ADDIS ABABA UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS
DEPARTMENT OF ECONOMICS

Welfare Implications of Migration, Remittance, and Governance

Kokeb G. Giorgis

A Dissertation Submitted

to

The Department of Economics

Presented in partially fulfillment of the Requirements for the degree of

Doctor of Philosophy in Economics

Addis Ababa University

Addis Ababa, Ethiopia

July 3, 2020

Thesis committee

Thesis main advisor

Professor Par Sjolander,
Jonkoping International Business School
Jonkoping University, Sweden

Thesis co-advisors

Professor Almas Heshmati,
Jonkoping International Business School
Jonkoping University, Sweden

Associate Professor Assefa Admassie,
Department of Economics
Addis Ababa University, Ethiopia

Addis Ababa University
School of Graduate Studies

This is to certify that the dissertation prepared by Kokeb G. Giorgis entitled: "Welfare Implications of Migration, Remittance, and Governance" and submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy (Economics) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by the examining Committee:

Examiner _____ Signature _____ Date _____

Examiner _____ Signature _____ Date _____

Advisor _____Signature _____ Date _____

Advisor _____Signature _____ Date _____

Advisor _____Signature _____ Date _____

_____

Chair of Department or Graduate Program Coordinator

Welfare Implications of Migration, Remittances, and Governance

Abstract

Migration be it internal or international is intensifying. This is due to globalization and demographic changes in developed and new developing countries. Migration is no longer a male dominated activity. Moreover, studies show that women received a lion share of remittances sent back home. Yet, most migration studies ignore gender perspective in the process and consequences of it. Thus, little is known on the linkages between gender, migration, and source households' well-being. In the context of Ethiopia this dissertation offers an insight into this aspect of migration. Moreover, from standpoint of governance quality, which is an important global development agenda, this dissertation sheds light on the effect of governance quality on food security in the contest of sub-Saharan Africa (SSA).

The first chapter analyzes impacts of migration on households' farm and off-farm incomes. To this end a panel data set of the World Bank Living Standard Measurement Survey (LSMS) is used. It finds that migration has a positive effect on farm households' livestock production but no impact on crop incomes. Considering the land size, migration has a negative effect on crop incomes for farmers who own land more than the median land size per capita. Moreover, we found that migration positively affected income generating activities of farm households. Overall, the findings show that households' heterogeneity needs to be considered for a comprehensive understanding of migration's impact.

Second and third chapters investigate implication of migration and remittances on left-behind households' welfare from a gender standpoint. The question whether gender matters in the impact of migration motivates these studies. Findings of these studies show that a gender disaggregated framework should be used for comprehensively understanding migration's impact on the well-being of source families as otherwise the findings are unlikely to be reliable for designing policies for enhancing the positive effects of migration and mitigating the negative ones.

Using panel data set the last chapter studies the effects of governance quality on food security in the context of sub-Saharan African countries (SSA). The study found that improving governance quality in SSA contributes positively and significantly to food security.

***Key words**:* Migration, remittances, governance, welfare, food security, the NELM

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to those who have been extraordinarily helpful during all my PhD study. Although this dissertation bears only my name, it is clear to anyone who has been in academia that a PhD thesis is not something you write all by yourself.

My first and notable gratefulness goes to my supervisors Professor Par Sjolander, Professor Almas Heshmati, and Associate Professor Assefa Admassie all have contributed to educate me on their own way. THANK YOU!

I am very grateful for my principal supervisor Professor Par Sjolander, I learned a lot from you. Indeed, your comments were insightful and contributed a lot to improve my dissertation. I would also like to thank you for all your encouragements to proceed on my work. Thank you for believing in me. I sincerely appreciate for your kind supports.

Professor Almas Heshmati, I benefited a lot from your excellent comments and suggestions. Throughout my frequent visit to Sweden your exceptional simplicity and accessibility created an excellent work environment. Please, accept my deepest gratitude for your kindness, concern, and close follow-up of my PhD project. This dissertation would not have reached this stage, without your unreserved help.

I owe a great deal of gratitude to my local supervisor, Associate Professor Assefa Admassie, from whom I benefited from his meticulous comments.

I would also like to thank my external reviewer of the dissertation Professor Jacques Silber for his comments and suggestions. It helped a lot to improve my dissertation.

I would like to extend my appreciation to all the academic staffs of the Economics Department of Addis Ababa University (AAU). My special thank goes to my teachers Professor Alemayehu Geda, Professor Tassew Weldhanna, Dr. Alemu Mekonnen, Dr. Fantu Guta, , Dr. Tadele Ferede, Dr. Tekie Alemu, and Dr. Wassie Berhanu for teaching me Economics and Econometrics, supporting and encouraging me in many ways. In a similar way I would also like to thank the post graduate program coordinator of the department Dr. Mesele Araya and head of the department of Economics Dr. Zerayehu Semie.

I gratefully acknowledge the financial support I received from the Swedish International Development Cooperation (SIDA), CBE, AAU, and OSSREA.

My special thanks goes to my beloved wife Samrawit Alemu for her encouragement, support, and patience, and sincere love. My children Barkon and Amen also deserve special appreciation.

I owe a great deal of gratitude to my parents G.Giorgis G.her and Kiros Alemayehu, to my sisters and brothers for their unreserved supports.

On top of all, I thank the Almighty God for giving me the endurance and guidance to successfully complete this difficult academy journey.

Kokeb G.Giorgis

June 2020

To:

My beloved father G.Giorgis G. her (GG)

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ACRONMYS AND ABBREVIATIONS

CSA Central Statistics Agency

FAO Food and Agriculture Organization of the United Nations

GDP Gross Domestic Product

Ha Hectare

HH Household

Km Kilometer

LSMS Living Standard Measurement Survey

NBE National Bank of Ethiopia

NELM New Economics of Labor Migration

SNNPR Southern Nations Nationalities and Peoples Region

SSA sub-Saharan Africa

TLU Tropical Livestock Unit

WB World Bank

Chapter One

1 Introduction and Summary of the Dissertation

There seems to be a disconnect between migration, remittances, governance quality, and welfare, all of which are crucial global development agendas.

All growth and development experiences involve labor reallocations across space and sectors within a country or across national borders. Hence, migration is an inherent and unavoidable feature of the economic development process. Intellectual debates on the link between migration and development swing back and forth from the 1950s and 1960s developmentalist optimism to the 1970s and 1980s structuralist and neo-Marxist pessimism, and more recently to the 1990s more nuanced views influenced by the new economics of labor migration. Since migration is multidimensional no single comprehensive theory fully explains it. This leads to a real challenge in understanding the factors that affect the fundamental heterogeneity of migration and its implications for development. Migration affects the welfare of the migrants, their households, and the communities that they leave behind, as well as the host communities in destination countries.

Migration is increasing. Worldwide nearly a billion people live and work outside their region of birth within their own country or outside their country of birth. Further, migration is no longer a male dominated activity. Different data sources show that around 50 percent of the migrants are women. Moreover, women receive a significant proportion of the remittances sent back home in developing countries. Gender as a social construct that organizes relations between males and females can differentiate the causes, processes, and impacts of migration between the two genders. However, few migration studies use a gender perspective. Thus, the real linkages between gender, migration, and source households' well-being has not been fully explored yet (de Brauw, 2017; Pfeiffer and Taylor, 2007).

Remittances from migration improves long-term welfare through enhancing investment in healthcare and education by relaxing liquidity and budget constraints. On the other hand, following migration the physical absence of a migrant may have multiple adverse effects on the welfare of the left behind household members. Hence, the impact of migration is complex, multi-channeled, and context-dependent. It ultimately depends on who migrates and who is left behind (for example,

gender and age). Given this, empirical studies are needed to clarify the net impact of migration which is a priori ambiguous.

One strand of literature focuses on the impact of governance quality on food security. Food insecurity continues to be a big challenge worldwide. For instance, in Africa around 27.4 percent of the population in 2016 was categorized as severely food insecure. Factors responsible for this included poverty, conflict, and poor government policies (Benson, 2004; Kidane et al., 2006; Maxwell and Slater, 2003; Mwaniki, 2005; Regmi and Paudel, 2016) in one way or another is linked to a country's governance quality (Nyanjom, 2011; Paarlberg, 2002). This dissertation moreover investigates the implications of good governance on food security. Addressing this question is important for two reasons. First, literature shows that there is a considerable disconnect between the two global development agendas of food security and governance. Second, the findings of existing studies are mixed.

The purpose of this dissertation is two-fold: First, understanding the links between gender, migration, and households' welfare. More specifically, the study contributes to literature by investigating the gender differentiated effects of migration on farming activities, technology adoption, and child nutrition. In addition, it sheds light on gender, remittances, and expenditure patterns in the context of urban Ethiopia. The second purpose of the dissertation is exploring the extent to which governance quality effects food security at the macro level.

1.1 Gendered Migration and its Welfare Implications

1.1.1 Migration and Remittances in Ethiopia

More than 84 percent of Ethiopia's population lives in rural areas (CSA, 2010) and largely depends on agriculture for both income and subsistence (Bezu and Holden, 2014; Gray and Mueller, 2012). Drivers of migration from rural areas in Ethiopia include droughts, ecological degradation, population pressure, inadequate incomes and limited access to farmland, lack of employment opportunities, and government resettlement policies (Belay, 2004; Berhanu and White, 2000; Bezu and Holden, 2014; Gray and Mueller, 2012; Hammond, 2008; Kassie et al., 2008; Mberu, 2006).

In Ethiopia getting an accurate picture of migration situation is difficult.[1] In general, the migrants

[1]Limitations of migration data includes lack of documentation of irregular migration, and absence of standard definition of migration.

are young, mainly between 18 and 25 years, single, increasingly there are more females, and more educated than non-migrants and most of them are from rural areas[2] (Kuschminder and Siegel, 2014).

Ethiopia has a diaspora of approximately 2 million people, one of the largest in SSA (Frous, 2015). International remittances to Ethiopia have been increasing at high rates and are sequentially taking the central position in the Ethiopian economy. According to the National Bank of Ethiopia (2016), external remittances increased sharply from 2 billion USD in 2012 to 4.5 billion USD in 2016-17, which exceeded Ethiopia's export earnings during the same period. This figure does not include remittance inflows through informal channels which too are very large. These inflows possibly lead to a decline in household poverty, liquidity constraints, and volatility of incomes. Moreover, remittances may increase household expenditure primarily on health, education, and housing which are considered to be particularly essential for economic development. Whether as household heads, who receive remittances or as migrants who send remittances, women form an increasing part of the migration movement (World Bank, 2016).

1.1.2 Farm Technology Adoption and Child Nutrition in rural Ethiopia

For many sub-Saharan African (SSA) countries including Ethiopia, agriculture is a leading source of employment as it engages at least two-third of the labor force. Agriculture in the region is still subsistence-based with low productivity growth at nearly half the average rate of growth compared to developing countries (NEPAD, 2014). To reverse this, adoption of improved farm technologies has been emphasized as being crucial by development experts (Karanja et al., 1998; Minten and Barrett, 2008). The rate of returns and the economic contributions of modern technology adoption are estimated to be high, and most farmers are aware of its importance. However, despite this the adoption of modern technologies by smallholder farmers in SSA is not only low but also slow compared to other developing countries (Johannes et al., 2010; Kudi et al., 2010).

Agricultural technologies are broadly grouped into mechanical such as tractors, pump sets, and farm implements, and biochemical such as chemical fertilizers, pesticides/herbicides, and

[2] A strong feminization of migration has been happening in Ethiopia as 60 percent of current migrants are females (Kuschminder, 2014; Kuschminder and Siegel, 2014).

improved seeds.[3] New and improved farm technologies and practices have different labor and land demands and thus require different investments. Use of chemical fertilizers is considered to be a labor-intensive technology, and it is frequently used as a basal-dose and top dressing (Rauniyar and Goode, 1992).

Studies on technology adoption in Ethiopia suggest that overall adoption is not only low but also the rate of this adoption is slow (Chamberlin and Schmidt, 2011; Spielman et al., 2011). For example, CSA (2013) reported that less than 5 percent of the total cultivated areas (around 12.3 million hectares) used improved seeds. Using nationally representative data from Ethiopia, Taffes et al. (2013) reported that the percentage of better seeds (high-yield variety seeds) used in the country was low. Tigist (2014) used Ethiopian rural household survey data in 2009 and showed that there were around 65 percent chemical fertilizer user farm households while users of better seeds was around 10 percent. This shows that farmers' rate of chemical fertilizer adoption was much better than their rate of better seeds adoption.[4]

Studies also show that availability of labor in a household is a significant factor in the adoption of improved management practices (Quisumbing and Pandolfelli, 2010; The World Bank, FAO and IFAD, 2009). Using Ethiopian Household Survey data, Tigist (2014) found that technology users' household size was nearly 7 persons per household, whereas non-user households had about 5 members each. This may support the idea that adopting labor-intensive technologies such as high-yield variety seeds and chemical fertilizers depends on the availability of labor in the context of poorly functioning rural labor markets in Ethiopia where household members do most of the work on the farm.

From the perspective of child nutrition, like other rural African societies child malnutrition is a critical and enduring problem mainly in rural Ethiopia. Over the past decade, stunting and wasting have decreased though they still remain high. For instance, according to the Demographic and Health Survey data, in 2016 slightly less than 38 percent of the children under-5 in Ethiopia were stunted as measured by height-for-age and around 10 percent were wasted as measured by weight-for-age (CSA and ICF, 2016). The primary cause of malnutrition is lack of sufficient food production at the farm level or lack of income for buying enough food. With migration, remittances

[3]The effects on agricultural production differs depending on the technology packages used. Mechanical technology enhances labor productivity and thus agricultural production; on the other hand by directly effecting plant physiology the use of bio-chemical technologies increases production.

[4]Among others, this may be due to more availability of chemical fertilizers than HYVS (see Tigist, 2014).

relax household budget constraints and create an opportunity for improving child nutrition.

1.1.3 Gendered Impacts of Migration

The presumption of this research with respect to gender differences in the effect of migration on the left behind household members is based on the assumption that different and distinctive gender norms are imposed on men and women. Moreover, substitution between women and men's agricultural labor is poor. Thus, it is reasonable to assume that differences exist in the effects of male and female migration on the left behind farm households.

Like in most rural farm households in Africa, household members in rural Ethiopia perform distinct tasks though eroding slowly with time. Division of labor on a farm is based on the gender and age of household members. Females engagement in agricultural activities is limited due to customary beliefs (that plowing, sowing seeds, and threshing are exclusively male activities), which necessitates male labor participation.[5,6] However, all reproductive and household related activities such as childcare and care for older family members, preparing food and drinks, washing clothes, and collecting fuelwood, water, and fodder are primarily the responsibility of adult female members (Demelash, 1988; Fasil and Asmerom, 1979).

Time-allocation studies in the Ethiopian context show that gender-specific labor allocations exist. According to Diksha and Rada (2013), the pattern of gender-specific intra-household labor allocation in a typical rural household in Ethiopia shows that women use more than 70 percent of their time on household and care work while men use a similar proportion of their time on farm work including tending to livestock. A case study by Aredo (1995) found that household chores used up a large portion of women's labor time. According to this study adult female on average spent more than 7.4 hours on household chores. However, men's involvement in these activities was very limited. This intra-household labor allocation can be critical in determining children's development.[7]

For instance, from the perspective of child nutrition, migrant remittances relax households'

[5]See for example, Sintayehu (2011) in the case of the Sidama region of SNNP, Ethiopia, where agricultural activities are predominantly men's responsibility.

[6] Unlike the old beliefs which state that women perform the bulk of the work in African agriculture (women contribute 60 to 80 percent of the labor used for producing food). However, recent assessments show the estimated female labor share to be slightly lower than 50 percent and not more than 28 percent in Ethiopia (see Ellen, 2018 for more information).

[7]See Hyder et al., (2005) and Quisumbing and Maluccio (2003).

budget constraints and create an opportunity for improving child nutrition. However, the additional income from remittances comes at a cost in terms of a household's labor and time endowments because migration means the absence of economically active family members and the loss of their time input in both market and household production. Migration thus reduces caring time for children, which may be harmful for their nutritional status. Compared to male migration, female migration may have a larger effect on child nutrition as females specialize in household chores including preparing food and caring for children at least in the context of this dissertation. The magnitude of the lost-labor effect associated with migration differs depending on who migrates - males or females - mainly because of differences in gender roles and the left behind activities to be performed - technology adoption and child nutrition.

However, beyond gender of the household head equally and if not more literature in the area also show that how empowered the women in the household also matters. A study by Izraelow and Silber (2019) using data from Ghana shows that the impact of women empowerment i.e. the ability for a woman to take decisions has a significant positive impact on the health of children.

1.2 Governance and Food Security

Compared to any other continent; Africa is severely food insecure. According to 2016 FAO report around 27.4 percent of Africa's population is food in secured; what is even more startling is that food insecurity is even increased compared to 2014 (FAO, 2017).

Following the 2007 and 2008 global food crises the importance of integrating governance at all levels with food security started gaining traction (Grindle, 2011). This is because poor governance depicted, among other factors, by conflict, lack of institutional capacity, and poor policy design and implementation can cause severe harm to food production and distribution.

There are three leading theoretical perspectives on the link between governance and food security. The first view is 'democracy prevents famines' as argued by Sen (1983) via reducing corruption and stimulating technological changes thus leading to growth.[8] Studies conducted to test this hypothesis came up with mixed findings (see, for example, Kirk, 2014; Rubin, 2009). The second view argues that there is a need to look beyond democracy as an indicator of governance. Hence, both formal and informal institutions which are proxies for governance are important

[8] Countries like China achieved technological change and growth without a democracy.

factors in achieving food security (Burchi, 2011, Rothstein, 2011; and Sacks and Levi, 2010). The third and more recent view is that food insecurity is nothing but a political phenomenon which emphasizes the role of political will in eradicating hunger (Devereux, 2000). These sets of theories linking governance to food security provide a point of departure for our empirical inquiry in the contest of sub-Saharan Africa.

1.3 Data and Limitations

Three different datasets are used in this dissertation. The first two chapters use a panel dataset of the Ethiopian LSMS.[9] The Ethiopian LSMS started in 2011-12 and has been collected three times every two years. The first wave of data included 3,776 representative households from all regions in the country. The second wave in 2013-14 and the most recent round in 2015-16 had 5,262 representative households from all over the country. The survey includes modules, among others, on household characteristics including detailed questions on migration and remittances, questions on child health, modules on agriculture together with farm technology used, and also community-level data.

