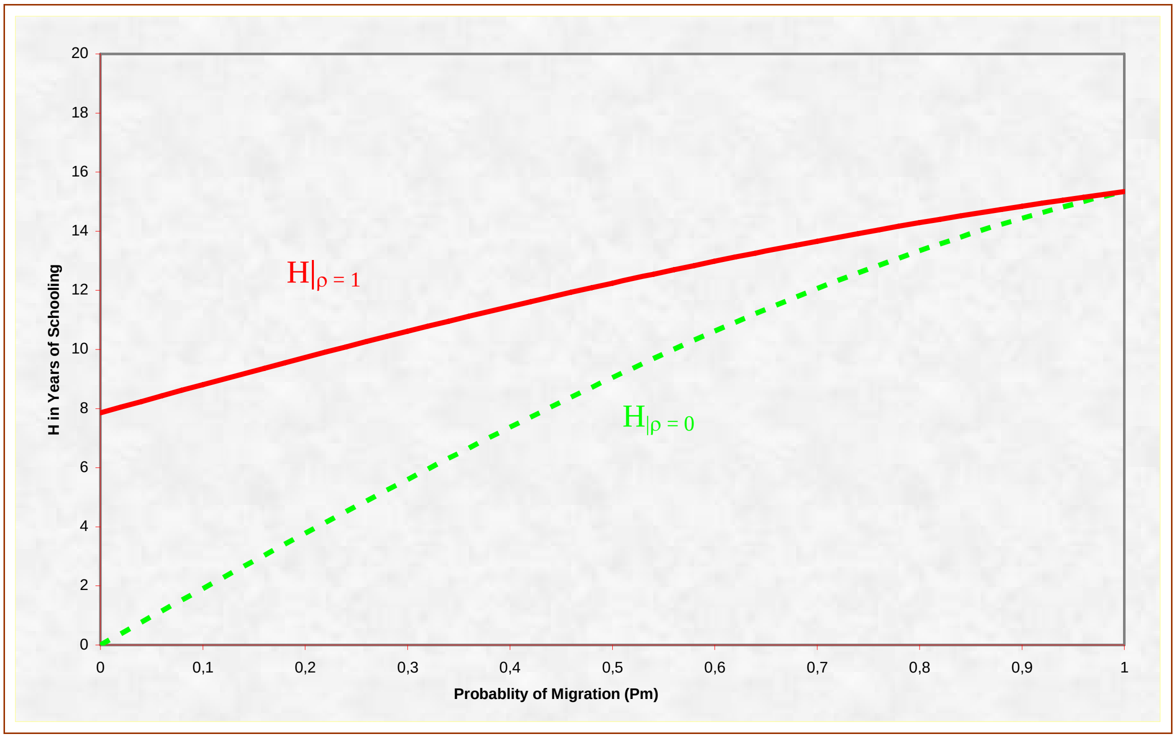

Figure 4-2: Human Capital as a Function of Probability of Migration: Simulation Result

In this analysis, it can be noticed that p_m is exogenously determined. To achieve a certain targeted level of human capital formation, one can read the level of probability of migration which corresponds to the targeted level of education. But achieving the particular level of probability of migration requires other instruments such as probability of finding job in urban areas, cost of migration, income differential, and education. It is possible to observe that there is a feedback effect of migration on education in that the fate of the first cohort of students graduating from a certain level of education determines the subsequent demands for education by the next generation of school age children.

In conclusion, the policy prescription of the standard Harris-Todaro model that targets on reducing the rural-urban migration by increasing the opportunity costs of migration could discourage human capital formation in the rural majority which is potentially vast source of talented individuals, and delay rural transformation.

4.4. TESTING THE THEORY

4.4.1. Introduction

In the preceding section, an attempt has been made to show theoretically that while rural households may send their children to school to fulfill the general obligation of universal education, the real trust of these households in education as a means to diversify sources of future income depends on the prospects of migration. Whether a household sends school age children for purposeful investment in education in anticipation for long term returns can be captured by the degree of sustainability of rural education to higher levels.

The few research works on the determinants of demand for schooling in Ethiopia (Mulat, 1997; Tassew, 2005, Befekadu et al, 2001) did not consider the dynamic aspect of education choice. In particular, no attempt had been made so far to account for the prospect of migration as a determinant of purposeful investment in education in the rural Ethiopia.

In this regard, analyzing factors that determine the probability of a child to have some level of education beyond village level classes is more relevant. Primarily, this section empirically tests the assertion that the prospect of migration lies at the heart of purposeful educational investments in rural areas. Other factors which determine the sustainability of rural education include the availability of school, household income, and some household specific demographic factors.

The dependent variable is a multinomial discrete choice variable where respondents are categorized as those with no formal education, with some primary level of education, secondary level of education, and tertiary level of education. Ordered logit model and its extensions are used depending on their appropriateness to estimate the education choice model.

In what follows, an attempt is made to motivate the ordered logit and probit models in the spirit of this analysis, explain the nature of the various explanatory variables, and discuss estimation results.

4.4.2. Motivating the Model

As it has been argued in the theoretical framework section, households maximize utility which they derive from consumptions of goods and services that are made available through the net earnings. The net earnings in turn accrue from investments in education.To motivate the model, let us assume that rural households optimally map their lifetime utility and the levels of education they choose to acquire. Hence, propensity of acquiring some level of education which in itself is not observed could reflect the underlying utility of the household that ultimately accrues to education. Suppose that E* represents the underlying propensity of acquiring some level of education by an individual.