The dissertation uses the author's own dataset for the third paper. This is a two-period repeated cross-sectional dataset from 2013 (round 1) and 2017 (round 2).[10] In both rounds detailed information was collected not only on migration and remittance experiences of the households but it also has questions related to household head's characteristics, human capital, income, consumption expenditure, and the well-being of the households. The first round covered 636 households from four major urban areas in the country (Addis Ababa, Gonder, Hawassa, and Mekelle). In round 2, using the same sampling procedure as in round 1 a total of 605 households were interviewed from the same urban areas in 2017.

The third dataset used is cross-country panel data from 26 sub-Saharan African countries from 1996 to 2016.

[9]LSMS – the Ethiopian Living Standard Measurement Survey- is a longitudinal household dataset collected by Ethiopian Central Statistics Agency (CSA) in collaboration the World Bank Living Standards Measurement Study – Integrated Surveys of Agriculture (LSMS-ISA).

[10]Round 1 data was collected with technical and financial support from the Organization of Social Science Research for Eastern and Southern African Countries (OSSREA) for a project on migration and development. Round 2 data was collected with support from the Commercial Bank of Ethiopia.

Some caveats are needed here. Unlike the second and third rounds, the first-round dataset of the LSMS lacked detailed information on migration and remittances especially on the characteristics of migrants in terms of gender. Thus, the study only focuses on the latest two rounds of the survey. The papers in this dissertation only study the direct effects of migration and remittances and do not look at any spillovers or positive/negative externalities on the communities in which the migrant households live. While spillovers are an important concept in economics, especially in migration and remittance studies, they are very difficult to measure. It is expected that migration and remittances positively or negatively affect communities where migration and remittances are pervasive say, for example, via labor markets.

1.4 Methodological Issues

Measuring the causal impacts of migration is challenging because migration is a choice variable and hence is non-random, that is, whether a household participates in migration or not is a matter of self-selection in terms of whether to participate in migration or not and if so how many family members to send, who should migrate, for how long, and whether to send remittances or not. This makes migration an endogenous variable and if not addressed properly, migration analyses become complicated. Hence, for estimating the causal impacts of migration appropriate strategies need to be followed.

The best approach for determining the causal effects of migration is using a randomized control trial. This helps to randomly select both treated (migrant households) and control groups (non-migrant households) from the total pool of potential households. This eliminates any significant variations between the two groups of households and mitigates the issue of self-selection in migration because households in both the groups have members who are willing to migrate. To this end, experimental data is vital though it is rarely available and is costly to construct.[11]

Since there is almost no access to randomized control trials, researchers have used various methods for solving self-selection problems by using observational data. The instrumental variable (IV) method is among the typical methods used. However, the challenge in using this approach is finding a valid instrument otherwise it may lead to misleading results if the instruments are weak.

[11]Some migration studies which use this approach are Gibson et al. (2011) in Samoa and Tonga. They used immigration-visa lotteries to compare households with a lottery winner (with a migrant) and a lottery loser (without a migrant) for solving self-selection in migration.

Selection models and matching methods are common approaches followed depending on a study's objectives and data availability. This dissertation uses a combination of these methods.

1.5 Summary and Contributions of the Chapters

This dissertation has four independent papers. The first three papers deal with welfare implications of migration and remittances from a gender perspective. The fourth paper investigates the link between governance quality and food security at the macroeconomic level in the context of sub-Saharan Africa.

The first paper, *Heterogeneous effects of Labor Out-migration on Farm and Off-farm incomes in Rural Ethiopia,* studies the impact of migration on farm and off-farm incomes of rural households in Ethiopia. In addition, the paper tests if the effect is heterogeneous across farm households land size. It uses the LSMS panel dataset. Among others the findings show that losing productive members following migration does not induce a substantial loss in crop incomes. However, we find migration impacts negatively crop income for farmers with larger own land size. This implies for comprehensive understanding on the impact of migration households' heterogeneity should be considered. This will encourage policymakers in Ethiopia to revisit some of the policies which can explicitly or implicitly hinder rural out-migration across the board.

The second paper, *Gender Impacts of Migration on Agricultural Technology Adoption and Child Nutrition in Ethiopia,* studies in the context of rural Ethiopia the effects of gendered migration on the probability of adopting farm technologies and child nutritional outcomes. It uses a counterfactual analysis and a multinomial endogenous switching regression model to measure these impacts using the LSMS panel dataset. The study finds that migration, regardless gender of the migrant, play a positive effect on farm households' technology adoption. However, from the perspective of child nutritional status, the effect is not gender neutral. On average, child health improved in male migrant households though it declined slightly in female migrant households. This finding shows that a gender disaggregated framework should be considered for understanding the effects of migration on the left behind farm households' welfare.

The third paper, *International Remittances, Gender, and Household Expenditure Behavior,* studies the effects of remittances on household budget allocations and how the gender of the remitter or receiver effects these allocations. The study is based on two repeated cross-sectional datasets from 2013 and 2017 covering four major urban areas in Ethiopia. Our findings show that

remittances do not result in stronger human capital accumulation. Further, when the effect of remittances is disaggregated by gender, our findings show that the gender-specific effect is rather small.

The fourth paper, *The Impact of Governance Quality on Food Security: Evidence from sub-Saharan African Countries*, assesses the impact of governance quality proxied by *control of corruption* and *composite governance index* on food security in 26 SSA countries for the 1996-2016 sample periods. It empirically shows that; taken into consideration macroeconomic variables; out of the two governance indicators used in the study, *control of corruption* has a positive and significant effect on food security. In conclusion improving governance in terms of controlling corruption on average makes a positive contribution to hunger reduction in the sampled countries. Hence, good governance in terms of controlling for corruption can be used as one of many important tools for fighting hunger in the region.

1.6 Recommendations

1.6.1 Future Research

For understanding the impact of migration on welfare besides looking at the gender differentiated effects of migration, it is also important for future research to assess if the type of migration (duration of migration) has implication for welfare of left behind families. This is because depending on the duration of migration, a migrant's commitment to his/her family may weaken over time leading to reduced financial transfers with implications for the welfare of the left behind family members. Moreover, a migrant's destination may also matter in the impact that migration has.

Another dimension that should be considered is related to the methodologies used for understanding the impact of migration. Most studies on migration rely on household survey data where the issue of non-random selection of individuals in migration is difficult to overcome. A promising solution for this problem is using experimental approaches though this is challenging and costly.

1.6.2 Policy Changes for promoting Welfare Impacts of Migration and Governance

1. For harnessing migration and remittances towards enhancing households' welfare and minimize its negative impacts the Ethiopian government should design a comprehensive migration and remittance policy which is context specific with gender perspective into account. In one way or another this policy should take into account the following[12]:
    - To cope up with determinant effects of migration on human capital accumulation the government should bolster support systems in healthcare and education for migrant households.
    - To fill the gap following the loss of economically active members due to migration; the government should work to improve the functioning of the rural labor market.
    - For hassle free and less costly remittance inflows; government should promote and further improve money transfer technologies including mobile banking. Moreover, it is also equally important to strengthen formal insurance and credit markets.
    - Though recently there have been some initiatives, the Ethiopian government should work extensively to inform and give short-term training to migrants before they leave, especially to female migrants going to the Middle East.
2. Ethiopian government should revisit some of its policies which directly or indirectly hinder rural labor out migration. For instance, land policy. Different studies indicate that the policy hinders rural labor out migration.
3. Government should replicate the urban youth revolving funds implemented in major urban areas of the country into the rural areas to create employment opportunities for unemployed rural youth.
4. From the perspective of governance, to enhance food security governments in sub-Saharan among other factors should work to curb rampant corruption.

[12] Except South Africa and Nigeria SSA countries including Ethiopia do not have a clear migration policy.

References

Aredo, D. (1995). The gender division of labor in Ethiopian agriculture: A study of time allocation among people in private and co-operative farms in two villages. Research Report 1, Organization of Social Science for Eastern and Southern African countries (OSSREA).

Belay, K. (2004). Resettlement of peasants in Ethiopia. *Journal of Rural Development, 27(Winter)*, 223-254.

Benson, T. (2004). Africa's Food and Nutrition Security Situation: Where Are We and How Did We Get Here? *2020 Discussion Paper 37.* Washington, DC: IFPRI.

Boyd, M., and Wang, H. H. (2011). Guest editorial: the role of public policy and agricultural risk management in food security. *China Agricultural Economic Review,* 3(4), 417–422.

Burchi, F. (2011). Democracy, Institutions and Famines in Developing and Emerging Countries. *Canadian Journal of Development Studies* 32 (1), 17-31.

Berhanu, B., and White, M. (2000). War, famine, and female migration in Ethiopia, 1960-1989. *Economic Development and Cultural Change, 49(*1*),*91-113.

Bezu, S., and Holden, S. (2014). Are rural youth in Ethiopia abandoning agriculture? *World Development, 64,* 259-271.

Central Statistical Agency of Ethiopia (CSA) (2010). *The 2007 Population and Housing Census of Ethiopia. National statistical report*. Addis Ababa: CSA.

Central Statistical Agency (CSA) (2013). *Ethiopian Agricultural Sample Survey. Technical Report*. Addis Ababa: CSA.

Central Statistical Agency of Ethiopia (CSA) and ICF International (2016). *Ethiopia Demographic and Health Survey 2016*. Addis Ababa and Rockville, Maryland: CSA and ICF.

Chamberlin, J., and Schmidt, E. (2011). Ethiopian agriculture: A dynamic geographic perspective. Unpublished.

de Brauw, A. (2017). Rural-Urban Migration and Implications for rural production. *Bio-based and Applied Economics, 6(3), 229-242.*

Demelash, L. (1988). Farming System in South-West Ethiopia: A Case Study of Villages around Gore. Unpublished.

Devereux, S., (2000). *Famine in the Twentieth Century. Working Paper, 105.* Brighton; Institute of Development Studies, University of Sussex.

Diksha, A., and Rada, C. (2013). Gender Differences in Time and Resource Allocation in Rural Households in Ethiopia. Unpublished.

Fassil, G., and Asmerom, K. (1979). *Socio-economic baseline survey of 'Welmera' II.* Addis Ababa University, Institute of Development Research.

Frous, B. (2015). *A certain Catalyst: An Overview of the (mixed) migration and Development Debate with Special focus on the horn of Africa.* Nairobi: The Regional Mixed Migration Secretariat (RMMs).

Gibson, J., McKenzie, D. and Stillman, S. (2011). The Impacts of International Migration on Remaining Household Members: Omnibus Results from a migration lottery Program. *Review of Economics and Statistics, 93(*4*),* 1297-1318.

Gray, C., and Mueller, V. (2012). Drought and population mobility in rural Ethiopia. *World Development, 40(*1*),* 134-145.

Grindle, M. S. (2011). Good Governance: The Inflation of an Idea. HKS Faculty Research Working Paper Series, RWP10-023, John F. Kennedy School of Government, Harvard University. Available at:

https://dash.harvard.edu/bitstream/handle/1/4448993/Grindle_GoodGovernance.
Hammond, L. (2008). Strategies of invisibilization: How Ethiopia's resettlement program hides the poorest of the poor. *Journal of Refugees Studies, 21(*4*),* 517-536.
Izraelov, M., and Silber, J. (2019). Women's Empowerment and Children's Health: The case of Ghana. In A. Heshmati & P. Nilsson (Eds.), *Efficiency, Equity and Well-Being in Selected African Countries* (pp. 123-148), Economic Studies in Inequality, Social Exclusion and Well-Being. Springer. Available at https://doi.org/10.1007/978-3-030-11419-0_2.
Johannes, A.T., Vabi, B. M., and Malaa, K. D. (2010). Adoption of maize and cassava production technology in the forest-savannah zone of Cameroon: implication for poverty reduction. *World Applied Sciences Journal, 11(*2*),* 196-209.
Karanja, D., Thomas, S. J., and Paul, S. (1998). Maize productivity and impact of market liberalization in Kenya. Mimeo.
Kassie, G.T., Asfaw, W., Zeleke, G., and Scott, D. (2008). *The nexus of migration, HIV/AIDS and food security in Ethiopia*. Washington, DC: IFPRI (Renewal Working Paper 2008).
Kidane, W., Maetz, M. and Dardel, P. (2006). *Food Security and Agricultural development in Sub-Saharan Africa: Building a Case for more Public Support*. Rome: FAO.
Kirk, H. (2014). Bread and Freedom: Linking Democracy and Food Security in Sub-Saharan Africa. *African Studies Quarterly*, 15 (1).
Kudi, T. M., Bolaji, M., Akinola, M. O., and Nasa'l, D. H. (2010). Analysis of adoption of improved maize varieties among farmers in Kara State, Nigeria. *International Journal of Peace and Development Studies, 1(*3*),* 8-12.
Kuschminder, K. (2014). *Shattered Dreams and Return of Vulnerability: Challenges of Ethiopian Female Migration to the Middle East.* Maastricht: Maastricht Graduate School of Governance, (IS Academy Policy Brief No. 18). Available at: *http://www.merit.unu.edu/publications/uploads/1389627443.pdf*.
Kuschminder, K., and Siegel, M. (2014). *Migration and Development: A world In Motion Ethiopia. Country Report.* Maastricht: UNU-MERIT. Available at: *http://www.unu.edu/publications/uploads/1389627443.pdf.*
Mberu, B.U. (2006). Internal migration and household living conditions in Ethiopia. *Demographic Research, 14(*21*),* 509-540.
National Bank of Ethiopia (NBE) (2016). Annual Report 2016-17. Addis Abeba, Ethiopia.www.nbe.bank.com.
New Partnership for Africa's Development (NEPAD) (2014). *Agriculture in Africa: Transformation and outlook.* Available at: www.nepad.org/system/files/Agriculture%20in%20Africa.pdf.
Nyanjom, O. (2011). Devolution in Kenya's New Constitution. Society for International Development. Constitution Working Paper No. 4, the Regal Press Kenya LT, Nairobi. Available at: http://sidint.net/docs/WP4.pdf.
Minten, B., and Barret, C. B. (2008). Agricultural technology, productivity, and poverty in Madagascar. *World Development, 36(*5*),* 797-822.
Hyder, A., Maman, S., Nyoni, J., Khasiani, S., Teoh, N., Premji, Z., and Sohani, S. (2005). The pervasive triad of food security, gender inequality and women's health: Exploratory research from sub-Saharan Africa. *African Health Sciences, 5(*4*),* 328-334.
Maxwell, S., and Slater, R. (2003). Food policy old and new. *Development Policy Review,* 21, (5-6), 531-553.
Mwaniki, A. (2005). Achieving Food Security in Africa: Challenges and Issues. Cornell University, Discussion Paper.

Paarlberg, R. L. (2002). *Governance and Food Security in an Age of Globalization: Food, Agriculture and the Environment. Discussion Paper 36.* Washington DC: International Food Policy Research Institute. Available at: http://www.oda-alc.org/documentos/1307636457.pdf.

Pereira, L. M., and Ruysenaar, S. (2012). Moving from traditional government to new adaptive governance: the changing face of food security responses in South Africa. *Food Security*, 4(1), 41–58.

Pfeiffer, L., and Taylor, J. E. (2007). Gender and the Impacts of International Migration: Evidence from Rural Mexico. Mimeo.

Quisumbing, A. R., and McNiven, S. (2010). Moving forward and Looking Back: The Impact of Migration and Remittances on Assets, Consumption, and Credit Constraints in the Rural Philippines. *Journal of Development Studies, 46(*1*),* 91-113.

Quisumbing, A. R., and Maluccio, J. A. (2003). Intra household allocation and gender relations: New empirical evidence from four developing countries. *Oxford Bulletin of Economics and Statistics, 68(*3*),* 283-328.

Rauniyar, G.P., and Goode, F. M. (1992). Technology adoption on small farms. *World Development, 20(*2*),* 275-282.

Regmi, M., and Paudel, K. P. (2016). Impact of Remittances on Food Security in Bangladesh. Food Security in a Food Abundant World. *Frontiers of Economics and Globalization*, 16, 145–158.

Rothstein, B. (2011). *The Quality of Government: Corruption, Social Trust, and inequality in international perspective.* Chicago: University of Chicago Press.

Rubin, O. (2009). The merits of democracy in famine protection: fact or fallacy? *European Journal of Development Research*, 21, 699–717.

Sacks, A., and Levi, M. (2007). *Measuring Government Effectiveness and Its consequences for Social Welfare*. University of Washington: Department of Sociology.

Sahley, C., Groelsema, B., Marchione, T., and Nelson, D. (2005). *The Governance Dimensions of Food Security in Malawi*. USAID.

Sen, A. K. (1983). Development: which way now? *The Economic Journal*, *93*, 745–762.

Sen, A. (1999). *Women's Agency and Social Change.* Oxford University Press.

Sintayehu, D. (2011). *Gender roles in agricultural production among the Sidama of south western Ethiopia. CERTWID.* Addis Ababa: Addis Ababa University Press.

Spielman, D.J., Davis, K., Negash, M., and Ayele, G. (2011). Rural innovation systems and networks: Findings from a study of Ethiopian smallholders. *Agriculture and Human Values, 28(*2*), 195-212.*

Taffes, A.S., Dorosh, P., and Gemessa, S. A. (2013). Crop production in Ethiopia: Regional patterns and trends. Food and agriculture in Ethiopia: Progress and Policy challenges.

Teklewold, H., Kassie, M., and Shiferaw, B. (2013). Adoption of multiple sustainable agricultural practices in rural Ethiopia. *Journal of Agricultural Economics, 64(*3*),* 597-623.

Tigist, M. (2014). *Productivity and Household Welfare Impact of Technology Adoption: A micro econometric analysis*. United Nation University and Maastricht University.

The World Bank (2016). World Development Indicators 2016. *World Bank Publications,* 105051 (1).

The World Bank, FAO, and IFAD (2009). *Gender in Agriculture. Sourcebook*. Washington, DC: The World Bank.

Chapter Two

Heterogeneous effects of Labor Out-migration on Farm and Off-farm incomes in Rural Ethiopia

Abstract

Does migration affect left behind farm households' farm and off-farm incomes? Does this effect vary across farm households' land size? This chapter answers these questions in the context of rural Ethiopia from the perspective of the new economics of labor migration theory. The study uses panel data sets of the Ethiopian Living Standard Measurement Survey. Taking into account endogeneity of migration, the results of the study show that migration has a positive effect on left behind farm households' livestock production but has no impact on crop incomes. However, once we allow the impact of migration to be different for farmers with different land sizes, we find that migration has a negative effect on crop incomes for farmers who own land above the median per capita land. This could be because compared to the small farmers, these farmers are more likely to be labor constrained. Moreover, we find that migration positively affects farm households' participation in off-farm income activities. Overall, the findings show that households' heterogeneity should also be considered to comprehensively understand the impact of migration.

Keywords: Migration, remittances, crop income, off-farm income, NELM, Ethiopia

JEL Classification Codes: J61, Q12, O13

2.1 Introduction

Rural out-migration is an inherent feature of economic development process. Migration is multifaceted and no comprehensive theory explains it fully.[13] In general, theories on migration follow two approaches --- individual and household. Earlier scholars in migration research such as Harris and Todaro (1970) and Todaro (1969) considered migration as an individual utility-maximizing decision.[14] However, shifting the emphasis from individuals, the New Economics of Labor Migration (NELM) model (Stark, 1991; Stark and Bloom, 1985) affirms migration as a household decision rather than a unilateral decision by individual actors. It conceptualizes migration in the wider context of household members' mutual and interdependent risk-sharing (Stark, 1991; Stark and Bloom, 1985). Moreover, unlike earlier studies, which analyze the determinants of migration independent of their impact, the NELM theory interlinks the causes and consequences of migration in a way that both positive and negative effects are possible (de Haas, 2006; Taylor, 1999).

From a theoretical point of view, there are two major opposing effects that migration can have on smallholder agriculture: labor lost and income effects. With migration, labor availability of migrant sending households decreases. Amid imperfect labor markets, farm households may face labor constraint which has implications for a decrease in crop production and yields, and thus crop incomes. However, remittances from migration may counteract the lost-labor effect as remittances reduce credit constraints and serve as insurance against risks (Taylor et al., 2003). With poor functioning rural credit markets, farm households can use incomes from remittances to invest in productivity enhancing choices with positive effects on households' incomes including incomes from crop production.

The NELM theory argues that via relaxing credit constraints or tightening labor constraints migration can have a positive or negative effect on farming activities. Remittances from migrants have a positive effect on farm incomes through enhancing agricultural productivity. Contrary to this as a result of worsening labor shortages migration decreases farm incomes due to the lost-

[13] Due to migrant's diverse migration experience, neither universal definition nor comprehensive migration theory exists (Castles, 2010; King, 2012).

[14] These are among the classical and neoclassical theories of migration. They have been criticized for their oversimplification of migration and thus failed to understand adequately the diversity of migration types.

labor effect. Therefore, the NELM theory hypothesizes the opposite effects of migrants and remittances on farm incomes of households that are left behind.

In empirical migration studies relatively limited attention has been given to the impact of migration on agricultural production; the findings are also mixed.[15] For instance, studies such as those by Gibson et al. (2013) in Samoa; and Marie (2018) in Uganda found that migration had a positive effect on agricultural incomes and productivity. However, studies such as those by Rozelle et al. (1999) and Taylor et al. (2003) found that maize yields and agricultural incomes in northeast China reduced with migration, but incomes from remittances partially compensated for the lost-labor effect. Moreover, numerous studies (such as, Kyle, 2000; Pribilsky, 2007) conclude that labor losses due to international migration have driven migrant households to switch from cropping to livestock production. While studies such as those by Quisumbing and McNiven (2010) in the Philippines and Gibson et al. (2011) in Tonga found no evidence that either internal or international migration had much of an effect on overall agricultural production/incomes.

In Ethiopia, rural out-migration has become a common phenomenon and is thus of concern for policymakers, development planners, and researchers. Agriculture is a major contributor to Ethiopia' GDP (45 percent) and the largest employer (85 percent) but the sector is still dominated by subsistence and labor-intensive activities. Due to constraints such as labor, credit, and insurance, agriculture has low productivity. Subsistence-oriented farming, coupled with dwindling farm sizes, makes it difficult for farm households to meet their basic needs. Hence, increasingly farm households are using migration as an income diversification strategy. Whether migration improves or worsens conditions in these farm households is still unclear and debatable. To this end Ethiopia is an interesting case to explore.

Following Taylor (2003) this study estimates the effect of migration on household incomes. More specifically, it provides answers to the following questions: (i) what is the effect of migration on crop production incomes and livestock production? (ii) Does migration affect farm households' participation in off-farm income activities? (iii) Does migration have a heterogeneous effect on crop incomes?

[15] The methodology applied which included a proper instrumentation of migration can explain the mixed findings. According to de Brauw (2017) a major challenge in conducting research on migration is addressing the issue of endogeneity.

This chapter makes a two-fold contribution to existing literature. First, in the context Ethiopia of where agriculture is highly labor-intensive and a dominant activity, this study contributes to existing literature on migration by providing evidence on the developmental impact of labor migration on household incomes. Very few rigorous empirical studies in the area exist.[16] Second, the study investigates if the effects of migration are heterogeneous across farmers with different land sizes as they may encounter different constraints in investing in agricultural production and different incentives/capacities to migrate. Moreover, the study uses an appropriate method to account for migration's endogeneity.

The study is based on the representative Ethiopian Household Living Standard Measurement Survey (LSMS) done by the World Bank every other year since 2011-12 (2011-12, 2013-14, and 2015-16).

Using appropriate regression techniques, the study found that losing productive members following migration did not lead to a substantial loss in crop incomes. However, the effect turned negative and statistically significant when only households that had landholdings above the EA (enumeration area) level median average were included in the regression. Thus, the effect of migration is heterogeneous across land sizes. On the other hand, the effect of migration on livestock incomes is positive and significant. This implies that migrant households might use remittance incomes from migration for stimulating livestock production and thus diversifying their income sources. From the perspective of participation in off-farm income activities, migration has a positive and significant effect. These findings will encourage policymakers in Ethiopia to revisit some of the policies which could explicitly or implicitly hinder rural out-migration.

This chapter is organized as follows. The next section is literature review on migration and its implications for agricultural activities. Section 3 gives the background and data. Section 4 describes the theoretical framework and the empirical strategy followed. The results are discussed in Section 5. The last section is conclusion and some recommendations.

[16] Primarily due to lack of comprehensive data on migration only a few studies have been done in the context of Ethiopia. Most of them use case studies with the objective of understanding the drivers of migration. An exception is De Brauw's (2014) study in Ethiopia as it indirectly tests the effects of migration on agricultural productivity.

2.2 Implications of migration for agricultural activities- A Review of literature

Of late, there has been an increase in the number of studies looking at the microeconomic impact of migration and remittances. Most of these studies are grounded in the NELM theory. According to this theory, migration is a strategic household decision which is taken to insure against production risks and coping with liquidity constraints (Stark 1982, 1991; Stark and Bloom 1985; Stark and Levhari 1982; Taylor 1999). The NELM theory assumes imperfect factor markets. If there is market failure, migration not only affects incomes but also farm households' production decisions. As a result, NELM's predictions about the impact of migration and remittances may differ depending on farms households' labor and liquidity constraints. Hence, NELM links remittances with migration in one framework unlike the neoclassical theory of migration where the focus is on migration's investment enhancing and risk-reducing effects.[17]

In the context of imperfect rural labor markets, a farm household relies on family labor. Migration via labor lost-effects could thus restrain a farm household's income-generating activities. The importance and size of this effect depends on labor market conditions, the type of employment that the migrants had before they left, the occupation types of a household's members, and whether the household has access to unpaid labor or not. Moreover, the effects could also determine whether a household shifts to less labor-intensive crops or rents out part of its land. Lucas (1987) found a decline in crop production in five African countries subsequent to labor migration to South Africa. Similarly, Taylor et al. (1999, 2003) found that migration negatively affected crop incomes in general and maize yields in China in particular. De Brauw (2010) found that migrant households decreased rice production in Vietnam by shifting to less labor-intensive crops. Studies such as those Kyle (2000) and Pribilsky (2007) conclude that migration induced migrant households to switch from cropping to livestock production.

Through reducing liquidity constraints and insurance against risks, income from remittances can partly compensate for the lost-labor effect by allowing farm households to engage in productivity enhancing choices such as using fertilizers, herbicides, or pesticides, which could increase crop incomes.

[17] Earlier studies on migration including the neoclassical approach assume perfect markets which separate household consumption from production decisions.

Aziz and Marrit (2011) in Kyrgyzstan and Gibson et al. (2013) in Samoa found a positive impact of migrant remittances on agricultural incomes. However, contrary to this, remittances may reduce work incentives for the left behind family members by reducing the opportunity cost of leisure and by increasing the reservation wage (see, for example, Amuedo-Dorantes and Pozo, 2006) and thus potentially compromising the positive effects of remittances. Other studies such as those by Quisumbing and McNiven (2010) in the Philippines and Gibson et al. (2011a) in Tonga found that migration had no effect on overall agricultural production.

Literature also shows that the effect of migration could be heterogeneous depending on initial asset endowments (the level of farm households' wealth), which determine their demand and access to liquidity and insurance and on the type of migration (internal versus international) since remittance incomes may vary depending on the destination. De Brauw and Giles (2008) found that in China productive investment levels increased with migration but only among richer households and not among poorer ones. However, Azize and Marrit (2011) found the opposite in Kyrgyzstan where the positive effects of remittances declined with increasing farm size. The justification given is that small farmers were more liquidity constrained than households with relatively abundant land and moreover remittances may reduce households' incentives to work that were relatively better-off financially. As far as the type of migration is concerned, de Brauw (2017) found little evidence of an impact of rural-urban migration on farm households' productive investment choices. However, there is stronger evidence in literature on positive effects of international migration in this regard, the idea being this is international migration may lead to larger remittances.

2.3 Data

This study uses the Ethiopian Living Standard Measurement Survey (LSMS) done with technical support from the World Bank by the Ethiopian Central Statistics Agency (CSA) Living Standard Measurement Survey carried out every other year, starting in 2011-12. The survey so far, has been undertaken three times. The first wave of data included only rural and small towns and covered 333 enumeration areas with 3,776 representative households from all regions of the country. The second wave in 2013-14 and the recent round in 2015-16 increased the coverage by including major urban areas, both medium and large cities, and thus 5,262 representative households were

included in the survey.

The units of interest in the survey are individuals, households, and communities in both rural and urban areas. The survey includes a range of socioeconomic and demographic indicators such as household farm and off-farm incomes, consumption, health, education, and migration with a special module on farming activities. This survey is available publicly.[18] Primarily the study uses the latest two rounds of the survey since we can get detailed information on migration.

The survey consisted of five questionnaires. Migration data was recorded in the household questionnaire in the first section, which collected individual information on household members currently abroad or who have migrated to another destination within Ethiopia. For each migrant, the survey reports his/her gender, age, literacy level, relationship with household head, the length of the migration period, destination, and employment. Data for crop incomes is primarily based on the post-harvesting section of the agriculture questionnaire. For each household member engaged in agriculture –for each landholder- the survey reports the area of the field, the types of crops planted, harvest in kg, the proportion of crops sold in kg, the total value of crops sold in the Ethiopian currency, and a host of other variables. Moreover, information on off-farm activities is derived from the labor and time use and non-farm enterprise sections of the survey.

Measuring Migration

This study follows the definition of migrant households as used by other studies on migration (such as, Koc and Onan, 2004), where it is extended to not only include members who live together and have communal arrangements concerning subsistence and other necessities of life but also those members who are residing abroad/locally but whose obligations are to the household. Thus, a migrant household in this study is a household having at least one member who has migrated for employment and who has spent at least three months in the destination area in 12 months preceding the survey.[19],[20]

After eliminating missing values and outliers, a total of 4,222 rural households engaged in

[18] Additional information on the data is available on the website of the Ethiopian Central Statistics Authority, www.csa.gov.et.

[19] A period of three months is the most common in literature (for example, Marie, 2018 used similar definitions).

[20] Households that only sent out migrant less than 15 years of age or individuals who may have left these households for other reasons such as marriage are not considered as migrant households.

cropping are used for our analysis.[21] Among these, 772 were migrant households (around 18 percent) in both the rounds.

Measuring crop incomes, livestock incomes, and participation in off-farm incomes

Like de Brauw's (2014) study in Ethiopia, in this study the gross value of major crops grown by a farm household is calculated by measuring the quantity of each crop grown and then multiplying it by some price, and then summing up the value of all crops produced by each household. To this end, prices are derived from median sales price at the village level, and, if prices were not available at the village level, they were derived from median sale prices at the regional level[22]. In this study household crop income is measured by the gross value of the major crops grown.[23]

Like other studies, livestock income is measured by aggregating earnings from the sale of livestock and livestock products. Moreover a dummy for households' participation in off-farm income activities is derived from: non-farm wage income-wage earned by supplying household labor to engage in outside the farm or/and non-farm self-employment income – income generated from participation in off-farm activities such as by engaging in non-farm microenterprises.

2.4 Theoretical and Empirical Framework

2.4.1 Theoretical Framework[24]

Efforts to explain migration can be categorized into individual and household approaches (Tsegai, 2007). In the first category, the neoclassical microeconomic model (see, Harris and Todaro, 1970; Todaro, 1969; Todaro and Smith, 2006) which oversimplifies migration as an individual utility-maximizing decision has been criticized for its inadequate capacity to understand the diverse types of migration.[25] However, by shifting the focus away from individuals, the new economics of labor migration (NELM) (Stark, 1991; Stark and Bloom, 1985) model conceptualize migration in the

[21] Only households living in rural communities engaged in farming practices, particularly in cropping activities with own land not less than 0.05 ha per household, are used in this analysis.
[22] Ideally the best price to use would be the price that the producer received, but not all households sell their crops.
[23] It is difficult to incorporate all the production types and varying crops at once. Hence, like other studies such as de Brauw (2014) top ten staple crops and three major cash crops are used based on area planted.
[24] This section draws heavily on Taylor et al. (2003)
[25] Also see the expectancy value theory (Fishbein and Ajzen, 1975) and the theory of planned behavior (Ajzen, 1988). Both follow a similar approach by considering migration as an individual decision.

broader context of household members' mutual and interdependent risk-sharing strategies (Stark, 1991; Stark and Bloom, 1985).[26]

Selecting an appropriate theoretical framework is challenging for this study the NELM model is chosen for various reasons. Firstly, in the context of rural Ethiopia, households control the assets and ensure the future of their families and hence are a suitable unit of analysis (De Haan and Yaqub, 2009). Moreover, NELM is appropriate for addressing both the determinants and consequences of migration strategies. [27]

The NELM theory was used among others in studies by de Brauw (2017), Rozelle et al. (2003), and Woutrse and Taylor (2008). According to these studies, whether a farm household invests in a high-return or low-return local activity,[28] is a function, among other determinants, of fixed resources (f) such as labor and land, and a vector of household characteristics (Z_i). Suppose Q_i denotes output from either the high or low activity as i=1, 0 respectively. Given relative prices, a farm household specializes in a high return activity having an output $Q^* = f_1(f, Z_i)$ with corresponding income $Y^*=g(Q^*)$. In the face of market constraints such as lack of formal credit, farm households invest only f_1 of the fixed inputs where $f_1 < f$ given by $C(.)=f_1$ where C(.) represents a constraint. Through remittances (R), migration (M) relaxes credit constraints. On the other hand, with imperfect labor markets, migration could constrain investing in high return activities by reducing labor availability. Thus, according to the NELM theory, households' investments in a high return activities is a function of migration and remittances such that C (M, R) = f_1. Since migration reduces household labor while providing capital for production it can be hypothesized that $C_M < 0$ and $C_R > 0$.

In the context of imperfect markets, we expect the impact of migration on farm production and thus household income to be non-zero. The net effect is ambiguous since the relative magnitude of the derivatives C_M and C_R is unknown a priori. Finding significant positive effects of migration and remittances on any non-migration source of income would mean that migration complements productivity or incomes of migrant-sending households via relaxing credit or risk constraints. Whereas a negative net effect implies that migration worsens labor shortages.

[26]The sustainable livelihoods approach sees migration as a livelihood strategy used by households for fulfilling their substance needs in response to risks and constraining conditions (Ellis, 2000, 2003).
[27] Same theoretical model is applied in studies such as Miluka et al., 2010; Taylor, 1999; Taylor and Wyatt, 1996; Wouterse and Taylor, 2008.
[28] Such as farm versus non-farm, low return cropping activity versus high return.

2.4.2 Empirical Framework

Based on the theoretical framework, by changing the availability of labor and income for migrant sending farm households, migration (M) could affect households' incomes. Following Taylor et al. (2003), farm households' income is affected by M. Hence:

$$\boldsymbol{Y}_{ijt} = \alpha + \beta M_{ijt} + \boldsymbol{X}_{ijt}\boldsymbol{\lambda} + \mu_t + H_i + \varepsilon_{it} \qquad (2.1)$$

where Y_{ijt} is the outcome of interest representing crop income, income from livestock production, and dummy for participation in off-farm income activities by farm household i in community j. M_i is the dummy for migration in household *i*; it is an endogenous binary variable that takes the value 1 if household i has a migrant and 0 otherwise. $\mathbf{X}_{\mathrm{ijt}}$ is a vector of observable community, farm, and household level socioeconomic variables. $\mathrm{H_i}$ and μ_{t} are unobserved household and year fixed effects respectively. Equation 2.1 is estimated for t = 2012-13 and 2015-16 since these are the years in which detailed data on households' migration is available. Parameters β and $\boldsymbol{\lambda}$ represent the effects of migration and other variables on the outcome being modeled respectively. α is an intercept. ε_{it} is assumed to be normally distributed as $N\ (0, \sigma^2)$. The objective is assessing the impact of migration on our outcome variables. The null hypothesis associated with the NELM theory is that migration has no effect on farm households' farm and off-farm incomes, that is, β= 0.

For consistent parameter estimates, a number of econometric issues need to be addressed. First, migration (M_i) is endogeneous. Hence, participation in migration is non-random and thus a selective process. Thus, a probit equation for participation in migration is given by:

$$M_{ijt} = \alpha_0 + \boldsymbol{Z}_{ijt}\boldsymbol{\lambda} + \mu_t + H_i + \xi_{ijt} \qquad (2.2)$$

where M_{ijt} is defined as earlier denoting migration and is a function of individual, household, and community level characteristics ($\boldsymbol{Z}_{ijt}$) and an instrument for household *i*'s participation in migration. $\boldsymbol{\lambda}$ is a vector of parameters.