While this latent variable is continuous, we only observe actual levels of education for those who decided to attend that particular level of education. Let us assume that individuals have threshold levels of propensity beyond which they tend to acquire a particular level of education. Let these levels which signal the unobserved propensity to acquire education be represented by E so that the probability of an individual to be in any of the *j* categories for a given exogenous factor **x** will be denoted by *Pr[E = j/x]*.

The structural model underlying the propensity of acquiring knowledge is given by:

$$E^{*} = x'\beta + \varepsilon \qquad (4.22)$$

where **x** is a vector representing probability of migration, distance from the next level of school, level of education of the head, level of education of the mother, distance to a road accessible by vehicle, family size, sex , and age; β = a vector of parameters to be estimated, and ε is error term where $\varepsilon/x \sim N(0,1)$.

In fact, E* need not be given a particular name. What is important in this case is that it is a continuous variable that characterizes the outcome of E. Its motivation from conceptual point of view is only relevant for the identification of the explanatory variables [Amemiya, 1981].

The outcomes that are categorized as "no formal education," "primary level of education," "some secondary level education," and "tertiary levels of education" are defined to take on values 0, 1, 2, and 3, respectively. The observed outcome E can be related to the latent variable E* according to:

$$E_i = j = \begin{cases} 0 & if \quad -\infty \le E_i^* < \mu_1 \\ 1 & if \quad \mu_1 \le E_i^* < \mu_2 \\ 2 & if \quad \mu_2 \le E_i^* < \mu_3 \\ 3 & if \quad \mu_3 \le E_i^* < \infty \end{cases} \tag{4.23}$$

where μ's are threshold parameters or cut points to be estimated along with the coefficients of the explanatory variables.

Thus, the probability of an individual to be in the category *j* is given by:

$$\begin{aligned} \Pr\left(E_i = j\right) &= \Pr\left(\mu_{j-1} < E^* \le \mu_j\right) \\ &= \Pr\left(\mu_{j-1} < x'\beta + \varepsilon \le \mu_j\right) \end{aligned} \tag{4.24}$$

The probability function can be expressed in terms of cumulative density function:

$$\Pr\left(E_i = j / x\right) = F\left(\mu_j - x\beta\right) - F\left(\mu_{j-1} - x\beta\right) \tag{4.25}$$

The particular distribution function depends on the assumption of the distribution of the error term ε. The ordered logit version of the probability of each observation is given, by[23]:

$$\Pr\left(E_i = j / x\right) = \frac{1}{1 + e^{\left(-\mu_j + x'\beta\right)}} - \frac{1}{1 + e^{\left(-\mu_{j-1} + x'\beta\right)}} \tag{4.26}$$

where $\operatorname{var}\left(\varepsilon\right) = \frac{\pi^2}{3}$.

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[23] An alternative to ordered logit model is ordered probit model which can be given by: $\Pr\left(E_i = j / x\right) = \Phi\left(\mu_j - x\beta\right) - \Phi\left(\mu_{j-1} - x\beta\right)$ where Φ(.) is the standard normal cumulative distribution function.

The ordered logit and ordered probit models are the standard estimation procedures used most frequently in ordered categorical choices. However, these models assume that coefficients of the explanatory variables are the same over the logs odds ratio of each category. For instance, the coefficient of the logs odds of observing an individual in the category of "no formal education" that is *Pr(E = 0/x)* and the categories greater than the category of no formal education *(Pr(E>0/x)* are the same as the coefficients in the odds ratio between observing an individual in category of primary level of education (*Pr(E=1/x*) and the categories greater than the category of primary level of education (*Pr(E>1/x*). This is referred to as the parallel regression assumption. In the case of ordered logit model, the parallel regression assumption is also called the assumption of proportional odds ratio [Long and Freese, 2001].

The parallel regression assumption is argued to be very restrictive and the major problem is that it is usually violated leading to a misleading result [Williams, 2006]. In such cases, it would be appropriate to test for the validity of parallel regression. One of the tests for the parallel regression assumption is the Wald test of Brant (1990). An important feature of this test is that it tests if individual coefficient for each odds ratio is not statistically different from the coefficients under the parallel regression assumption.

If the parallel regression assumption is violated, it is proposed that generalized ordered logit model would rather be used. The generalized ordered logit model extends the ordered logit model accounting for the j-1 multiple coefficients for j categories. It estimates a set of logit equations by taking the logs odd ratio of an individual being observed in higher categories to the immediate lowest category at a time [Long and Freese, 2001]. The general form could assume:

$$\Pr\left(E_i > j/x\right) = G\left(x\beta\right) = \frac{e^{\left(\alpha_j + x_i\beta_j\right)}}{1 + e^{\left(\alpha_j + x_i\beta_j\right)}}, \quad j = 1,2,3,\ldots,M\text{-}1. \qquad (4.27)$$

4.4.3. The Data and Estimation Results

As it has been indicated in section 4.1 the dependent variable E is a categorical (discrete) choice for which values 0, 1, 2, and 3 are assigned. In Each category are, in that order, individuals who have never attended any class so far, those who have attended some primary, secondary, and tertiary levels of education.

On the side of the covariates, probability of migration (p_m) which is the core variable is the predicted value of the migration decision model estimated by excluding education. The dependent variable in the migration decision model assumes a value of 1 if the respondent migrated and 0 otherwise. It has been regressed on income differential, distance from major urban centers, age, square of age, sex, and per capita land size. The income differential in turn is calculated using the predicted income of both migrants and non-migrants which they earn at their respective locations and which they would have earned in the alternative locations. Earnings functions of the migrants and incomes functions of the non-migrants have been estimated using the Full Maximum Likelihood Estimation (FMLE) and the Heckman two step estimation procedures. [Refer to chapter three for the details].