A causal interpretation of the ordinary least squares (OLS) estimates in Equation 2.1 is inappropriate since M_i is potentially endogenous. A migration decision is not random process. Among other factors it is based on both observable and unobservable characteristics of households. Moreover, simultaneity bias may also be a concern, that is, migration and the outcome variables

need to be determined simultaneously. To address this issue, this study exploits the popular instruments for migration.

Identification Issues

To address the potential endogeneity bias of migration, we used lag of migration prevalence in the community defined as the percentage of households with at least one migrant, as an instrument for migration calculated from the 2011-12 round of the survey.[29] This facilitates migration as it lowers risks and transaction costs of movement by providing information regarding available economic opportunities at the destination (Massey et al., 1993; Mckenzie and Rapoport, 2009).

The remaining regressors included in the model are primarily drawn from literature on farming and migration. Household heads' demographic characteristics such as gender, age, and education levels are included to capture the effects of human capital and risk tolerance on farm households' incomes. Moreover, households' farm size and livestock holdings, which are indicators of their socioeconomic status are bound to affect farm and non-farm incomes. Credit availability is a critical factor that effects farm and non-farm incomes because it relaxes liquidity constraints. The effects of savings and wealth are also captured using the value of household assets. Finally, to account for migration's heterogeneous effects on crop incomes, location and agro-ecological characteristics are also included.

Estimation Strategy

In estimating Equation 2.1 applying the fixed effects model with instruments (FE-IV) could be the most credible way. However, through the within transformation, this estimator drops time invariant variables, which are the variables of interest. Hence, to accommodate the time invariant variables our choice lies on other panel data models.

According to Semykina and Wooldridge (2015) in non-linear panel data models with a short time period such as in this study, the random effects approach is much less robust as it requires serial independence of the errors whereas the pooled method does not as one can simply cluster the standard errors. (Murtazashvili and Wooldridge, 2016; Semykina and Wooldridge, 2015).

[29] The following measure is constructed for each community based on the 2011-12 LSMS: $= \frac{\#\ households\ with\ migrants}{total\ \#\ of\ households\ in\ the\ community}$

Moreover, for robustness checks the pooled OLS is also estimated, which is well advocated by Angrist and Pischeke (2009) and supported by much real-world experience in binary regressions.

To attain the objectives of this study, some type of a two-step approach is required. In the first stage, the endogenous variable, in this case migration, is regressed on the instrument-lag of prevalence of migration in the area and other exogenous variables. In the second stage the predicted probabilities are used in the outcome model. Moreover, alternative estimation methods are also used which are known to produce qualitatively similar results.

2.5 Results and discussion

This section discusses both the descriptive and empirical results. For the empirical results of the impact of migration on farm and off-farm income activities different estimation strategies are applied and presented. Further, as an exploratory exercise sub-sets of the sample are used to understand if migration's effects vary with destinations and land owned. Hence, separate regressions are presented for this.

2.5.1 Descriptive Analysis

Since the objective of this study is analyzing the impact of migration on farm and off-farm household incomes, farm households with own land are divided into four quartiles along per capital land owned. On average, households in the first quartile owned 0.07 ha per capita. Households in the second, third, and fourth quartiles on average owned 0.17, 0.27, and 0.57 ha of land per capita respectively.

Table 2.1 summarizes the migration status of farm households as per the per capita land quartiles. Based on the average sample, relatively many more migrant households were found in the middle land distribution ranges in the panel survey (second and third quartiles). This is a bit different from the idea that migrants are more likely to come from households with lower internal returns to labor. This might be because migration is a costly activity and thus households with less land per capita might be more constrained to participate in migration than households with high land per capita.[30]

[30] Costs associated with migration include transport costs, initial costs for job search, and finding a place to live. For international migrants costs for visas and passports may be substantial and may hinder migration (see, Mckenzie, 2007).

Table 2.1 Distribution of households with migration status across land per capita quartiles

Share of households with:		Land per capita quartiles			
		I	II	III	IV
2014	Migrant HHS	0.16	0.27	0.24	0.32
	Non-migrants HHs	0.27	0.26	0.25	0.22
2016	Migrant HHS	0.24	0.26	0.21	0.30
	Non-migrant HHS	0.25	0.26	0.25	0.24
Average	Migrant HHS	0.19	0.27	0.23	0.32
	Non-migrant HHS	0.26	0.26	0.25	0.23

Source: Author's computations based on survey data.

Table 2.2 compares the share of income between migrant and non-migrant households along per capita land quartiles. Comparing crop incomes between migrant and non-migrant households, migrant households had slightly more crop incomes than non-migrant households. Moreover, the difference widened slightly with an increase in farm size, that is, along with the differences in the land quartile, crop incomes increased for large farms.

Table 2.2 Crop and off-farm incomes with and without migrants across land quartile average for both rounds (in Ethiopian Birr)

Income type	Quartile	Migrant HHS		Non-Migrant HH	
Crop incomes	I	8,639	(6,575)	9,424	(9,386)
	II	14,725	(12,022)	13,350	(13,257)
	III	20,759	(18,661)	19,589	(20,590)
	IV	37,052	(34,187)	31,960	(30,882)
	All HHs	20,293	(20,563)	16,902	(15,078)
Off-farm incomes	I	5,586	(5,444)	4,674	(3,089)
	II	2,947	(2,801)	3,046	(2,785)
	III	2,735	(2,792)	2,511	(2,043)
	IV	3,077	(3,075)	2,848	(2,177)
	All HHs	3,586	(3,438)	3,269	(3,125)

Note: Standard deviations are in parentheses.
Source: Author's computations based on LSMS.

Table A2.1 in Appendix A2 summarizes the independent variables used in the regression.

2.5.2 Empirical Analysis

2.5.2.1 Drivers of migration

An analysis of the impact of migration on farm households' farm and off-farm incomes was initiated by testing for the endogeneity of migration. This was done using the Durbin-Wu-Hausman test as shown in Table A2.2 in Appendix A2 which shows that migration is endogenous.

Table A2.3 in Appendix A2 gives the results of the estimation of migration in Equation 2.2. The error terms are clustered by villages. We estimated the migration equation using pooled probit (Column 1) and pooled OLS (Column 2) methods. Irrespective of the model used, the instrument used for identifying migration 'lagged prevalence of migration in the area' is positive and significant. This implies that the prevalence of migration encourages further migration by information-provision at the source community level and risk-management in the host country (Masey et al., 1993).

Moreover, household level factors which determine migration include the asset index[31] and total land owned in ha which proxy household wealth being strongly correlated with migration. This may be because migration involves significant costs. Household level demographic characteristics such as 'household size' are positively related to the probability of a household's participation in migration. This is mainly because larger households have more labor to allocate across various activities. Though, statistically insignificant, households with access to credit are more likely to participate in migration because credit might soften households' liquidity constraints allowing them to participate in migration.

2.5.2.2 Migration and Farm incomes

Table 2.3 gives the estimates of crop incomes and livestock production equation using three different regression alternatives, the results of which are reported in Columns 1-6: a two-stage OLS; an IV regress model; and a three-stage least squares model are used. In all the three models the instrument for migration is obtained from an OLS migration probability model. According to Angrist (2000) in the case of binary endogenous variables such as in our case an instrumental variable linear probability model yields 'best linear estimates' of average treatment effects . The

[31] The principal component analysis is used to build the asset index.

methods used correct standard errors for the IV procedure and the three-stage least squares method corrects for a correlation between the equations. Irrespective the estimation method followed our findings are reasonably robust. This discussion is based on the 3sls method.

Columns 1-3 in Table 2.3 give the estimates of the crop income equation. Despite reduced labor availability among migrant households following migration; on average migration has no significant effect on farm households' crop incomes irrespective of the type of model used. Hence, this finding in the context of Ethiopia does not support any of the predictions of the NELM theory in which migration is associated with the lost-labor effect. This may imply that households that migrants leave are able to shift resources on the intensive margin to maintain at least the same level of productivity or by substituting capital for labor so that the value of crop production does not change. An alternate and also complementary explanation is that migrants may not have been productive agricultural workers prior to leaving. These findings are in agreement with the findings of other studies in the area such as Quisumbing and McNiven (2010) in the Philippines and Gibson et al. (2011) in Tonga that neither internal or international migration had much of an effect on overall agricultural production/incomes.

Columns 4-6 in Table 2.3 give the estimates of the livestock income equation. Regardless of the models applied, the results show that on average migration has positive and significant effect on livestock production. This result supports the view that remittances from migration fuel farm households' livestock production and thus incomes. In the context of rural Ethiopia, little labor is required for small-scale livestock production and it is likely that one can easily find substitutes within a household with the requisite skills to care for livestock (for example, children tending to animals). Our finding is consistent with earlier findings such as those by Juna et al. (2010) and McCarthy et al. (2006). Yet, it is contrary to studies such as Amina et al. (2013) in Nepal who found that higher income from migrant remittances had a negative impact on livestock output and thus farm incomes.

Crop incomes and livestock production are also affected by household and community level factors. For instance, as per expectations, demographic and household level variables have a significant effect on crop incomes. Households with heads who have higher formal education generate higher crop incomes and these incomes decrease with household heads' participation in off-farm income activities. Further, households with higher wealth proxied by the higher asset-wealth index earn higher crop incomes. This may be because higher wealth may be directly

associated with investments in farm production activities which enhance farm productivity and thus incomes. Moreover, as per expectations, farm households with larger land size are positively related to higher crop incomes. Distance to the nearest market and access to extension services also play a role in rural income generation. Likewise, from the perspective of livestock, total land owned, household head's participation in off-farm income activities, and distance to the nearest market have a significant impact on livestock outputs.

In terms of regional heterogeneity, compared to the control region Tigray, labor out-migration had a negative and significant effect on crop incomes of farm households in Amhara, Oromia, and SNNP. This might be because these regions have relatively higher landholdings per capita and relatively higher quality land suitable for farming compared to the control region. Moreover, these regions are characterized by high prevalence of rural out-migration.

Table 2.3 Estimation results of the impact of migration on crop incomes and incomes from livestock production

	Crop income			Livestock income		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	2 Stage OLS	IV regress	3SLS	2 Stage OLS	IV regress	3SLS
Prediction Migrant household (1=yes)	-1,663.0	-1,657	-1,709	2,408.1*	2,398***	1,190*
	(1,935.3)	(1759.3)	(1636.2)	(1,247.6)	(810.5)	(709.8)
Male head (1=yes)	281.5	282.2	280.5	12.5	11.9	-26.2
	(234.0)	(183.1)	(183.6)	(353.0)	(313.5)	(313.5)
Age of HH head	-3.2	-3.2	-3.021	-9.9	-9.8	-4.5
	(10.4)	(5.8)	(5.6)	(10.9)	(7.7)	(7.7)
Educ. of HH head	124.5**	124.3***	124.3***	20.8	20.7	21.1
	(50.5)	(40.2)	(40.2)	(33.6)	(32.2)	(32.1)
HH head off-employed (1=yes)	-954.9**	-922.4***	-921.2***	259.9***	260.5***	251.0***
	(385.1)	(322.4)	(322.5)	(62.3)	(53.6)	(53.9)
Household size	20.8	21.0	20.6	-290.2	-333.4	-316.4
	(62.2)	(44.81)	(44.6)	(439.5)	(387.6)	(383.5)
Asset wealth index	80.6**	80.2***	80.8***	-8.1	-7.6	-4.1
	(40.2)	(25.72)	(25.7)	(34.1)	(26.4)	(26.2)
Total land owned in ha	689.2***	689.5***	690.3***	533.6***	533.1***	549.8***
	(174.0)	(98.9)	(99.3)	(135.7)	(116.9)	(116.5)
HH has access to credit (1=yes)	-206.7	-199.2	-198.8	-117.0	-127.4	-118.1
	(238.0)	(180.5)	(180.5)	(211.7)	(198.2)	(196.8)
HH access extent. services (1=yes)	400.2*	375.7**	375.4**	-5.3	-5.2	-5.5
	(235.4)	(183.9)	(184.2)	(13.0)	(10.4)	(10.4)
Distan. To nearest mkt. in km	-60.2***	-60.3***	-60.4***	338.3	374.2*	367.8*
	(17.5)	(10.0)	(10.0)	(236.9)	(204.7)	(204.0)
Tigray (control region)						
Amhara	-1,277.5*	-1,277***	-1,274***	-595.1	-594.3	-522.6
	(769.1)	(278.1)	(276.7)	(570.5)	(521.3)	(525.3)
Oromia	-1,112.0	-1,111***	-1,110***	-1,053.2*	-1,052*	-1,029*
	(798.7)	(305.0)	(304.6)	(602.5)	(544.6)	(545.2)
SNNP	-849.3	-850.1***	-851.9***	-1,011.1*	-1,008.0*	-1,051**
	(725.0)	(264.5)	(263.6)	(581.7)	(531.0)	(525.3)
Other_regions	2,696.1**	2,695***	2,695***	707.3	708.7	717.6
	(1,246.7)	(454.0)	(453.9)	(951.8)	(724.9)	(725.8)
Year_dummy (1=2016)	520.1	252.3	249.6	791.1*	407.8*	341.9
	(481.8)	(177.3)	(177.1)	(458.1)	(218.8)	(217.8)
Constant	1,598.6	-506,604	-500,997	504.0	-820,803*	-688,071
	(1,084.4)	(357,566)	(357,041)	(662.6)	(440,836)	(438,730)
Observations	4,222	4,222	4,222	4,222	4,222	4,222
R-squared	0.103	0.088	0.087	0.029	0.026	0.031

Note For regression 1 it is assumed that migration is endogenous. Using predictions from 1st stage OLS from Table A2.4, weighted and clustered for survey correction.

2.5.2.3 Migration and Participation in off-farm income activities

Table 2.4 gives the results of farm households participation in off-farm income activities using three different specifications, the results of which are reported in Columns 1-3: a two-stage probit model; an IV linear probability model; and a three-stage least squares linear probability model. In the two linear probability models the instrument for migration is obtained from an OLS migration probability model. Errors are clustered by villages. Our findings are reasonably robust with respect to the estimation methods used. The results are discussed based on the 3sls model.

The results show that the impact of migration on farm households' participation in off-farm income generating activities is positive and statistically significant. On average, migration enhances households' participation in off-farm income generating activities. More specifically, migration leads to a 26 percent higher likelihood of participating in this activity. This implies that the lost-labor effect associated with migration does not affect farm households' participation in non-farm income generating activities. Likewise, as per expectations, remittance incomes from migration may help farm households overcome entry barriers that would otherwise prevent them from engaging in non-farm self-employment activities.

Other household level factors that affect households' participation in off-farm income activities include demographic and household level variables. For instance, household size positively and significantly affects participation in off-farm income generating activities. This is mainly because larger households have more labor to allocate across various activities. However, households with older heads who have a larger number of dependents (number of children < 15) have lower probability of participating in off-farm income activities. Moreover, access to extension services is negatively related to participation in off-farm income generating activities.

Overall, the findings of our study have two major implications. First, rural farm households in Ethiopia use migration and remittances for diversifying their income sources by increasing participation in non-farm income generating activities. Moreover, they also enhance their incomes by rearing livestock. These findings support the basic tenets of income diversification, according to which in addition to crop production farm households also engage in non-farm income-generating activities. This helps mitigate income shocks by diversifying households' portfolios and they can earn extra income to finance farm investments. However, these findings do not imply

that migration is used by rural farm households at least in Ethiopia as an avenue for leaving the agriculture sector.

Table 2.4 Second-stage household activities-- Choice regressions-participation in off-farm income generating activities.

VARIABLES	(1) 2-Stage Probit (marginal effect)	(2) IV regress	(3) 3sls
Prediction Migrant household (1=yes)	0.242**	0.337***	0.255***
	(0.107)	(0.070)	(0.063)
Male head (1=yes)	0.028	0.030*	0.028*
	(0.023)	(0.017)	(0.015)
Age of HH head	-0.004***	-0.0040***	-0.004***
	(0.000)	(0.0005)	(0.001)
Educ. of HH head	-0.003	-0.003	-0.003
	(0.003)	(0.002)	(0.002)
Household size	0.01***	0.014***	0.013***
	(0.004)	(0.003)	(0.003)
Dependency ratio	-0.048	-0.039**	-0.038*
	(0.036)	(0.002)	(0.021)
Asset wealth index	-0.0003	-0.0003	-0.000
	(0.002)	(0.002)	(0.002)
Total land owned in ha	-0.004	-0.006	-0.005
	(0.007)	(0.005)	(0.005)
HH has access to credit (1=yes)	0.005	0.780***	-0.007
	(0.018)	(0.017)	(0.017)
Steepy slope land (1=yes)	-0.029	-0.029**	-0.028*
	(0.024)	(0.014)	(0.015)
Distan. to nearest mkt. in km	0.001	0.0009	0.001
	(0.001)	(0.0007)	(0.001)
HH access extent. services (1=yes)	-0.034**	-0.029**	-0.030**
	(0.015)	(0.013)	(0.013)
Tigray (control region)			
Amhara	-0.017	-0.022	-0.017
	(0.048)	(0.024)	(0.023)
Oromia	0.0267	0.0067	0.008
	(0.007)	(0.025)	(0.024)
SNNP	0.049	0.074***	0.071***
	(0.169)	(0.022)	(0.022)
Other_regions	0.140***	0.152***	0.152***
	(0.049)	(0.026)	(0.026)
Year_dummy (1=2016)	-0.007	0.0036	-0.001
	(0.036)	(0.017)	(0.017)
Constant	-	-7.017	1.933
		(34.490)	(33.820)
Observations	4,222	4,222	4,222

Note: * significant at 10%; ** significant at 5%; and *** significant at 1%

(1) Probit assuming that migration is endogenous; using predictions from the 1st stage probit model in Table A2.3, weighted and clustered for survey corrections.

(2) Survey corrected instrumental variables' linear probability model.

(3) Three-stage least squares linear probability model.

2.5.2.4 Heterogeneity

An important source of heterogeneity is related to households' landholdings since households with more per capita land might have higher marginal returns to labor, and hence a higher lost-labor effect. This is associated with higher effects on crop incomes. On the other hand, households with less per capita land might be less constrained by the labor-lost effect. Further, the effect of remittances might also differ for households with different asset endowments and thus different liquidity and insurance positions because the positive impact of remittances is not expected to be homogeneous across farmers and depends on how constraints are distributed among them. To investigate heterogeneity along the land gradient, we split the sample at the median per capita land holdings in each enumeration area (EA), and re-estimated the crop equation using both households with below and above median landholdings.