In the migration decision model that is used to predict the probability of migration p_m, level of education is excluded on the ground that it is highly correlated with education choice which in this case is endogenous. After all, the categories in the education choice variable are grouped according to the level of education of respondents.

The variable *DNS* is the distance in kilometer between the village and the nearest village or town where the next school level is located. 'Roof Type' is a dummy for which a value of 1 is assigned if the household owns a house with a roof of corrugated iron, and 0 otherwise. In the sample, only corrugated iron and grass roofs are found. This is used as a proxy for a household wealth. Assefa and Bedi (2004) used roof type as a proxy for wealth in their model of school attendance. For the variable 'SEX', a value of 1 is given if the respondent is female and 0 otherwise. The variable SAFSR is school age children to family size ratio. Education and age variables are measured in years.

It is believed that the impacts of the variables SEX and SAFSR on choice of education levels by the households depend on the distance from urban center. To account for this, interaction variables (r×SEX and r×SAFSR), where r is distance from towns, are introduced as well.

The model is estimated under two scenarios. In the first scenario, probability of migration was instrumented by income differential adjusted by probability of finding job in urban centers, distance from major urban centers, age, square of age, sex, the household's relative asset within the community, the square of relative asset possession and per capita land holding.

It might be logical to suspect that incomes differential could not be a good instrument because years of schooling was used to estimate the incomes of migrants in urban centers and to predict the level of income which the non-migrants would earn at destinations if they were to migrate. To account for the possible bias, the incomes differential in the second scenario was dropped and the probability of migration was predicted by the remaining variables. [See Appendix C, Table 4-3].

The other difficulty which might arise in predicting the probability of migration is that distance from urban centers which predicts the probability of migration may be correlated with distance to next schools in the sense that most secondary schools are found in urban areas. In a situation where instruments other than distance from urban centers are weak, the option is to make sure that the impact of distance to urban centers on education choice is through its impact on prospects of migration rather than through school availability in urban centers. Luckily, the next school levels including senior secondary schools are found in district towns which have less importance in terms of attracting migrants. In fact, distance from small towns, and distance from next schools (which are highly correlated) were insignificant in the migration decision equation when it is estimated by introducing one of them at a time. On the other hand, distance from major towns is found to be significant in the migration equation. This may suggest that the impact of distance from major urban centers on education choice is indirect and exclusively through its impact on migration decisions. [See Table 4-2 in Appendix C].

One last challenge in modeling the education choice is the possibility of the existence of unobservable attributes such as personal ability, and networking. Unfortunately data was not available to account for such attributes. The best we could do was to use level of education of the head of the household and the mother. It might be also logical to assume that personal abilities are normally distributed across villages if not across individuals. The major point is that individuals nearer to urban centers do have the opportunity to reveal their talents in the light of prospect of migration while individuals far from urban centers can hardly mange to reveal their abilities. Moreover, in this regard, personal abilities usually matter in joining tertiary level of education since the basic criterion to be enrolled in tertiary level education is the grade point average of a national school leaving certificate and entrance examinations. To exploit this fact, we employed a binary logit model to estimate the log-odds ratio of consecutive categories for a given age interval.

In terms of networking to urban centers, those who are relatively nearer to urban centers might have relatives who can be a good source of information upon migration. This is, however, made possible by proximity of their village to urban centers even some time in the past.

In both scenarios, probability of migration was consistently significant and positive. [See Tables 4-4 and 4-5]. In general, probability of migration is found to affect the probability of an individual to have a relatively higher level of education. The slopes show that a marginal increase in the probability of migration reduces the probability of an individual not having any formal education. In other words, it is highly unlikely to find someone with a relatively higher prospect of migration to be uneducated at all. On the other hand, probability of migration tends to increase the chance of an individual to have a secondary level of education and beyond.

The slope of the probability of migration in the primary school category was not statistically significant. A marginal change in prospect of migration may not necessarily affect the probability of an individual to acquire a primary level of education significantly. This might be due to the fact that primary education is becoming almost mandatory that households are obliged by the government to send one or more of their children to the nearby school.

Distance from the next school has been found to be significant with expected signs in both scenarios. This partly measures the impact of the increased cost of education. Unless education is seriously considered by households as an indispensable investment venture, students in villages far from the next school may drop out from school since their labor which was used to contribute to farm activities would no more be available increasing the opportunity cost of education. Moreover households incur transport costs and other additional leaving expenses equivalent to the gains in economies of scale is the children were to live with their parents.

In most cases, only primary level of education (grades 1 to 6) is provided in rural areas. School levels beyond village levels are found at a varying distance from villages. The result shows that in villages far from the next level of school, students tend to dropout before or after they completed the village level grades.

Roof type (a proxy for household wealth) was significant and positive in both scenarios. The fact that schools beyond village levels are far from villages increases cost of education. If schools are found at a walking distance from the villages, students do not incur transpiration costs. Moreover, since children attending schools share meal and other accommodations with the parent household, there is a sort of scale of economies and thus cost of living is minimized. More importantly, the opportunity cost of time is significantly reduced because each child can contribute to farm and home activities after school. In some village of Ethiopia, children who attend school constitute five hours of work per day in assisting their parents [Assefa and Bedi, 2004). When students promote to the next level, households incur these costs unless the schools are found at a walking distance. In such cases, wealthier households can afford to cover the direct and indirect costs and thus can send their children to the next levels while poorer households may find it difficult to send their children to schools beyond village levels.

Levels of education of the head and the mother were also introduced in the estimation. It was found that those households whose head has some primary level of education tend to send children to higher levels of school than those households whose head has no any formal education. Additional junior and senior secondary school levels of education by the head were not statistically significant in affecting the probability of a child to attend higher levels of education.

Unfortunately for this study, mother's education was not significant in affecting a child's probability of being in higher levels of education. This may explain the fact that in rural areas, major household decisions are made by the head of the household rather than the mother.

The impact of gender on the probability of promoting to the next levels of school might depend on distance of the villages from urban centers. The presumption is that households who are nearer to urban centers have information on the labor market in urban centers and hence invest in purposeful education. Since they believe they boys rather than girls can be successful both in achieving good grades in their study and finding jobs in urban centers, withstanding all the odds, they tend to prefer to send boys than girls whenever they have to choose. Parents usually avoid kinship of their daughters with boys and unwanted pregnancy by forcing them to engage in a pre-arranged marriage before completing their education.

This has partly economic motives in that female children can fetch income in the short run. The husband has to pay a significant amount of money to the family of the bride. An important phenomenon in the villages under study in this regard is that girls have to drop out their education even from village level schools to migrate to the Gulf countries. As it has been indicated in the preceding chapters, about 77% of the total migrants to the Gulf countries are girls most of them (89%) with no or only primary level of education. The annual remittance from these migrants in some villages accounts for 38% of the income of the sending households and 15% of the village level average income of households.

This has also support from other studies. Aguayo et al (2007) argued that in rural Mexico, some 15 out of 100 parents do not invest in their daughters' education because they believe that girls usually get married before parents reap the return.

Poor long term job prospects due to high fertility of women is also considered to be one of the reasons that discourage parents to send their daughters to school. In the *quid pro quo* sense, parents make sure that their daughter must more than repaid what they have invested on them before they get married compromising their prospect of long term high paying careers [Parish and Willis, 1993].

In another study, Bommier and Lambert (2000) have found that girls in Tanzania in general have lower education than boys. What is interesting in their result however is the fact that girls are enrolled earlier than boys where normally children in Tanzania are enrolled 2 to 3 years later than the norm. They conjectured low pre-school returns for girls and marriage decisions are reasons for early enrolment of girls than boys.

On the other hand, households in remote areas do not invest in purposeful education since they have no much information about the labor market in the urban areas. In such areas, boys are much needed on the farm while girls are ultimately destined for marriage (including early marriage) and their labor is not needed on the farm. Normally, girls are supposed to assist their mother at home and they can still contribute to the house work after school. Hence, at least for primary school level, girls have a higher probability of being enrolled than boys.

To account for the distance specific impact of gender on the probability of being enrolled, both sex and an interaction variable of sex and distance from urban centers were used. Interestingly, the result seems to support our presumption in that the interaction term was positive and significant probably witnessing the fact that households far from urban centers tend to send more girls than boys to school. The insignificance of the coefficient of sex could suggest that in the limiting case where households dwell almost in urban centers, the discrimination between boys and girls tends to diminish. The result is consistent with data which is obtained from the villages. The share of girls in total enrollment increases with distance from 42% in Mersa Zuria, which is the nearest to urban centers, to 63% in Habru Ligo, which is the farthest.

The coefficients for both the school age to family size ratio and the interaction term of the variable with distance from urban centers are statistically significant. The negative sign of the coefficient for school age to family size ratio and the positive sign of the coefficient for the interaction variable may indicate that for households nearer to urban centers, having more school age children discourages the probability of being enrolled in school in a sustainable manner while for households which are far from urban centers, having more school children tend to favor children's probability of being enrolled in the village level schools and beyond. It might be possible to argue that households nearer to urban centers have already sent many of their school age children and hence sending an additional child could be costly. On the other hand, households in villages far from urban centers do have many school age children who support the extended family through their labor and sending one child to school might have a lower opportunity cost compared to those households who do not have enough children that can operate on the farm.

The age variables are introduced to control for the age effect of one's being enrolled in primary instead of secondary school level. The result simply shows that other things being equal, age naturally determines an individual's probability of being in a particular level of education, and it is highly unlikely for old men to be enrolled in any of these formal levels of education.

Alternatively, individuals were categorized by age and level and binary logit was applied. The first category contains individuals with the age of 6 and above and who have never been enrolled and those who are enrolled in primary school level. The second category includes individuals with the age of 12 and above and who have primary and secondary level. The third category includes respondents who are 16 and above, and have preparatory and tertiary levels.

In the first category, a value of 1 was assigned for those who have some primary level of education and a value of 0 was given for those who are above 6 and have never been enrolled. In the second category, a value of 1 was given for those who are above 12 and have some secondary level of education and a value of 0 for those with primary education. In the third category, a value of 1 was assigned for those individuals who have attended preparatory and tertiary levels of education that is beyond the general education which ends at grade 10.

The result (see Tables 4-6 and 4-7 of Appendix C) support the argument that prospect of migration tends to encourage investment in human capital formation. Except for the level of education of the head of the household, the result is more or less consistent with the ordered logit estimates. In the case of the last group where respondents with general education and above preparatory level of education are compared, no variable has been found to be statistically significant. The pseudo R^2 was as low as 0.09. One possible explanation could be that once children reach a secondary level of education, the probablity of joining preparatory and tertiary levels of education depends on their personal abilities. In particular, the supply side of education dominates at these stages due to limited number of universities and colleges. Until recently, the country had no more than two universities and a candidate had to score 3 points and above to join a two years diploma program and 3.4 and above to be admitted in degree programs which normally take four or more years.