Table 2.5 gives the results of three model: a two-stage OLS; an IV 2sls model; and a three-stage least squares model (Columns 1-6): the first three columns give estimation results of households below the median per capita landholdings level while Columns 4- 6 give the results for households above the median per capita landholdings level.

The findings show that depending on the farm households' land size, migration has differentiated effects on crop incomes. Migration is found to be statistically insignificant in effecting crop incomes of those households which own below the median per capita land. This implies that the labor-lost effect is neither associated with migration nor that remittances from migration are important in effecting crop incomes for this category of small farm households. However, the effect of migration on crop incomes is found to be negative and statistically significant for households above the median land distribution. Based on the results of the 3sls method the coefficient estimate of crop income is around 3,900 Birr, suggesting that on average migration is associated with lower crop income for this category of households by about 3,900 Birr. This finding implies that the labor-lost effect induced by migration has a disproportionately higher negative effect on crop incomes as compared to small farm households. This finding shows that households with larger land size or households where farmers own land above the median average are more labor constrained than households that own relatively smaller pieces of land. Moreover, an alternate but complementary explanation might be that remittances may have a negative effect on work incentives for households that are already relatively well-off. This finding is contrary to

Marie's (2018) finding in Uganda as she found that overall effects of internal migration were positive, but the effects were negative for most small farmers. Our finding is in line with Aziz and Marrit's (2011) finding in the Kyrgyz Republic that small farmers with small land sizes benefited more from migration than better-off households with larger land sizes.

Another important source of heterogeneity is the type of migration. To investigate heterogeneity along migration destinations we split the sample into internal and international migrant households and re-estimated the equations for the sub-sample of internal migrant households.[32] Table A2.4 in Appendix A2 gives the results for the sub-sample of internal migrants and the findings show that there is no statistically significant effect of internal migration on crop incomes.

[32] Since we have a relatively small number of international migrant farm households in the dataset, we only give the results of internal migrant households which give some insights.

Table 2.5 Estimation results of the impact of migration on crop incomes for below and above median land distributions

VARIABLES	(1) 2 Stage OLS	(2) IV-regress	(3) 3sls	(4) 2 Stage OLS	(5) IV-regress	(6) 3sls
Prediction of Migrant household (1=yes)	895.5	802.2	424.7	-3,655.0	-4,020.0***	-3,914.0***
	(2,453.6)	(1,118)	(885.1)	(2,228.0)	(1,058.0)	(953.4)
Male head (1=yes)	331.4	348.9	325.0	23.9	37.5	39.9
	(384.8)	(313.2)	(311.2)	(252.8)	(240.9)	(240.3)
Age of HH head	-27.6*	-28.4***	-26.05***	14.3	12.7*	12.4*
	(14.2)	(10.4)	(10.0)	(12.5)	(6.7)	(6.6)
Educ. of HH head	113.8	112.7*	114.3*	134.1**	131.3**	131.5**
	(75.2)	(62.4)	(62.8)	(63.8)	(51.2)	(51.4)
HH head off-employed (1=yes)	-478.6	-549.3	-514.0	-1,281.0***	-1,395.0***	-1,392.0***
	(651.3)	(661.0)	(652.2)	(490.2)	(332.9)	(330.3)
Household size	38.9	39.7	35.8	2.3	-0.3	0.356
	(102.3)	(77.3)	(77.0)	(51.6)	(48.0)	(47.7)
Asset wealth index	101.3*	102.9***	103.5***	67.7*	70.2**	69.8**
	(60.2)	(38.3)	(38.3)	(40.2)	(34.0)	(33.8)
Total land owned in ha	566.7**	568.6***	573.8***	1,254.0**	1,579.0***	1,567.0***
	(219.7)	(137.9)	(139.0)	(502.6)	(408.5)	(407.2)
HH has access to credit (1=yes)	-424.8	-447.1*	-434.8*	80.2	20.1	21.6
	(366.8)	(261.6)	(260.6)	(260.6)	(244.7)	(244.4)
HH has access extent. services (1=yes)	81.4	105.9	98.7	640.0**	661.0**	659.6**
	(368.7)	(251.1)	(253.9)	(257.3)	(277.2)	(277.0)
Distance to nearest mkt. in km	-58.5**	-57.6***	-58.1***	-62.9***	-59.52.0***	-59.8***
	(25.3)	(14.8)	(14.1)	(23.1)	(14.2)	(14.2)
Tigray (control region)						
Amhara	-2,385.5*	-2,399.0***	-2,369.0***	-83.4	-187.5	-191.0
	(1,228.0)	(463.9)	(458.7)	(324.3)	(241.9)	(238.8)
Oromia	-2,064.8*	-2,061***	-2,053.0***	-122.7	-96.8	-98.0
	(1,249.4)	(499.8)	(497.7)	(347.4)	(273.1)	(271.1)
SNNP	-1,597.0	-1,575***	-1,601.0***	174.0	226.5	228.5
	(1,207.2)	(468.5)	(465.9)	(319.5)	(219.1)	(216.7)
Other_regions	2,047.7	2,030***	2,041.0***	3,590.0***	3,497.0***	3,498.0***
	(1,778.5)	(760.0)	(758.5)	(1,234.0)	(493.1)	(493.0)
Year_dummy (1= 2016)r	633.2	317.3	297.0	736.8	355.6	361.0
	(654.4)	(248.6)	(249.3)	(580.8)	(240.4)	(239.8)
Constant	3,694.6**	-635,292.0	-594,508.0	-486.8	-716,609.0	-727,494.0
	(1,791.0)	(501,229.0)	(502,685.0)	(655.0)	(484,594.0)	(483,381.0)
Observations	2,112	2,112	2,112	2,110	2,110	2,110
R-squared	0.090	0.085	0.088	0.116	0.101	0.106

Note: For regression 1 it is assumed that migration is endogenous. Using predictions from the 1st stage OLS from Table A2.4, weighted and clustered for survey corrections.

2.6 Conclusion and Recommendations

Using panel data from the 2013-14 and 2015-16 rounds of the Ethiopian Living Standard Measurement Survey (LSMS), this study examined the impact of migration and the resultant remittances on farm households' crop and livestock incomes. It also studied migration's effect on households' participation in off-farm income generating activities in the context of rural Ethiopia. In addition, we tested whether these effects varied across different farm sizes and types of migration using a more pragmatic two-step approach for dealing with the issue of endogeneity.

The findings show that losing productive members following migration does not induce a substantial loss in crop incomes. This probably might be because Ethiopia has long faced severe problems of land scarcity and a dwindling farm sizes[33] so there is no lost-labor effect. This is not surprising. However, the effect turns negative and statistically significant when only households that have landholdings above the EA level median average are included in the regression. This shows that households with more per capita land are more likely to be labor constrained and thus in the absence of rural labor markets the effect of labor out-migration may be more pronounced for this group of households. Thus, the effects of migration are heterogeneous across land sizes. However, the effects remain consistent for the sub-sample of internal migrant households.

On the other hand, the effect of migration on livestock incomes is positive and significant. This means that migrant households might use remittance incomes from migration to stimulate livestock production thus diversifying their income sources. Likewise, from the perspective of participation in off-farm income activities, migration has a positive and significant effect on livestock production. This shows that farm households in rural Ethiopia use migration and remittances for diversifying their income sources but do not use these remittances to leave back-bending farming activities. These findings should encourage policymakers in Ethiopia to revisit some of the policies which could explicitly or implicitly hinder rural out-migration.

Based on the findings the following specific policy recommendations are made. The government should design programs that create employment opportunities for unemployed youth in rural areas outside the villages. For instance, youth revolving funds implemented in major urban areas to reduce urban unemployment can be replicated in the rural areas of the country. Such programs might do

[33] For example, during 2011-12, more than half the households in Ethiopia cultivated less than one ha of land (CSA, 2012).

well since they are not likely to affect agricultural productivity. Further, if remittances can be fostered, there will be a good chance of increasing agricultural productivity through migration as small farm households in Ethiopia are highly liquidity and insurance constrained. Hence, the government should promote hassle free and cheap money transfer mechanisms such as mobile banking.

The conclusions and policy recommendations will be a little different without accounting for heterogeneity between households. Overall study findings show that studies on the impact of migration on sending economies should account for such potentially heterogeneous effects.

References

Ajzen, I. (1988). *Attitudes, personality and behavior*. Chicago: Dorsey Press.

Amina, M. , Siegfried, B., and Knerr, B. (2013). Migration for labor and its impact on farm production in Nepal. Working Paper IV, Center for the Study of Labor and Mobility, Nepal.

Amuedo-Dorantes, C., and Pozo, S. (2006). Migration, Remittances, and Male and Female Employment Patterns. *The American Economic Review, 96(*2*),* 222-226.

Angrist, J. (2000). Estimation of Limited-Dependent Variable Models with Dummy Endogenous Regressors: Simple Strategies for Empirical Practice. *National Bureau of Economic Research Technical Working Paper* 248. Available at: http://www.nber.org/papers/TO248.

Angrist, J., and Pischeke, J.S. (2009). *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press.

Atsede, D.T., and Marianne, P. (2016). Determinants of rural out-migration in Ethiopia: Who stays and who goes? *Demographic Research. 35(*34*)*, 1011-1044. Available at: http://www.demographic-research.org/Volumes/Vol35/34/.

Aziz, A., and Marrit, V. d. B. (2011). Heterogeneous Effects of International Migration and Remittances on Crop Income: Evidence from Kyrgyz Republic. *World Development*, Elsevier, vol. 40(3), pages 620-630.

Belay, K. (2004). Resettlement of peasants in Ethiopia. *Journal of Rural Development, 27*(Winter), 223-254.

Berhanu, B., and White, M. (2000). War, famine, and female migration in Ethiopia, 1960-1989. *Economic Development and Cultural Change, 49(*1*),*91-113.

Bezu, S., and Holden, S. (2014). Are rural youth in Ethiopia abandoning agriculture? *World Development, 64,* 259-271.

Castles, S. (2010). Understanding global migration: A social transformation perspective. *Journal of Ethnic and migration Studies, 36(*10*),* 1565-1586.

Central Statistical Agency of Ethiopia (CSA) (2010). *The 2007 Population and Housing Census of Ethiopia. National statistical report*. Addis Ababa: CSA.

Central Statistical Agency (CSA) (2013). *Ethiopian Agricultural Sample Survey. Technical Report*. Addis Ababa: CSA.

Castles, S. (2010). Understanding global migration: A social transformation perspective. *Journal of Ethnic and migration Studies, 36(*10*),* 1565-1586.

de Brauw, A. (2010). Seasonal Migration and Agricultural Production in Vietnam. *Journal of Development Studies, 46(*1*),* 114-139.

de Brauw, A. (2014). Migration, Youth, and Agricultural Productivity in Ethiopia. 2015 Allied Social Sciences Association (ASSA) Annual Meeting, January 3-5, 2015, Boston, Massachusetts 189684, Agricultural and Applied Economics Association.

de Brauw, A. (2017). Rural-Urban Migration and Implications for rural production. *Bio-based and Applied Economics, 6(3), 229-242.*

de Brauw, A., and Giles, J. (2008). Migrant Labor Markets and the Welfare of Households in the Developing World: Evidence from China. *Policy Research Working Paper No. 4585*, The World Bank, Washington, DC.

De Haan, A., and Yaqub, S. (2009). Migration and poverty: Linkages, knowledge gaps and policy implications. *Geneva: United Nations Research Institute for Social Development (Social Policy and Development Program, Paper Number 40.*

Ellis, F. (2000). The determinants of rural livelihood diversification in developing countries. *Journal of Agricultural Economics, 51(2),* 289-302.

Ellis, F. (2003). A livelihoods approach to migration and poverty reduction. *Norwich: Department for International Development (DFID) (No. CVTR-034890).*

Filmer, D., and Pritchett, L. H. (2001). Estimating wealth effect without expenditure data – or tears: an application to educational enrollments in states of India. *Demography* 38: 115–32.

Fishbein, M., and Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and Research*. Reading, MA: Addison-Wesley.

Gibson, J., McKenzie, D. and Stillman, S. (2011). The Impacts of International Migration on Remaining Household Members: Omnibus Results from a migration lottery Program. *Review of Economics and Statistics, 93(*4*),* 1297-1318.

Gibson, J., McKenzie, D. and Stillman, S. (2013). Accounting for Selectivity and Duration-Dependent Heterogeneity When Estimating the Impact of Emigration on Incomes and Poverty in Sending Areas. *Economics Development and Cultural Change, 61(*2*),* 247-280.

Gray, C., and Mueller, V.(2012). Drought and population mobility in rural Ethiopia. *World Development, 40(*1*),* 134-145.

Harris, J., and Todaro, M. (1970). Migration, unemployment and development: A two sector analysis. *The American Economic Review, 60(*1*),* 126-142.

Hammond, L. (2008). Strategies of invisibilization: How Ethiopia's resettlement program hides the poorest of the poor. *Journal of Refugees Studies, 21(*4*),* 517-536.

Kassie, G.T., Asfaw, W., Zeleke, G., and Scott, D. (2008). *The nexus of migration, HIV/AIDS and food security in Ethiopia*. Washington, DC: IFPRI (Renewal Working Paper).

Kilic, T., Carletto, C., Miluka, J., and Savastano, S. (2007). Rural non-farm income and its impact on Agriculture: Evidence from Albania. *Agricultural Economics, 40,* 139-160.

King, R. (2012). Theories and typologies of migration: An overview and a primer. Malmo, Sweden*: Malmo Institute for Studies of Migration, Diversity and Welfare (MIW) (Willy Brandt Series of Working Papers in International Migration and Ethnic Relations 3/12).*

Koc, I., and Onan, I. (2004). International migrants' remittances and welfare status of the left-behind families in Turkey. *International Migration Review, 38(*1*)*, 78-112.

Kyle, D. (2000). Transnational Peasants: Migration, Networks, and Ethnicity in Andean Ecuador. Baltimore-Maryland: The Johns Hopkins University Press.

Kuschminder, K., and Siegel, M. (2014). *Migration and Development: A world In Motion Ethiopia. Country Report.* Maastricht: UNU-MERIT. Available at: *http://www.unu.edu/publications/uploads/1389627443.pdf.*

Lee, L.F. (1981). "Simultaneous Equation Models with Discrete and Censored Dependent Variable", in C.F.

Lucas, R. (1987). Emigration to South Africa's Mines. *The American Economic Review, 77(*3*),* 313-330.

Marie, A. D. (2018). Incentives to Labor Migration and Agricultural Productivity: the Bayesian Perspective. *WIDER Working Paper 2018/45*.

Massey, D.S., Arango, J., Hugo, G., Kouaouci, A., Pellegrino, A., and Taylor J. E. (1993). Theories of International Migration: A Review and Appraisal. *Population and Development Review, 19(3),* 431-466.

Mberu, B.U. (2006). Internal migration and household living conditions in Ethiopia. *Demographic Research, 14(*21*),* 509-540.

McKenzie, D. (2007). Paper Walls are Easier to Tear Down: Passport Costs and Legal Barriers to Migration. *World Development, 35(11),* 2026-2039.

McCarthy, N., Carletto, C., Kilic, T., and Davis, B. (2009). Assessing the Impact of Massive Out-Migration on Albanian Agriculture. *European Journal of Development Research, 21,* 448-470.

Mckenzie, D., and Rapoport, H. (2009). Network effects and the dynamics of migration and inequality: Theory and evidence from Mexico. *Journal of Development Economics, 84 (*1*),* 1-24.

Miluka, J., Carletto, C., Davis, B., and Zezza, A. (2010). The Vanishing Farms? The Impact of International Migration on Albanian Family Farming. *Journal of Development Studies, 36(4),* 625-640.

Murtazashvili, I. and Wooldridge, J. M. (2016) - A control function approach to estimating switching regression models with endogenous explanatory variables and endogenous switching. *Journal of Econometrics,* Elsevier, vol. 190(2), pp 252-266.

Pribilsky, J. (2007). *La Chulla Vida: Gender, Migration, and the Family in Andean Ecuador and New , Migration, and the Family in Andean Ecuador and New York City*. Syracuse: Syracuse University Press.

Quisumbing, A. R., and McNiven, S. (2010). Moving forward and Looking Back: The Impact of Migration and Remittances on Assets, Consumption, and Credit Constraints in the Rural Philippines. *Journal of Development Studies, 46(*1*),* 91-113.

Rozelle, S., Taylor, J. E., and de Braw, A. (1999). Migration, Remittances, and Agricultural Productivity in China. *The American Economic Review, 89(*2*),* 287-292.

Semykina, A. and Wooldridge, J. M. (2015) - Binary response panel data models with sample selection and self-selection. *Journal of Applied Econometrics*, Wiley Online Library.

Stark, O. (1982). Research on rural-to-urban Migration in LDCs: The Confusion Frontier and Why We Should Pause to Rethink A fresh. *World Development,* 10(1), 63-70.

Stark, O. (1991). *The Migration of Labor.* Cambridge, MA: Basil Blackwell, Inc.

Stark, O., and Bloom, D. E. (1985). The new economics of labor migration. *The American Economic Review 75*, 173-178.

Stark, O., and Levhari, D. (1982). On Migration and Risk in LDCs. *Economic Development and Cultural Change, 31(1), 191*.

Taylor, J. E. (1999). The New Economics of Labor Migration and the role of Remittances in the Migration Process. *International Migration, 37(*1*),* 63-88.

Taylor, J. E., Rozelle, S., and de Braw, A. (2003). Migration and income in source communities: A new economics of labor migration perspective from China. *Economic Development and Cultural Change, 52(*1*),* 75-101.

Taylor, J.E., and Wyatt, T. J. (1996). The shadow value of migrant remittances, income and inequality in a household-farm economy. *Journal of Development Studies 32,* 899-912.

Todaro, M. P. (1969). A model of labor migration and urban unemployment in less developed countries. *The American Economic Review, 59,* 139-149.

Todaro, M.P., and Smith, S. C. (2006). *Economic Development, 9th edition,* Boston: Pearson Addison Wesley.

Tsegai, D. (2007). Migration as a household decision: what are the roles of income differences? Insights from the Volta basin of Ghana. *European Journal of Development Research, 19(*2*),* 305-326.

Woutterse, F. and Taylor, J. E. (2008). Migration and Income Diversification: Evidence from Burkina Faso. *World Development, 36 (*4*),* 625-640.

Appendix A2

Table A2.1 Summary statistics of the variables used in the regression

Variable	Mean	Std. Dev.
Migrant household (1=yes)	.183	.387
Annual crop income in birr	17371.1	15337.7
Annual income from sale of livestock in birr	2583.2	7242.2
Household engaged in off farm income active. (1=yes)	.220	.413
Household Head is male (1=yes)	.810	.390
Age of HH head (in number)	46.3	14.6
Education of head (in years)	1.56	2.89
Household head is employed in off-farm activities. (1=yes)	.044	.204
Household size (in number)	5.45	2.21
Number of children < 15 years of age	2.44	1.71
Number of HH members >65 years of age	.230	.490
Asset wealth index	.36	4.79
Total land in hectares owned	1.33	1.31
Tropical Livestock Unit (TLU)	3.47	3.27
Household has access to credit (1=yes)	.45	.41
Household has access to extension serv. (1=yes)	.80	.45
Steepy slopped land (1=yes)	.25	.43
Distance to the nearest market in Kms.	6.6	9.5
Instrument for Migration		
Lag of Migration prevalence in the Community	.43	.23
Observations	4222	

Table A2.2 IVS tests

	Crop Income	Income from Livestock production	Participation in Off-farm income
DWH test F (1, N)	5.070	10.680	24.120
P-value	0.002	0.000	0.000

Source**:** Author's computations using survey data.

Table A2.3 First-Stage Prediction of Migration

VARIABLES	(1) Pooled Probit	(2) Pooled OLS
Household head is male (1=yes)	-0.115	-0.024
	(0.076)	(0.018)
Age of HH head	0.014***	0.0036***
	(0.002)	(0.0005)
Education of head (in years)	-0.010	-0.0011
	(0.011)	(0.002)
Household size	0.023	0.0069**
	(0.015)	(0.003)
Asset wealth index	0.007	0.0026**
	(0.005)	(0.001)
Total land owned in hectares	0.059***	0.0129**
	(0.020)	(0.005)
HH access credit (1=yes)	0.046	0.0058
	(0.067)	(0.016)
Distance to the nearest market in km	-0.002	-0.00012
	(0.003)	(0.0006)
Lag of mig. prevalence (instrument)	2.037***	0.452***
	(0.194)	(0.037)
Location (Tigray-control region)		
Amhara	-0.038	-0.001
	(0.138)	(0.028)
Oromia	-0.112	-0.024
	(0.154)	(0.031)
SNNP	-0.138	-0.020
	(0.134)	(0.026)
Other_regions	-0.104	-0.018
	(0.140)	(0.028)
Year_dummy (1=2015/6)	-0.786***	-0.179***
	(0.122)	(0.030)
Constant	-1.971***	-0.034
	(0.183)	(0.043)
Observations	4,222	4,222
R-squared		0.128

Note: Regression corrected for survey design where possible and, where not possible the regression is weighted to correct for the survey design and errors are clustered by EAs.

Robust standard errors in parentheses.
*Significant at 10%, ** significant at 5%; and *** significant at 1%.

Table A2.4 Estimation results of the impact of migration on crop incomes
(for sub-sample of internal migrants)

VARIABLES	(1) 2 stage OLS	(2) IVregress	(3) 3sls
Migrant household (1=yes)	-1,465.0	-1,735.0	-1,872.0
	(1,985.8)	(9374.4)	(7734.4)
Male head (1=yes)	294.0	303.7	300.9
	(239.0)	(186.2)	(187.5)
Age of HH head	-3.8	-2.646.0	-2.053.0
	(10.6)	(6.3)	(6.004.0)
Educ. of HH head	126.9**	126.6***	126.6***
	(50.7)	(40.5)	(40.6)
HH head off-employed (1=yes)	-977.8**	-927.9***	-923.5***
	(391.4)	(326.2)	(326.9)
Household size	22.8	19.6	18.4
	(63.1)	(45.8)	(45.7)
Asset wealth Index	82.0**	81.9***	82.6***
	(40.8)	(26.0)	(26.1)
Total land owned in hectares	683.9***	691.5***	693.7***
	(174.4)	(99.2)	(100.1)
HH has access to credit (1=yes)	-195.0	-194.1	-193.8
	(241.0)	(182.5)	(183.2)
HH access extent. services (1=yes)	391.7*	366.7**	365.7*
	(235.7)	(186.1)	(186.9)
Distan. To nearest mkt. in km	-60.2***	-59.9***	-59.9***
	(17.7)	(10.1)	(10.1)
Tigray (control region)			
Amhara	-1,380.6*	-1,345.0***	-1,335.0***
	(789.0)	(291.0)	(288.6)
Oromia	-1,204.5	-1,167***	-1,161.0***
	(816.6)	(315.0)	(314.3)
SNNP	-914.5	-886.6***	-888.0***
	(741.4)	(269.3)	(269.9)
Other_regions	2,690.2**	2,702***	2,704.0***
	(1,275.2)	(466.9)	(467.5)
Year_dummy (1=2016)	574.5	252.3	243.6
	(489.0)	(183.2)	(182.2)
Constant	1,622.7	-506,453.0	-488,964.0
	(1,101.5)	(369,350.0)	(367,395.0)
Observations	4,141	4,141	4,141
R-squared	0.104	0.087	0.085

Note: For regression 1 assuming that migration is endogenous. using predictions from the 1st stage OLS from Table A2.4, weighted and clustered for survey correction.

Chapter Three

Gender Impact of Migration on Agricultural Technology Adoption and Child Nutrition in Ethiopia

Abstract

Migration is intensifying and is no longer a male dominated activity. A growing body of literature investigates its impact on various development outcomes. However, only a few studies use a gender perspective. This study examines whether gender matters in the impact that migration has on rural households' productivity enhancement choices. It uses a multinomial endogenous switching regression model based on the panel datasets of the World Bank Living Standards Measurement Survey (LSMS). This paper examines whether gender matters as far as the impact of migration on rural households' productivity enhancement choices is concerned, namely *technology adoption* and *child health* measured by child stunting and wasting. The findings show that migration has gender-differentiated effects on child growth but its impact on technology adoption is gender neutral. On average, child health improves in male migrant households and it declines slightly in female migrant households. However, whether males or females migrate, the effect is positive on technology adoption. Hence, the findings show that a gender disaggregated framework should be considered for comprehensively understanding the impact of migration on the well-being of source families.

Keywords: Migration, Gender, farm technology adoption, child nutrition

JEL Classification Codes. J61, Q12, O13, I31

3.1 Introduction

How does the gender of migrants' impact on-farm technology adoption and child nutrition of the farm households' who are left behind? Literature on gender and farming in Africa suggests that in agriculture, male and female labor is not interchangeable (Aredo, 1995; Diksha and Rada, 2013; Doss, 1999). Further, differences in gender productivity and variations in gender roles affect the magnitude of the lost-labor effects associated with migration which might differ depending on who migrates and what activities are performed by those who are left behind. Migration is rising owing to globalization and demographic changes in advanced countries, and it is no longer dominated male.[34] Migration entails intra-household labor reallocations and its effect on the farming system and thus technology adoption, as well as child nutritional outcomes might depend on who migrates, a male or a female.

Integrating a gender perspective in development policies and programs can contribute to their efficacy and sustainability (Ramirez et al., 2005). Migration can be an important driver in improving households' welfare. However, most migration studies ignore gender perspective. Consequently, the actual link between gender, migration, and source households' well-being is almost missing (de Brauw, 2017; Pfeiffer and Taylor, 2007). It is, therefore, more insightful to investigate the issue using a gender perspective to understand if technology adoption/child nutrition vary between these two groups of households in the absence of a perfect labor market. This study provides new empirical evidence on this issue.

This study contributes to literature by investigating the gender differential effect of migration on farm technology adoption and child nutritional outcomes in the context of rural Ethiopia. The question of whether gender matters as far as the impact of migration is concerned motivates this study. In this respect, the Ethiopian case is interesting for two main reasons. Firstly, a relatively large proportion of the population continues to live in rural areas with subsistence agriculture using backward technologies as their main source of livelihood and there is high prevalence of child malnutrition (38 percent and 10 percent of the children under 5-years of age were stunted and wasted in 2016 respectively) according to a CSA and ICF (2016) report. Secondly, there has recently been a strong feminization of migration in Ethiopia and also in its rural areas (Kuschminder, 2014;

[34] In today's world female migrants constitute around 50 percent of the total 250 million or so international migrants where most moved from and within developing countries (The World Bank, 2016).

MoLSA, 2012-13). Further, there is high potential for rural out-migration with returns as high as 110 percent (de Brauw et al., 2014).

The focus of this chapter is on understanding whether farm technology adoption/child nutrition in source households is influenced by a migrant's gender. For this it considers two groups of households: female and male migrant households.

This study uses the World Bank Living Standards Measurement Study (LSMS) data collected by the Ethiopian Central Statistics Authority (CSA) every second year since 2011-12 (2011-12, 2013-14, and 2015-16). Adopting a multinomial endogenous switching regression model, the study found that migration had a gender-differentiated effect on *child stunting* and *child wasting*, but not on the adoption of labor-intensive farm technologies. On average, child malnutrition slightly declined for male migrant households but somewhat deepened for female migrant households. Conversely, irrespective of who migrated, a male or a female, on average the effect was positive on technology adoption. This result shows that a gender disaggregated framework should be considered to understand effects of migration otherwise findings are unreliable to design policies to mitigate negative effects and enhance positive ones.

The rest of this chapter is structured as follows. The next section briefly reviews literature on migration and technology adoption/child nutrition. Section 3 discusses the data and descriptive statistics. Section 4 describes the theoretical framework and the empirical strategy followed while Section 5 discusses the results. The last section gives a conclusion and some policy implications of the findings of the study.

3.2 Literature review

We examine the extent to which left behind households' farm technology adoption and child nutrition are linked to labor out-migration by drawing on insights from literature. From the point of view of economic development, looking at the impact of migration on source households' poverty livelihood strategies, food security, and other welfare indicators are central for developing countries. Different studies show that migration has a positive effect on the standard of living of migrant households (Adams and Cuecuecha, 2010; Adams and Page, 2005). However, the particular dynamics of migration and its effects on long-term and sustainable growth have been debated for long. Some scholars argue that migration leads to a withdrawal of human capital and has an adverse effect on rural economies (such as, De Haas, 2006). Others argue that migration and remittances

serve as an important source of investment capital in countries where households have no or only limited access to credit and insurance markets (Richter, 2008; Wouterse, 2010).

Only a few studies have analyzed the impact of migration on technology adoption (Kaninda, 2014 in Kenya; Mendola, 2006 in Mexico; and Quinn, 2009 in Bangladesh). Kaninda's (2014) study is based on cross-section data from rural Kenya using a three-stage least squares method. It found that migration and remittances positively affected the adoption of new farm technologies. Quinn (2009) found that migration had a positive impact on agricultural investments as it reduced credit and risk constraints faced by farming households. However, this positive impact depended on the amount of remittances received by source households. Mendola's (2006) study in Mexico established that international migration had a positive impact on the adoption of high-yielding seed varieties, but this was not the case for internal migration.

However, no study, including the ones mentioned here has used a gender disaggregated framework for capturing the effect of migration on technology adoption. Numerous studies show that credit constraints, risks and uncertainties, and labor availability are responsible for the low rates of technology adoption (Doss and Morris, 2000; Gilbert et al., 2002; Peterman et al., 2011; Thapa, 2008; Tiruneh et al., 2001). Moreover, labor quality in terms of age and gender plays an important role in technology adoption (Anouka and Katrine, 2015). Further, literature on gender and farming in Africa suggests that men and women's labor are not interchangeable (Aredo, 1995; Diksha and Rada, 2013; Doss, 1999). This may explain the differential impact of male migration vis-à-vis female migration on agricultural technology adoption by source households.

Another strand of literature picks up on the latter theme, focusing on the impact of migration on child nutritional outcomes. Child nutrition is a crucial area of welfare improvement and long-term development. Nutritional improvements in children reduce mortality and increase adult heights (Alderman et al., 2006), which enhances productivity. Moreover, through its impact on education, child nutrition also affects a country's socioeconomic development in the long run. Child nutrition is a complex process. Empirical evidence from low income countries shows a number of key determinants of child nutritional outcomes: household income (Skoufias, 1998) and food security (Reis, 2012); parental education (Thomas et al., 1991); sibling rivalry (Garg and Morduch, 1998); and local infrastructure availability such as electricity, piped water, and modern sewerage (Thomas and Strauss, 1992).

Existing literature, much of it recent, has generally found that the effects of migration on child

nutrition of source households are mixed. For instance, studies such as those by Jayatissa and Wickramage (2016) in Sri Lanka; Anton (2010) in Ecuador; Azzarri and Zezza (2011) in Tajikistan; and Carletto et al. (2011) in Guatemala found an overall positive effect of migration and remittances on child nutrition while studies such as those by Davis and Brazil (2016) in Guatemala and Gibson et al. (2011) in Tonga found a negative effect. Moreover, a study by de Brauw and Mu (2013) in rural China found no significant effect of migration on children's height but a positive and significant effect on their weight. A few studies have tried to decompose the effects from a gender viewpoint. There is evidence from Jayatissa and Wickramage's (2016) study in Sri Lanka that gender mattered as far as the effects of international migration on child nutritional status are concerned. According to this study under-nutrition of children aged 6-59 months remained a major concern if the mother was a migrant worker while the opposite was true if the father was a migrant worker. Contrary to this finding, Macours and Vakis' (2010) study in Nicaragua found a positive relationship between maternal migration and child health.

Therefore, further research should explore how the effects differ by gender and dig deeper into how migration affects children's nutrition and also technology adoption. This study fills this gap by exploring the linkages between migration and technology adoption/child nutrition from a gender perspective in the context of Ethiopia.

3.3 Data and descriptive statistics

3.3.1 The data

This study uses a panel dataset of the Ethiopian LSMS.[35] This survey has modules on household characteristics including detailed questions on migration and remittances, questions on child health (including anthropometric measurements), modules on agriculture together with farm technology used, and also community-level data. This study is based on two recent rounds-- 2013-14 and 2015-16.[36]

Data on indicators of technology adoption are primarily based on the post-planting section of the agriculture questionnaire. For each household member engaged in agriculture (for each landholder)

[35] The same dataset is used as in the previous chapter.
[36] Ddetailed information on migration is available for both rounds.

there is information on the area of the field, the cropping method, crop sowing techniques, soil conservation methods used, the use of irrigation, application of chemical fertilizers, pesticides, herbicides, and improved seeds, and a host of other variables. Indicators for child nutrition are derived from the health section (section 3) of the household questionnaire.

3.3.2 Measurement of the variables and descriptive statistics

3.3.2.1 Outcome variables

Migration

For evaluating the impact of migration, a treatment variable is defined as female and male migrant households. Households with both male and female migrants are excluded. After rigorous data cleaning and excluding outliers, 544 male and female migrant households are identified and included in this study. Since 4,778 households are identified in both rounds in total, the remaining 4,234 households are labeled as non-migrant households.

Table 3.1 shows that in 2013-14 among the total female migrant households, around 20 percent had migrants abroad. However, this percentage was slightly lower for male migrant households (approximately 17 percent). This figure increased to around 30 percent and 21 percent respectively for female and male migrant households in the latest round of the survey in 2015-16. A higher proportion of females migrating abroad may be due to growing demand for domestic female workers in the Middle East, especially in Saudi Arabia. Comparing average remittances of the households' gender wise, the table shows that on average males remitted slightly more than females. Moreover, comparing average remittances per household between the two rounds, in 2015-16 on average both groups of households received more remittance than they did in 2013-14. This difference may be a consequence of the slight drought in 2015-16. Migration serves as a hedge against risks, including droughts, so it is expected that migrants will remit more to compensate for income losses during such periods.

Table 3.1 Remittances and Migration by Destination (2013-14 and 2015-16)

	Female Migrant HHs	Male Migrant HHs	Difference b/n means	SE
2013/14 Round				
Average remittance (HH level)	1256.71	1470.30	-213.59	(209.0)
% of international Migrants	19.54	16.94		
2015/16 Round				
Average remittance (HH level)	2285.16	2474.48	-189.32	(156.0)
% of international Migrants	29.67	21.17		
Number of Observations	188	356		

Note: 1 dollar is approximately 18 and 23 Ethiopian Birr respectively for the two rounds.
Source: Author's computations using data from ESES 2013-14 and 2015-16 rounds.

Tables A3.1 and A3.2 in Appendix A3 give details of migrants by origin and occupation in destination areas disaggregated by gender. Table A3.1 shows more than three-quarter of the rural migrants in Ethiopia came from Amhara, Oromia, and SNNP regions. For international migrants, Arab countries, in particular Saudi Arabia (62 percent), was the major destination area. Table A3.2 shows occupations at the destination were not the same for female and male migrants. Females were primarily hired for domestic work while males were hired for doing low paying construction work including working as daily laborers and in agriculture and other services like guards but both were hired in low paying and elementary occupations. Besides this, there were no systematic differences in the origin and location between female and male migrants.

We first examine the relationship between household well-being and migration (Table 3.2). In the 2013-14 round, compared to female migrants male migrant households on average had more landholdings per capita, more oxen, and more livestock and were thus more likely to be classified as non-poor. In the 2015-16 round, male migrant households continued to have more livestock, oxen, and landholdings compared to female migrant households. Studies in other developing countries such as the Philippines and Sri Lanka, found that rural migrant men came from upper- and middle-class households, whereas female migrants were often from households near or below the poverty line.

Table 3.2 Characteristics of household wealth (household assets) by gender of the migrants

	Female Migrants households	Male Migrants households	All Migrant households	Non-Migrant households
2013-14 round				
Tropical livestock units (TLUs)	3.67(3.07)	3.88(3.48)	3.79(3.32)	3.49(3.25)
Average # of oxen owned	0.86(0.96)	1.05(1.15)	0.98(1.08)	0.88(1.07)
Landholdings in ha per capita	0.20(0.22)	0.24(0.24)	0.22(0.23)	0.25(0.27)
2015-16 Round				
Tropical Livestock Units (TLUs)	3.63(2.60)	4.0(3.70)	3.85(3.16)	3.51(3.25)
Average # of oxen owned	0.89(0.97)	1.02(1.08)	0.97(1.03)	0.90(1.09)
Landholdings in ha per capita	0.22(0.23)	0.25(0.24)	0.24(0.24)	0.25 (0.27)
Number of Observations	188	356	544	4234

Source: Author's computations using data from ESES 2013-14 and 2015-16 rounds.