Lastly, the parallel regression assumption of the ordered logit model was tested using both an approximate LR test, and a wald test of Brant (1990). For the overall model, the null for proportional odds was rejected and thus there was no statistical support for the validity of the assumption. In particular, for the coefficients of the variables Pm, DNS, SEX×r, and age, the individual test statistics were significant. However, in the case of variables of education of the head, education of the mother, wealth, and the school age family size ratio, the null for proportional odds was not rejected.

In most cases, the results are not unintuitive in that the impact of variables such as probability of migration on different levels of categories may not be the same. For unit change in probability of migration, the response of a household who contemplates between sending one or more of the household members to primary school and work on the farm cannot be the same as the response of a household who contemplates between sending his children to secondary school level and withdrawing from primary level of education.

In general, however, since the overall ordered logit model failed to pass the assumption of proportional odds, the estimates have to be supported by other alternative estimation procedures. One option could be multinomial logit or probit model [William, 2006]. The problem with this procedure, however, is that it is based on the assumption of independent of irrelevant alternatives (IIA). This amounts to shift to another complication and it is usually difficult to interpret results. Hence, switching to the multinomial logit procedure could even add more complications.

The other option which would keep the ordered nature of the responses is the general ordered logit model. This model was applied and results are shown on Tables 4-8 and 4-9 of Appendix C. Overall, in the results of the generalized ordered logit model, there is no major change in terms of significance of coefficients compared to the results of the standard ordered logit model. The major value-added in extending the estimation procedure to generalized ordered logit is that coefficients that seemed to be significant for the overall model are disaggregated in which case some variables turn out to be insignificant for some comparisons.

4.5. CONCLUSIONS

In this chapter, it has been demonstrated that prospect of rural-urban migration induces human capital formation in rural areas. With a widely held rural perception that education does not contribute to the productivity of agricultural activities, pessimism in prospect of migration would lead to inadequate human capital formation.

Econometric analysis has been conducted using data from six rural villages in Northern Ethiopia. Predicted value of the probability of migration was used as a determinant of the probability of a school age children to have some education of a particular level. Other exogenous factors include distance to the next school level, wealth (proxied by type of roof the house of the household), number of school age children to family size ratio, age, and sex. The probability that a school age child either be illiterate or have some primary, secondary, or tertiary school levels is estimated using ordered logit procedures. This result has been supplemented by generalized ordered logit models, and binary logit models for different age groups. It has been found that the probability of an individual to be in higher levels compared to primary level is positively and significantly determined by probability of migration. Distance from the next school level, wealth, education level of the head of the household, are also significant with expected signs. It has been found that the impact of number of children in comparison to the overall household size and sex depend on the location of villages from urban centers.

In general, the study reveals that rural households tend to respond to incentive-based schemes such as prospect to migration while other persuasive or forced education schemes may have unsustainable and unintentional enrollments. While education fosters smooth rural-urban migration, making education a rural phenomenon with desired quality requires provision of incentives that maximize prospects of migration. This calls for considerations of urban development to foster rural development.

Appendices C

Table 4-2: Logit Estimates of Migration Decision –Different Distance Measures

Dependent Variable: Decision to Migrate (M = 1 if migrated and 0 if not)			
	(1)	(2)	(3)
Distance -Major Towns	-0.008		
	(2.03)*		
Distance-District Towns		-0.031	
		(0.92)	
Distance – Next School			-0.051
			(1.31)
Income Differential	0.974	1.192	1.076
	(2.72)**	(3.13)**	(3.18)**
Asst Rank	0.000	-0.000	-0.000
	(0.12)	(0.53)	(0.58)
Rank Square	0.000	0.000	0.000
	(1.63)	(0.88)	(0.83)
Age	0.364	0.360	0.362
	(4.31)**	(4.29)**	(4.30)**
Age Square	-0.006	-0.006	-0.006
	(4.04)**	(4.02)**	(4.03)**
Sex (female =1)	-0.289	-0.238	-0.232
	(-1.04)	(-0.86)	(-0.83)
Per capita land size	2.625	2.150	1.676
	(1.32)	(1.06)	(0.83)
Level of Education	0.231	0.229	0.242
	(5.23)**	(4.78)**	(5.68)**
Constant	-10.091	-10.190	-9.982
	(8.18)**	(8.20)**	(7.94)**
Observations	1590	1590	
Wald $\chi 2$ (.)	132.73	127.26	126.19
Pseudo R^2	0.36	0.35	0.35

Robust z statistics in parentheses
* significant at 5%; ** significant at 1%

Table 4-3: Logit Estimates of Migration Decision with and without Income Differential

Dependent Variable: Decision to Migrate (M = 1 if migrated and 0 if not)		
	(1)	(2)
Distance-major town	-0.015	-0.018
	(4.30)**	(5.25)**
Income Differential	1.887	
	(6.40)**	
Age	0.421	0.528
	(5.50)**	(7.08)**
Age Square	-0.008	-0.009
	(5.47)**	(6.41)**
Sex (female =1)	-0.595	-0.801
	(-2.32)*	(-3.23)**
Per capita land size	7.183	1.142
	(3.80)**	(0.75)
Constant	-10.225	-8.937
	(8.99)**	(8.59)**
N	1590	1590
Wald $\chi 2$ (.)	97.69	79.21
Pseudo R^2	0.29	0.22

Robust z statistics in parentheses
* significant at 5%; ** significant at 1%

Table 4-4: Ordered Logit Estimates of Sustainable School Attendance

Dependent Variable: Level of Education by Category (E =0, 1, 2, 3)					
		Marginal Effects			
	Coeffieint	Pr(E=0)	Pr(E=1)	Pr(E=2)	Pr(E=3)
P_m	11.676	-1.926	0.748	1.070	0.108
	(6.88)**	(-4.39)**	(1.53)	(6.02)**	(3.47)**
DNS	-0.489	0.081	-0.031	-0.0445	-0.005
	(7.73)**	(6.32)**	(-1.75)+	(-4.74)**	(-2.91)*
Education-Head					
Primary	0.330	-0.054	0.020	0.031	0.003
	(2.24)*	(-2.13)*	(1.31)	(2.15)*	(1.86)+
Secondary	0.527	-0.075	0 .011	0.058	0.006
	(1.56)	(-1.77)+	(0.55)	(1.32)	(1.15)
Education-Mother	-0.005	0.0008	-0.0003	-0.0005	-4.6×10^{-5}
	(0.16)	(0.16)	(-0.16)	(-0.16)	(-0.15)
Roof Type	0.518	-0.086	0.034	0.047	0.005
	(3.46)**	(-2.98)*	(1.49)	(3.33)**	(2.39)*
Sex (female = 1)	-0.177	0.029	-0.012	-0.016	-0.002
	(0.47)	(-0.47)	(0.49)	(0.45)	(0.44)
Distance × sex	0.057	-0.009	0.004	0.005	0.0005
	(2.05)*	(2.13)*	(-1.53)+	(-1.83)+	(-1.57)
SAFSR	-4.706	0.776	-0.301	-0.431	-0.043
	(5.34)**	(4.67)**	(-1.67)+	(-4.15)**	(-2.82)**
SAFSR×Distance	0.415	-0.068	0.027	0038	0.004
	(6.07)**	(-5.38)**	(1.73)+	(4.26)**	(2.77)**
Age	0.186	-0.031	0.012	0.017	0.002
	(2.40)*	(-1.94)*	(1.06)	(3.36)**	(2.99)**
Age Square	-0.006	0.001	-0.0004	-0.0005	-5.4×10^{-5}
	(2.54)*	(2.00)*	(-1.06)	(-3.91)**	(-3.54)**
μ_1	-5.534				
μ_2	-2.147				
μ_3	0.468				
N	871				
Wald $\chi2$ (12)	264.62				
Pseudo R^2	0.24				
Link test+	1.95				
Brant test: $\chi2$	174.31				

Robust z statistics in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

Table 4-5: Ordered Logit Estimates of Sustainable School Attendance (Instruments of Probability of migration excludes income differential)

Dependent Variable: Level of Education by Category (E =0, 1, 2, 3)					
		Marginal Effects			
	Coeffieint	Pr(E=0)	Pr(E=1)	Pr(E=2)	Pr(E=3)
P_{m2}	4.629	-0.765	0.243	0.456	0.066
	(3.07)**	(-2.87)**	(1.58)	(3.22)**	(3.04)**
DNS	-0.469	0.078	-0.025	-0.046	-0.007
	(7.43)**	(7.02)**	(-2.12)*	(-6.03)**	(-4.05)**
Education-Head					
Primary	0.313	-0.051	0.016	0.031	0.0045
	(2.16)*	(-2.13)*	(1.48)	(2.13)*	(1.96)*
Secondary	0.497	-0.072	0.006	0.057	0.009
	(1.55)	(-1.79)+	(0.36)	(1.34)	(1.19)
Education-Mother	-0.023	0.004	-0.001	-0.002	-0.0003
	(0.75)	(0.76)	(-0.73)	(-0.75)	(-0.74)
Roof Type	0.290	-0.048	0.016	0.028	0.004
	(2.03)*	(-1.97)*	(1.42)	(2.04)*	(1.85)+
Sex (female =1)	-0.469	0.078	-0.026	-0.0459	-0.007
	(1.34)	(-1.36)	(1.25)	(1.31)	(1.22)
Distance × sex	0.067	-0.011	0.004	0.0066	0.001
	(2.49)*	(2.52)*	(-1.72)+	(-2.40)*	(-2.13)*
SAFSR	-4.531	0.749	-0.238	-0.446	-0.064
	(5.44)**	(5.24)**	(-2.03)*	(-4.89)**	(-3.69)**
SAFSR×Distance	0.392	-0.065	0.021	0.037	0.006
	(5.71)**	(-5.56)**	(2.06)*	(5.05)**	(3.70)**
Age	0.240	-0.040	0 .013	0.024	0.003
	(4.53)**	(-3.67)**	(1.61)	(5.52)**	(4.09)**
Age Square	-0.006	0.001	-0.0003	-0.001	-8.5×10^{-5}
	(4.23)**	(3.36)**	(-1.52)	(-5.75)**	(-4.48)**
μ_1	-4.924				
μ_2	-1.686				
μ_3	0.634				
N	871				
Wald $\chi2$ (12)	209.39				
Pseudo R^2	0.20				
Link test+	7.23				
Brant test: $\chi2$	207.63				