Further, when comparing migrant and non-migrant households, it appears that migrant households had more oxen and more livestock, though they had slightly less land per capita compared to non-migrant households in both the study periods. In sum, there was a slight difference, though not significant, between migrant and non-migrant households. Overall, household wealth proxied by household asset holdings did not play a large role in migration.

Measures of technology adoption

This study also focuses on two well-promoted technologies, improved seeds and chemical fertilizers. Use of chemical fertilizers and improved seeds was measured by whether a household used any of these biochemical technologies in crop production in the past 12 months on any of its fields. Hence, a dummy variable was defined based on the use of chemical fertilizers, improved seeds, and a combined use of both.

Table 3.3 summarizes farm technology adoption by disaggregating migrant households by the gender of the migrant. In the two rounds, compared to male migrant households, female migrant households used slightly fewer chemical fertilizers and improved seeds. On the other hand, there was a discernible pattern in both rounds in terms of technology use between migrant and non-migrant households. As can be seen in Table 3.3 on average more migrant households adopted farm technologies in both periods as compared to non-migrant households. Since different crops are

grown in different places and soil fertility is also different, the use of different farm technologies could vary with location. Hence, accounting for location will yield more consistent patterns. Consequently, for measuring the true impact of using technology we did a counterfactual analysis.

Table 3.3 Technology Adoption and Migration Status of farm households

	Female Migrant HH	Male Migrant HH	Differen b/n means	All Migrant HH	Non-Migrant HH
2013-14 Round					
Chemical fertilizers (1=used)	0.55 (0.49)	0.58(0.49)		0.57(0.49)	0.47(0.49)
Improved seeds (1=used)	0.10(0.28)	0.13(0.34)		0.14(0.34)	0.12(0.32)
Combined use^{+} (1=yes)	0.10(0.27)	0.11(0.30		0.11(0.30)	0.09 (0.29)
2015-16 Round					
Chemical fertilizers (1=used)	0.54(0.49)	0.57(0.49)		0.56(0.49)	0.49(0.49)
Improved seeds (1=used)	0.11(0.31)	0.15(0.35)		0.14(0.34)	0.11(0.31)
Combined use^{+} (1=yes)	0.06(0.24)	0.13(0.34)		0.10(0.30)	0.09(0.28)
Number of Observations	188	356		544	4234

Note: + adoption dummy calculated from use of both chemical fertilizers and improved seeds.
Source: Author's computations using data from Ethiopian LSMS 2013-14 and 2015-16 rounds.

Measures of child nutritional status

Nutritional status of under-5 children was measured using anthropometric measures. In this study stunting and wasting is used as indicators of child malnutrition. Wasting is a short-term indicator of acute malnutrition whereas stunting is the most important long-term indicator of child nutritional status (Manda et al., 2016; Slavchevska, 2015; WHO, 1995). Two indices, weight-for-height (WHZ) and height-for-age (HAZ) were constructed and recorded as a z-score. A z-score describes the number of standard deviations by which a child's anthropometric measurement deviates from the median in WHO's 2006 child growth standards. A less than -3 z-score is defined as severe stunting or wasting which shows severe undernutrition. A z-score cutoff point between -3 and -2 classifies low weight-for-height and low height-for-age as moderate wasting and stunting, suggesting moderate undernutrition (WHO, 1997). In this study, a dummy for stunting or wasting is constructed accordingly. Table 3.4 summarizes child nutritional outcomes by migration status.

Table 3.4 Farm households' **c**hild nutritional outcomes and Migration status

	Female Migrant households	Male Migrant households	All Migrant households	Non-Migrant households
2013-14 Round				
Child Stunted (1=yes)	0.39(0.47)	0.37(0.49)	0.38(0.48)	0.47(0.49)
Child Wasting (1=yes)	0.12(0.26)	0.14 (0.38)	0.12(0.33)	0.11(0.30)
2015-16 Round				
Child Stunted (1=yes)	0.58(0.49)	0.35(0.47)	0.42 (0.49)	0.42(0.49)
Child Wasting (1=yes)	0.15(0.35)	0.13(0.34)	0.13(0.34)	0.10(0.29)
Number of Observations	278	393	671	6258

Note**:** Dummies for child stunted and child wasted are based on the z-score of height-for-age and weight-for-height indices. A score less than -2 denotes moderate to severe stunting or wasting.
Source: Author's computations based on data from LISMS 2013-14 and 2015-16 rounds.

In both survey rounds, on average children in migrant households had a slightly lower likelihood of being stunted/wasted compared to children in non-migrant households. Further, disaggregating the results by gender, the differences in child nutritional outcomes for the 2015-16 round become evident. Hence, in 2015-16 there was a higher probability of children in female migrant households being stunted/wasted compared to children in male migrant households? However, no significant differences between the two groups of households were observed in the 2013-14 round. Overall child malnutrition in migrant households was more or less similar to the national average of child stunting and child wasting for the respective years[37] (CSA and ICF, 2016).

3.3.2.2 Choice of explanatory variables

The remaining exogenous regressors included in the model are primarily drawn from literature on technology adoption and child nutrition. Demographic characteristics such as household head's gender, age, and education level are included to capture the effect of human capital on our outcomes. Further, other household-level characteristics such as the number of children and number of active members in the household are included to capture the effects of labor availability on the variable of interest. Households' farm size and livestock holdings which indicate their socioeconomic status are also supposed to affect technology adoption and child nutrition. Farm revenue, excluding remittances is also a critical factor affecting technology adoption via relaxing liquidity constraints. The value of household assets is included to capture the effects of savings and wealth on adoption.

[37] According to the Ethiopian demographic and population survey (2016), for instance, national average child stunting and wasting in 2014-15 was 40 percent and 9 percent respectively.

We also included variables such as child characteristics (gender and age), access to improved water sources and sanitation to control for the effect on child nutritional status (Manda et al., 2016). Finally, location and agro-ecological characteristics are included to account for any heterogenous effects.

Table A3.3 in Appendix A3 gives a summary of the explanatory variables included in the econometric model that can potentially affect our outcome variables. The descriptive statistics show that migrant households have older household heads with larger household sizes compared to non-migrant households. Moreover, compared to non-migrant households, migrant households have a lower proportion of active males and a higher dependency ratio. However, both the groups have more or less similar endowments in terms of physical capital such as the size of farmland and livestock holdings. Further, migrant households have greater access to unpaid/mutual labor and more land under farming than non-migrant households.

3.4 Methodology

3.4.1 Theoretical framework

Based on the NELM theory; consider farm households migration decision. A migrant might leave because returns to labor at a potential destination are higher than at home. Since returns to labor for the overall household unit increase, income is also expected to increase. However, there are additional impacts on the household because with migration overall time endowment of left behind households decreases. Thus, time for local production (for example, agriculture) or for child rearing, cooking, or other activities within the household declines. Migration thus has competing effects on households which send migrants out: income and lost-labor time effects.

Following Cortes (2011), suppose farm households' productivity enhancing choices such as technology adoption/child nutritional status given as (h) are determined by two inputs: income (R) and time (T) given as:

$$h(R, T) \qquad (3.1)$$

where income denotes household income, which is required to buy productivity enhancing farm inputs such as chemical fertilizers or for buying adequate food to feed the children. T represents the amount and quality of time farm households devote to household production activities. Based on this simple model of the household production function, migration (M) affects households'

technology adoption/ the level of child nutritional status as:

$$\frac{\mathrm{dh}}{\mathrm{dM}} = \frac{\partial h}{\partial R} * \frac{dR}{dM} + \frac{\partial \mathrm{h}}{\partial \mathrm{T}} * \frac{dT}{dM} \qquad (3.2)$$

Therefore, the impact of migration on the outcome variables depends on how it affects the two inputs. Given that one can safely assume $\frac{dR}{dM} > 0$ and $\frac{dT}{dM} < 0$ and that the marginal productivities are strictly positive, the effect is a priori ambiguous.

What differential effects should one expect to see on the outcome variables? The data description section in this chapter (see, Table 3.1) clearly shows that male migrants send relatively more remittances than female migrants.[38] Thus, $\frac{\partial R}{\partial M}$ (male migrants) > $\frac{\partial R}{\partial M}$ (female migrants). What about the labor-lost effects between female and male migrant households? ($\frac{\partial \mathrm{T}}{\partial \mathrm{M}}$ (female migrant) $\mathrm{v_s}$ $\frac{\partial \mathrm{T}}{\partial \mathrm{M}}$ (male migrant)? Theoretically, who migrates - male or female- should not matter if the household members left behind carry and fulfill all caring responsibilities. However, gender roles are still very rigid in rural Ethiopia. Thus, the lost-labor effect may depend on who migrates --- male or female -- and the activities left behind that need to be performed. Male and female labor are less substitutable and traditionally males and females do different tasks at least in the context of this study. Males usually do outdoor activities including farming which is energy intensive, while females primarily engage in household chores such as preparing food and taking care of children.

Therefore, from the perspective of child nutrition, especially among young children, a larger drop in time investments is expected if a female adult household member, especially a mother, migrates. Conversely, in male migrant farm households, with a diminishing supply of male labor, it is expected that the household will experience a larger drop in time investments in farming practices. Thus, depending on how important the lost-labor effect is, the gender of the migrants may have a differentiated effect.

3.4.2 Other channels

The empirical results in this study are primarily interpreted in the light of the impact of migration

[38] Studies found that female migrants remit more than their male counterparts proportional to their earnings; yet in gross terms females remit less than males do. This may be because most female migrants work in relatively low paying occupations such as domestic work.

on technology adoption/child nutritional outcomes from a gender perspective. Thus, we abstract from alternative mechanisms through which an impact on technology adoption/child nutrition may occur. Obviously, one can consider alternative causal channels. Remittance incomes may be used by farm households to exit from the farming activity or for diversifying income sources by investing in non-farm activities which may lead to a decline in agricultural production and thus in the adoption of labor-intensive technologies. Remittances may also affect farming activities and thus technology adoption by affecting leisure time. Moreover, with the diffusion of agricultural technical knowledge/childcare practices from migrants' destination to source farm households, migration may alter farming and child-rearing practices at home. These and the possibility of alternative mechanisms is taken into account in the interpretation of the empirical results.

3.4.3 Modeling gender differential impacts of migration

As a risk-minimizing strategy, farmers' migration decisions and whether to send a male or female member are voluntary and based on individual self-selection. Migrant households (who send migrants locally or abroad) may have systematically different characteristics from those that do not send members out. Households' unobserved characteristics may affect both migration decisions and outcome variables, resulting in inconsistent parameter estimates if the issue of endogeneity is left unaddressed. For example, if only the wealthiest farm households choose to send migrants abroad and one fails to control for wealth, this may lead to an upward bias.

To address these issues, a household's gender specific migration decisions and their impact are modelled using a multinomial endogenous switching regression framework. It is a selection-bias correction method based on a multinomial logit model (Bourguignon et al., 2007). According to Bourguignon et al. (2007), even if the assumption of independence of irrelevant alternatives (IIA)[39] is not attained which is one of the assumptions for getting consistent estimates, with this approach one can get efficient and consistent estimates of the selection process and a reasonable correction in the outcome equations. This framework has the advantage of evaluating migration decisions while controlling for self-selection bias caused by both observed and unobserved heterogeneity (Mansur

[39]Independent of the irrelevant alternative (IIA) assumption is a property of the multinomial logit model. Bourguignon et al. (2007) showed that even if the IIA hypothesis is violated selection bias correction based on the multinomial logit model seems a reasonable alternative when the focus is on estimating an outcome over selected populations rather than on estimating the selection process itself.

et al., 2008; Wu and Babcock, 1998). Previous empirical studies have used the same approach (for example, Di Falco and Veronesi, 2013).

The estimation is done simultaneously in two steps using the *selmlog* stata command (Bourguignon et al., 2007). In the first stage, farmers' choices of migration strategies are modelled using a multinomial logit selection model. In the second stage, the impact of gender-specific migration along with a set of explanatory variables on technology adoption and child nutritional status are determined using a logit model with selectivity correction terms.

Stage 1- Selection Model for gender-specific participation in migration

Selection equation for participation in migration is specified as:

$$Mig_{ij}^{*} = \boldsymbol{\beta_j X_{ji}} + \xi_{ji}$$

$$With \;\; Mig_{ji} = \begin{cases} 1 \quad iff \;\; Mig_{ji}^{*} > \max\limits_{k \neq 1}\left(Mig_{ji}^{*}\right) \text{ or } \pi_{1i} < 0 \\ \ldots \\ M \quad iff \;\; Mig_{ji}^{*} > \max\limits_{k \neq j}\left(Mig_{ji}^{*}\right) \text{ or } \pi_{ji} < 0 \end{cases} \rangle \;\; for \;\; all \;\; k \neq j \qquad (3.3)$$

where Mig_{ij}^{*} is a continuous latent variable that represents the expected benefits from implementing strategy *j* (*j*= 1, 2, 3) with respect to implementing any other strategy *k*. Based on the NELM framework, where the household is the decision making unit, households must choose whether or not to send out a migrant as well as which individual or individuals should migrate (de Brauw, 2017). Accordingly, farm household *i* will choose among three distinct migration strategies (1= 'not to participate in migration', 2= 'sending a male member', and 3= 'sending a female member'). Thus, household *i* chooses strategy *j* if the chosen strategy is expected to provide a higher benefit than any other strategy k, $k \neq j$, that is, if $\pi_{ji} = \max\limits_{k \neq j}(Mig_{ki}^{*} - Mig_{ji}^{*}) < 0$.

$\boldsymbol{X_i}$ is a vector of individual, household, and community level characteristic that affect the likelihood of choosing strategy *j*. $\boldsymbol{\beta_j}$ is a vector of parameters to be estimated. ξ_{ij} is an idiosyncratic unobserved stochastic component such as motivation and skills which are unknown to the researcher but are relevant for a household's decision making. It can be interpreted as the unobserved individual propensity to participate in migration.

It is assumed that the idiosyncratic unobserved stochastic component ξ_{ji} is uncorrelated with the covariate vector $\boldsymbol{X}_{ji}$, that is, $E(\xi_{ji}|\boldsymbol{X}_{ji}) = 0$. Further, under the hypothesis of independence of irrelevant alternatives (IIA), ξ_{ji} are independent and identically Gumbel distributed --- the probability that household i with characteristics $\boldsymbol{X}_{ji}$ will choose strategy j can be specified by a multinomial logit model (McFadden, 1973) where the probability of choosing strategy j (P_{ij}) is:

$$P_{ji} = Pr(\ \pi_{ji} < 0\ |\boldsymbol{X}_{ji}) = \frac{\exp\ (\boldsymbol{\beta_j X_{ji}})}{\sum_{k\neq 1}^{M} \exp\ (\boldsymbol{\beta_k X_{ji}})} \qquad (3.4)$$

Stage 2- Multinomial Endogenous switching Regression Model

A multinomial endogenous switching regression model can be estimated in the second stage to investigate the impact of each strategy on our outcome variables using Bourguignon et al.'s (2007) selection bias correction model. Our model implies that farm households face a total of *j*=3 strategies and regimes (one regime per strategy, where j=1 is the reference category 'non-migrant households').

A binary response outcome $\boldsymbol{y}_{ji}$ for each possible regime j is defined as:

$$\begin{aligned}
&\text{Regime 1:} \quad \boldsymbol{y}_{1i} = \boldsymbol{\alpha_1 Z_{1i}} + \delta_1 \bar{\mathbf{Z}}_{1i} + \ \varepsilon_{1i} \ \ if \ \ Mig_i = 1 \\
&\text{Regime 2:} \quad \boldsymbol{y}_{2i} = \boldsymbol{\alpha_2 Z_{2i}} + \delta_2 \bar{\mathbf{Z}}_{2i} + \ \varepsilon_{2i} \ \ if \ \ Mig_i = 2 \qquad j = 1,2,3 \qquad (3.5) \\
&\text{Regime 3:} \quad \boldsymbol{y}_{3i} = \boldsymbol{\alpha_3 Z_{3i}} + \delta_3 \bar{\mathbf{Z}}_{3i} + \ \varepsilon_{3i} \ \ if \ \ Mig_i = 3
\end{aligned}$$

here $\boldsymbol{y}_{ji}$ denotes dummy for farm technology adoption and child nutritional status in farm household i in each regime 1, 2, and 3. $\boldsymbol{Z}_i$ denotes a vector of exogenous variables. As there are several cases under which some of the explanatory variables will be correlated with the unobserved heterogeneity term, following Mundlak (1978) and Wooldridge (2010), the mean of household and plot level varying explanatory variables are included to control for unobserved characteristics, $\bar{\mathbf{Z}}_i$[40]. ε's are error terms distributed with $E(\varepsilon_{ji}\,|\boldsymbol{Z}_i, \bar{\mathrm{Z}}_i) = 0$ and $Var(\varepsilon_{ji}\,|\boldsymbol{Z}_i, \bar{\mathrm{Z}}_i) = \sigma_j^2$. For each sample observation, only one among the *j* dependent variables is observed.

When estimating this model, the outcome Equation 3.5 is estimated separately. However, if the error terms of the outcome Equation 3.5 ε_{ji} are correlated with the error terms of the selection model

[40] The assumptions of this approach is the unobserved characteristics is a linear function of the time averages of the time varying household level variables $vi = \bar{\mathrm{Z}}_i\boldsymbol{\pi} + \mathrm{c_i}$, with $\mathrm{c_i} \sim \mathrm{IIN}(0, \sigma_c^2)$ and $E(\mathrm{c_i}) = 0$, where $\boldsymbol{\pi}$ is the corresponding vector of coefficients and $\mathrm{c_i}$ is normal error term uncorrelated with $\bar{\mathrm{Z}}_i$.

(3.3) ξ_{ij} that is, if ε_{ji} and ξ_{ij} are not independent, our parameter estimates $\boldsymbol{\alpha}$ and $\boldsymbol{\delta}$ become inconsistent. To correct for this potential inconsistency, Bourguignon et al.'s (2007) model is employed which takes into account the correlation between the two error terms. Subsequent to the terminology used by Maddala and Nelson (1975) extended to the multinomial case, this model is referred to as the multinomial endogenous switching regression model.