Robust z statistics in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

Table 4-6: Logit Estimates of School Attendance by Age Group

	"No formal Education" versus "Primary Education"	"Primary Education" versus "Secondary Education"	"Secondary Education" versus "Tertiary Education"
P_m	8.647	11.605	0.479
	(2.58)**	(4.18)**	(0.27)
DNS	-0.133	-0.367	-0.154
	(1.38)	(3.68)**	(1.02)
Education-Head			
Primary	0.176	0.071	0.403
	(0.84)	(0.26)	(0.95)
Secondary	0.315	0.899	-0.606
	(0.37)	(1.40)	(0.84)
Education-Mother	0.022	0.064	0.036
	(0.34)	(0.98)	(0.39)
Roof Type	0.444	0.917	0.923
	(1.76)	(3.23)**	(2.35)*
Sex (female =1)	-0.327	1.829	-1.549
	(0.50)	(2.78)**	(1.52)
Distance × sex	0.088	-0.132	0.098
	(2.16)*	(2.49)*	(0.89)
SAFSR	-0.430	-3.400	-1.984
	(0.26)	(2.29)*	(1.08)
SAFSR×Distance	0.124	0.265	0.140
	(1.22)	(2.27)*	(0.78)
Age	-0.130	-0.045	0.030
	(5.27)**	(1.51)	(0.81)
Constant	3.451	3.619	0.747
	(2.07)*	(2.63)**	(0.42)
N	620	316	152
Wald $\chi 2$	111.06	219.48	17.39
Pseudo R^2	0.26	0.28	0.09

Robust z statistics in parentheses
* significant at 5%; ** significant at 1%

Table 4-7: Logit Estimates of School Attendance by Age Group (Instrument for Probability of migration excludes income differential)

	"No formal Education" versus "Primary Education"	"Primary Education" versus "Secondary Education"	"Secondary Education" versus "Tertiary Education"
P_{m2}	-0.705	5.460	-0.721
	(0.32)	(2.07)*	(0.29)
DNS	-0.102	-0.338	-0.160
	(1.01)	(2.59)**	(1.01)
Education-Head			
Primary	0.122	0.064	0.411
	(0.58)	(0.24)	(0.97)
Secondary	0.221	0.952	-0.592
	(0.29)	(1.55)	(0.82)
Education-Mother	0.010	0.034	0.028
	(0.16)	(0.55)	(0.30)
Roof Type	0.234	0.609	0.869
	(1.05)	(2.27)*	(2.11)*
Sex (female = 1)	-0.694	1.658	-1.691
	(1.08)	(2.56)*	(1.62)
Distance × sex	0.101	-0.130	0.103
	(2.50)*	(2.50)*	(0.94)
SAFSR	-0.139	-3.147	-2.050
	(0.08)	(1.85)	(1.08)
SAFSR×Distance	0.084	0.237	0.142
	(0.79)	(1.56)	(0.77)
Age	-0.094	0.001	0.039
	(7.40)**	(0.03)	(0.96)
Constant	3.038	3.076	0.813
	(1.77)	(2.02)*	(0.43)
N	620	316	152
Wald $\chi 2$	129.49	43.96	16.47
Pseudo R^2	0.25	0.10	0.09

Robust z statistics in parentheses
* significant at 5%; ** significant at 1%

Table 4-8: Generalized Ordered Logit Estimates-Unrestricted

	0 vs 1-3	1 vs 2-3	2 vs 3
P_m	14.320	11.207	2.258
	(3.89)**	(4.13)**	(1.09)
DNS	-0.290	-0.564	-0.353
	(3.03)**	(4.74)**	(2.44)*
Education-Head			
Primary	0.313	0.403	0.622
	(1.58)	(1.74)	(1.54)
Secondary	0.777	0.422	1.348
	(0.95)	(0.98)	(1.85)
Education-Mother	0.040	-0.010	0.006
	(0.68)	(0.20)	(0.05)
Roof Type	0.741	0.778	0.788
	(3.03)**	(2.82)**	(1.69)
Sex (female = 1)	-0.091	0.887	-0.635
	(0.13)	(1.47)	(0.56)
Distance × sex	0.074	-0.088	-0.031
	(1.76)	(1.43)	(0.28)
SAFSR	-2.317	-3.765	-4.280
	(1.36)	(2.76)**	(2.74)**
SAFSR×Distance	0.253	0.305	0.297
	(2.46)*	(2.36)*	(2.23)*
Age	0.021	0.725	1.335
	(0.19)	(4.74)**	(4.96)**
Age Square	-0.004	-0.016	-0.025
	(1.12)	(4.00)**	(4.48)**
Constant	4.458	-3.168	-16.249
	(2.65)**	(2.32)*	(4.72)**
Observations	871		
Wald $\chi^2(36)$	305.26		
Pseudo R^2	0.35		

Robust z statistics in parentheses
* significant at 5%; ** significant at 1%

Table 4-9*: Generalized Ordered Logit Estimates with LR Restriction on Coefficients*

	0 vs 1-3	1 vs 2-3	2 vs 3
P_m	14.443	10.731	2.485
	(4.59)**	(4.31)**	(1.36)
DNS	-0.371	-0.538	-0.436
	(5.90)**	(7.75)**	(4.60)**
Education-Head			
Primary	0.379		
	(2.36)*		
Secondary	0.606		
	(1.67)		
Education-Mother	0.013		
	(0.34)		
Roof Type	0.718		
	(3.84)**		
Sex (female = 1)	0.324		
	(0.70)		
Distance × sex	0.048	-0.037	-0.112
	(1.58)	(0.82)	(1.59)
SAFSR	-3.718		
	(3.88)**		
SAFSR×Distance	0.320		
	(4.66)**		
Age	0.038	0.719	1.296
	(0.32)	(4.85)**	(5.44)**
Age Square	-0.004	-0.016	-0.024
	(1.27)	(4.03)**	(4.80)**
Constant	5.956	-3.580	-15.443
	(4.81)**	(2.57)*	(5.33)**
N	871		
Wald $\chi^2(22)$	292.04		
Pseudo R^2	0.35		

Chapter Five

Summary and Conclusion

For a typical developing country such as Ethiopia where the large majority of the population dwell in the rural area making its living from subsistent agriculture, rural transformation naturally becomes a priority. Such transformation requires strong rural-urban linkages in many aspects. This dissertation identifies rural livelihood, migration, and human capital as the three major elements of rural-urban linkages. A smooth and successful rural transformation requires the dynamic interaction of these pillars catalysed by location of agricultural activities in relation to urban centers.

The possible interactions of these pillars of transformation have been discussed by this dissertation under three major chapters by illustrating the Ethiopian case. The first major chapter attempts to address the impact of location, and human capital on rural livelihood through crop choice. Using data from villages in the Northern Ethiopia, it has been found that proximity to urban centers which are by default the major markets for agricultural surplus and level of education of the head of the households determine the decision of a household to allot his plot for the production of either high value cash crop or a less risky staple crop. This has been translated into a consistent variation in income across households with different proximity to urban centers, and on the status of formal education.

The result might have an implication beyond a simple association of location and crop choice. The significant variation in crop choice and the associated level of income for modest variation in location in the radius of some 100 kilometres may suggest that the meagre demand from the urban population, which in turn is primarily a result of low urbanization rate, is not capable of triggering agricultural surplus which would have been a basis for rural transformation.

Variables associated with risk management schemes such as availability of irrigation, climate, liquid wealth, and livestock have been considered in the crop choice model.

Households with access to irrigation and more liquid wealth tend to allot their plots for high value crops. The impact of livestock as either an insurance mechanism or a rival activity with crop choice seems to depend on the particular location of the activities. A single crop season and absence of permanent crops that could adapt to cold climate discourages households in the highland area to allocate their plots of land for the production cash crop.

The second main chapter focussed on the importance of smooth and sustainable rural-urban migration in order to facilitate rural transformation. It argues that even if rural-urban migration is seen as a phenomenon that signals development problem in urban areas, it remains to be one of the most effective ways of transforming the rural economy. The challenge rather is how to make it smooth and sustainable. We argue that education lies at the center of achieving such sustainable smooth rural-urban migration. Making education a rural phenomenon can induce the rural majority to change their modes of production, consumption preferences, and the type and quality of wealth they accumulate.

Estimations of the determinants of rural-urban migration decisions using data from Ethiopian villages showed that education along with incomes differential affects individuals' decision to migrate. The fact that education is used in estimating the incomes differential and that education becomes significant in the migration decision model might suggest that the impact of education on rural-urban migration is through two channels. The primary impact of education on migration is through incomes differential as the urban labor market pays higher wages to educated migrants. The second channel might be due to its impact on the preference of individuals to urban based goods vis-à-vis rural based 'cultural' goods.

The role of education in triggering migration is not a new issue. What might be new is the emphasis on education as a policy instrument to foster sustainable rural-urban migration. But even more important issue that has been neglected at least in the literature of rural-urban migration is the feedback effect of prospects of migration on human capital formation. The third main chapter took up this issue and argued that while education ensures smooth rural-urban migration, prospects of migration in turn encourages human capital formation in rural areas. In particular in rural Ethiopia, households send their children to school in anticipation for jobs outside agriculture mostly in urban centers. Given the low perception that education would help in increasing agricultural productivity, rural individuals hardly invest in education for the sake of being educated farmers. Thus, increasing opportunity costs of rural-urban migration may result in under-investment in the critically needed human capital formation in rural areas.

The empirical analysis that made use of the Ethiopian data seems to support the dual dependence of prospects of migration and human capital formation. Probability of migration instrumented by incomes differential and/or distance from major urban centers has been positive and significant in the education choice model. To pass note, the direction of the impact of gender and family size on education choice depend on the proximity of households to urban centers.

Given that the dissertation is inspired by the situation in Ethiopia, the lesson that can be drawn from this study for the country might be worth considering. The need for rural transformation is quite understandable by the Ethiopian policy makers. The Ethiopian government has launched what is termed as agricultural development-led industrialization (ADLI) policy. As part of the policy package, the government has embarked on ambitious primary education program in rural areas. But at least three major issues are out there to be addressed from the point of view of this study. The first is that the last decade witnessed an apparent neglect to the industrial sector. After fifteen years of effort, value-added in the industrial sector has stagnated at about 12 percent indicating the small size of the private sector. Second, in the face of declining per capita rural land size and meagre demand from the urban center due to low rate of urbanization, the policy makers seem to be fearful of rural-urban migration. Third, secondary level education is still an urban phenomenon and the rural based primary level of education does not seem to be purposeful from the individuals' perspectives.

In light of the arguments of this study, the above challenges require synchronized policy that targets on both the demand and supply aspects of rural transformation. Giving emphasis to the private sector would create an opportunity in term of demand for agricultural surplus, market for the educated migrants so that the improved prospect of migration encourages purposeful investments in sustainable education. Such prospects would help the rural majority to reveal their talents to contribute both to the formal sector and the agricultural sector.

The seemingly increasing population pressure on the urban centers is not because the rural-urban migration rate is something unprecedented. It is rather because there are few urban centers with relatively better infrastructure. Such incidence of high population pressure on the limited number of urban enclaves in particular the capital may be alleviated through decentralization of urbanization. This would at the same time serve as creating demands for agricultural surplus (taking the market to the farmer's doors), increasing prospects of migration, and bringing more education access to the rural majority.

In conclusion, transformation of the Ethiopian economy in general and the agricultural sector in particular requires a policy that targets on the strengthening of the positive elements of the rural-urban linkages. This calls for a sectorally balanced development policy that synchronizes the demand and supply aspects of the rural base, namely agriculture.

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