Bourguignon et al. (2007) show that estimating the following selection bias-corrected adoption/ child nutritional status equations yields consistent estimates as follows:

$$\begin{aligned}
&\text{Regime 1:} \quad \boldsymbol{y_{1i}} = \boldsymbol{\alpha_1 Z_{1i}} + \boldsymbol{\delta_1 \bar{Z}_{1i}} + \sigma_1 \hat{\lambda}_{1i} + u_{1i} \;\; if \;\; Mig_i = 1 \\
&\text{Regime 2:} \quad \boldsymbol{y_{2i}} = \boldsymbol{\alpha_2 Z_{2i}} + \boldsymbol{\delta_2 \bar{Z}_{2i}} + \sigma_2 \hat{\lambda}_{2i} + u_{2i} \;\; if \;\; Mig_i = 2 \qquad j = 1,2,3 \qquad (3.6) \\
&\text{Regime 3:} \quad \boldsymbol{y_{3i}} = \boldsymbol{\alpha_3 Z_{3i}} + \boldsymbol{\delta_3 \bar{Z}_{3i}} + \sigma_3 \hat{\lambda}_{3i} + u_{3i} \;\; if \;\; Mig_i = 3
\end{aligned}$$

here $\widehat{\lambda_j}$ is the inverse Mills ratio derived from the estimated probabilities in Equation 3.4 as: $\lambda_{ji} = \sum_{m \neq j}^{J} \rho_j [\frac{\hat{P}_{mi} \, ln(\hat{P}_{mi})}{1-\hat{P}_{mi}} + ln(\hat{P}_{ji})]$; ρ is the correlation coefficient of ε's and ξ's error terms with an expected value of zero. σ_j is the covariance between ε's and ξ's. This indicates that in each equation the number of bias correction terms is equal to the number of multinomial logit choices *M*. To account for heteroskedasticity arising from the two-stage estimation procedure the standard errors in Equation 3.6 are bootstrapped.

For a better identification of the model an exclusion restriction is used. Selection of the exclusion restriction is guided by economic theory and empirical studies. To address the potential endogeneity bias of migration, the lagged prevalence of migration in the community is used as an instrument for migration as discussed in the previous chapter clearly. McKenzie and Rapoport (2010) among others illustrate that such community level variables can serve as strong exclusion restrictions since they capture the influence of exogenous historical, cultural, and geographic factors.

Counterfactual analysis and treatment effects

According to Heckman et al. (2001) treatment effect is the effect of the treatment of 'adoption of strategy j' on our binary outcomes of the farm households that adopt strategy j. In the absence of a self-selection problem, it would have been appropriate to assign the average outcomes of non-migrant households with the same observable characteristics as counterfactual outcomes of farm households that have migrant members. Nevertheless, unobserved heterogeneity in the propensity to choose a strategy affects our outcomes and also creates a selection bias in our outcome equations

that cannot be ignored. Hence selection–corrected predictions of counterfactual outcomes can be achieved by applying a multinomial endogenous switching regression model.

Following impact literature, first the expected binary outcomes of farm technology adoption/ child nutritional status of households that participate in migration, where j=2 for 'male migrant households' and j=3 for 'female migrant households' is derived as:

$$E(\boldsymbol{y}_{2i} | Mig_i = 2, \boldsymbol{Z}_{2i}, \bar{\mathrm{Z}}_{2i}, \hat{\lambda}_{2i}) = \boldsymbol{\alpha_2 Z_{2i}} + \boldsymbol{\delta_2}\bar{\mathbf{Z}}_{2i} + \sigma_2\hat{\lambda}_{2i} \quad (3.7)$$

$$E(\boldsymbol{y}_{3i} | Mig_i = 3, \boldsymbol{Z}_{3i}, \bar{\mathrm{Z}}_{3i}, \hat{\lambda}_{3i}) = \boldsymbol{\alpha_3 Z_{3i}} + \boldsymbol{\delta_3}\bar{\mathbf{Z}}_{3i} + \sigma_3\hat{\lambda}_{3i} \quad (3.8)$$

Then one can derive the counterfactual farm technology adoption and child nutritional status of farm households that participate in migration in the counterfactual hypothetical case that they do not participate as:

$$E(\boldsymbol{y}_{1i} | Mig_i = 2, \boldsymbol{Z}_{2i}, \bar{\mathrm{Z}}_{2i}, \hat{\lambda}_{2i}) = \boldsymbol{\alpha_1 Z_{2i}} + \boldsymbol{\delta_1}\bar{\mathrm{Z}}_{2i} + \sigma_1\hat{\lambda}_{2i} \quad (3.9)$$

$$E(\boldsymbol{y}_{1i} | Mig_i = 3, \boldsymbol{Z}_{3i}, \bar{\mathrm{Z}}_{3i}, \hat{\lambda}_{3i}) = \boldsymbol{\alpha_1 Z_{3i}} + \boldsymbol{\delta_1}\bar{\mathrm{Z}}_{3i} + \sigma_1\hat{\lambda}_{3i} \quad (3.10)$$

Equations 3.7 and 3.8 are actual expected outcomes for treated groups (migrant households) observed in the data after estimating the parameters of Equation 3.6. Equations 3.9 and 3.10 represent the 'counterfactual' expected outcomes. The counterfactual is defined as what the farm technology adoption/child nutritional status outcomes would have been if the returns on their characteristics/covariates had been the same as the returns on the characteristics of the non-treated groups (non-migrant households).

Subsequent to Heckman et al. (2001) and Di Falco et al. (2011) the difference between Equations 3.7-3.9 yields average treatment effects on the treated (ATT) for 'male migrant households' whereas Equations 3.8-3.10 give ATT for 'female migrant households.' Hence, one can find out whether there is a gender differential effect of migration on technology adoption/child nutritional status.

3.5 Results and Discussion

This section briefly discusses the determinants of gender-specific migration and then the welfare implications of implementing a particular migration strategy for the outcome variables.

3.5. 1 Drivers of Gendered Migration

This section briefly discusses the regression results of the outcome and parameter estimates of the gender-specific migration equations while the full results are given in Appendix A3 Tables A3.4-A3.6. Table A3.4 presents the parameter estimates of gender-specific migration results. The error terms are clustered by villages. The regression output shows that the instrument used for migration is relevant since it has the expected sign and is strongly correlated with the endogenous regressor. The statistical significance and signs of the estimated coefficients are broadly consistent with migration literature. The result suggests that family size, a possible proxy for labor availability, increases the probability of both male and female migration. This may be because households have more labor to allocate across various activities. On the other hand, the number of children and old age people decrease the probability of migrating, especially for women. Households with larger asset holdings have a significantly higher probability of participating in migration, irrespective of who migrates, although the impact is not statistically significant for either gender. Other covariates such as households' access to unpaid labor have a positive effect on male migration but an insignificant effect on female migration.

Looking at gender-specific migration location-wise, the results show that there is no statistically significant difference between the regions. This finding is in line with our descriptive statistics which show that there is no systematic difference in the origin between female and male migrants. Moreover, it is worth noting that the coefficients of the outcome equations vary in the different groups of households (see Table A3.5 and A3.6 in Appendix A3).[41]

3.5.2 Impact on Agricultural technology adoption

Column *C* in Table 3.5 gives the conditional impacts of adopting various migration strategies j (j=2, 3) on technology adoption, computed as the difference between Columns A and B. The results show that if a household sends a female member (j=3) its probability of adopting chemical fertilizers, improved seeds, or their combined use increased by about 10, 15, and 8 percentage points respectively than the counterfactual scenario of not participating in migration, that is, in all the counterfactual cases, had households not sent female migrants, they would on average have been less likely to adopt any of the farm technologies or both of them (see Column B). Likewise, male

[41] Coefficient estimates of the outcome equation are provided in Tables A3.5 and A3.6 in Appendix A3.

migrant households are more likely to adopt improved seeds (3 percentage points higher) than in the counterfactual scenario. However, for male migrant households, at the difference of what was true for female migrant households, the effect, though positive, is not significant, as far as the adoption of chemical fertilizers (or the combined use) is concerned.

Therefore, one can conclude that from the perspective of technology adoption, the gender of the migrant does not matter and hence there is no systematic difference in technology adoption of left behind households in the two groups. This may probably be because Ethiopia has long faced severe problems of land scarcity and dwindling farm sizes.[42] With scarcity of land on the one hand and a higher population density on the other, the labor-lost effect associated with migration is less likely to lead to the adoption of labor complementary technologies for either gender. Considering this, it is not surprising that participation in this activity responds positively and thus there are no differences in the effects of male and female migration. Hence, it can be hypothesized that irrespective of who migrates, migration affects the adoption of farm technology positively, mainly through a remittance effect that cancels out any labor-lost effect associated with migration. Thus, these findings support both risk and liquidity constraint hypotheses. Previous studies in this area such as those by Mendola (2006), Quinn (2009), and Zahonogo (2011) show that migration had a positive effect on the adoption of modern farm technologies.

Table 3.5 Impact of gender specific migration on farm technology adoption

Outcome variables	Treatment Effects		
	Actual outcomes	Counterfactual outcomes	Impact (Migration Effect)
	A	**B**	**C=A-B**
Chemical fertilizer use:			
Male migrant HHs, E(y|j=2)	0.567 (0.019)	0.546 (0.016)	0.021 (0.025)
Female migrant HHs, E(y|j=3)	0.590(0.024)	0.495(0.021)	0.096***(0.031)
Improved seeds use:			
Male migrant HHs, E(y|j=2)	0.167 (0.009)	0.134 (0.005)	0.034***(0.010)
Female migrant HHs, E(y|j=3)	0.268 (0.022)	0.124 (0.006)	0.145***(0.017)
Combined Use:			
Male migrant HHs, E(y|j=2)	0.111 (0.008)	0.109 (0.005)	0.003 (0.012)
Female migrant HHs, E(y|j=3)	0.181 (0.013)	0.098 (0.005)	0.084***(0.011)

Note: j represents different migration strategies as discussed in the methodology; the figures in parentheses are bootstrapped standard errors; *** and ** indicate statistical significance at 5% and 1%.

[42]For example, during the 2011-12, more than half the households in Ethiopia cultivated less than 1 hectare of land (CSA, 2013).

The findings also show that other significant determinants of farm technology adoption include the gender of the household head, access to plow animals, and access to credit and advisory services. For instance, farmers with access to advisory services provided by extension agents/workers and those with access to credit are found to have a higher probability of adopting farm technologies. However, variables such as total land in ha owned and access to plough animals have a negative effect. Surprisingly, farm households with access to plough animals, were less likely to adopt farm technologies. Lastly, the study also found significant and positive coefficients of two of the regional dummies signifying that farmers in these agro-ecological zones were less likely to adopt improved farm technologies relative to farmers in 'other regions' (the base region for the model).

3.5.3 Impact on child nutritional status

This study also looked at the impact of gender-specific migration on child nutritional status using the prevalence of stunting and wasting. Interestingly, unlike the effect on technology adoption, the results show a differentiated impact of female and male migration on the nutritional status of the 'children left behind.' Table 3.6 shows that a migrant male adult (possibly a father) reduces the prevalence of stunting by about 5 percentage points while this has no significant effect on child wasting. On the contrary, this study found that child malnutrition in terms of wasting deepened by about 6 percentage points when a female adult member (possibly a mother) was a migrant worker.

A possible explanation for this differential effect may be because of two very different channels. One, suggested by the descriptive statistics in Table 3.1 is that when a male member migrates he is more likely to send remittances, and conditional on sending, these remittances are larger. The second explanation is that even if females and males send the same remittances, the loss of a mother migrating or of another adult female member may reduce the time available for preparing food and caring for the children, so the lost-labor effect is more pronounced than when the migrant is a male. These findings support the hypothesis that the absence of an adult female member has a stronger effect than a male member's absence. These results corroborate Bronte-Tinkew and Dejong (2004), Cameron and Lin (2007), and Jayatissa and Wickramage's (2016) findings.

Table 3.6 Impact of gender specific migration on Child nutritional status

Outcomes variables	Treatment Effects		
	Actual outcomes	Counterfactual outcomes	Impact (Migration Effect)
	A	**B**	**C=A-B**
Stunting:			
Male migrant HHs, E(y|j=2)	0.379 (0.017)	0.429 (0.005)	-0.050***(0.017)
Female migrant HHs, E(y|j=3)	0.435 (0.024)	0.420 (0.005)	0.005 (0.023)
Wasting:			
Male migrant HHs, E(y|j=2)	0.114 (0.007)	0.117 (0.004)	-0.003 (0.009)
Female migrant HHs, E(y|j=3)	0.187 (0.014)	0.131 (0.004)	0.056*** (0.014)

Note 1: j=2 for male migration, j=3 for female migration; and j=1 for households with no migrants. Figures in parentheses are standard errors; *** and ** indicate statistical significance at 5% and 1%.

When investigating the other results of the regressions, the signs of the coefficients are as expected. On average, the schooling levels of household heads had a negative impact on child wasting and stunting. This is in line with Anton's (2010) findings for Ecuador where mothers' education negatively affected both height-for-age and weight-for age Z-scores. Moreover, other household level characteristics such as household size and number of children less than 15 years of age were positively and significantly related to child stunting and wasting. Study also found that households' wealth proxied by the asset wealth index and land owned in ha effected child nutrition positively. Moreover, in accordance with literature, households with improved access to water sources and access to waste disposal were less likely to have stunted or wasted children.

3.6 Conclusions and Policy Implications

This study investigated the effects of migration with a focus on the gender of the migrants on the probability of adopting labor intensive farm technologies and child nutritional outcomes in Ethiopia. The study used a counterfactual analysis and employed a multinomial endogenous switching regression model for measuring these impacts.

Our study concludes that migration, regardless of the gender of the migrant, played a positive role in enhancing the likelihood of technology adoption by rural Ethiopian households. However, from the perspective of the child nutritional status, the effect was not gender neutral. On average, child health (as measured by stunting and wasting) improved in male migrant households but declined in female migrant households. This result suggests that an imperfect labor market, if it exists in rural

Ethiopia, hinders the hiring of perfect substitutes for the female labor that migrates. Thus, positive migration effects are apparent only for male migration at least from the perspective of technology adoption and child nutritional status.

Hence, an important conclusion of this study is that for clearly understanding the effects of migration on the left behind farm households' welfare a gender disaggregated framework should be considered. Otherwise, the findings are likely to be unreliable for designing policies to mitigate the negative effects of migration and enhancing its positive effects. This conclusion is also likely to be true for other developing countries where like in Ethiopia gender roles are very persistent. The key policy takeaway of this study is that Ethiopia needs to draft a comprehensive migration policy which takes into account different support services mechanisms for those left behind.

References

Adams, R. H., and Cuecuecha, A. (2010). Remittances, household expenditure and investment in Guatemala. *World Development, 38 (*11*),* 1626-1641.

Adams, R. H., and Page, J. (2005). *Do international migration and remittances reduce poverty in developing countries?* World Bank Publications. Washington DC, The World Bank.

Alderman, H., Hoddinott J., and Kinsey, B. (2006). Long term consequences of early childhood malnutrition. *Oxford Economic Papers, 58 (*3*)*, 450-474.

Anouka, V. E., and Katrine, D. (2015). Gender Matters in Farm Power. 10.13140/RG.2.1.2262.8566.

Anton, Jose-Ignacio (2010). The impact of Remittances on Nutritional Status of Children in Ecuador. *International Migration Review, 44(2)*, 269-299.

Aredo, D. (1995). *The gender division of labor in Ethiopian agriculture: A study of time allocation among people in private and co-operative farms in two villages.* Research Report 1, Organization of Social Science for Eastern and Southern African countries (OSSREA).

Azzarri, A.C., and Zezza, Z. A. (2011). International migration and nutritional outcomes in Tajikistan. *Food policy, 36*, 54-70.

Bourguignon, F., Fournier, M., and Gurgand, M.(2007). Selection Bias corrections based on the multinomial logit model: Monte-Carlo Comparisons. *Journal of Economic Surveys. 21,* 174-205.

Bronte_Tinkew, J., and DeJong, G. (2004). Children's Nutrition in Jamaica: do household structure and household economic resources matter? *Social Science and Medicine, 95(3), 499-514.*

Cameron, M., and Lin, S. (2007). Household Resources, Household Composition, and Child Nutritional Outcomes. Presented at the Australian Agricultural and Resource Economics Society Conference.

Carletto, C., Katia, C., and Maluccio, J. A. (2011). Migration and child growth in rural Guatemala. *Food Policy, 36,* 16-27.

Central Statistical Agency of Ethiopia (CSA) and ICF International (2016). *Ethiopia Demographic and Health Survey 2016*. Addis Ababa and Rockville, Maryland, USA: CSA and ICF.

Cortes, Patricia (2015). The Feminization of International Migration and its effects on the Children Left behind: Evidence from Philippines. *World Development, 65(C), 62-78.*

Davis, J., and Brazil, N. (2016). Migration, Remittances and Nutrition Outcomes of Left-Behind Children: A National-Level Quantitative Assessment in Guatemala. *PLoS ONE 11(3):e0152089.*

de Brauw, A. (2017). Rural-Urban Migration and Implications for rural production. *Bio-based and Applied Economics, 6(3), 229-242.*

de Brauw, A., and Mu, R. (2013). Migration and young child nutrition: Evidence from rural China. *Institute for the Study of labor- IZA, DP No.* 7466.

De Brauw, A., Mueller, V., and Woldehanna, T. (2014). Does Internal Migration Improve Overall Well-Being in Ethiopia? *IFPRI Ethiopia Strategy Support Program, Working Paper #55*.

De Haas, H. (2006). Remittances, Migration and social Development: A conceptual Review of the Literature. *Social policy development paper No* 34*, United Nations Research Institute for Social Development.*

Di Falco, S., and Veronesi, M. (2011). On adaptation to climate change and risk exposure in the Nile basin of Ethiopia. *IED working paper 15, ETH* Zurich.

Diksha, A., and Rada, C. (2013). Gender Differences in Time and Resource Allocation in Rural Households in Ethiopia. Unpublished.

Doss, C. R. (1999). Twenty five years of research on women farmers in Africa: Lessons and implications for agricultural research institutions; with an annotated bibliography. *CIMMYT Economics Program Paper 00-02. Mexico, D.F.*

Doss, C. R., and Morris, M. L. (2000). How does gender affect the adoption of agricultural innovations? *Agricultural Economics, 25(*1*),* 27-39.

Garg, A., and Morduch, J. (1998). Sibling rivalry and the gender gap: evidence from child health outcomes in Ghana. *Journal of Population Economics, 11,* 471-493.

Gibson, J., Mckenzie, D., and Stillman, S. (2011). What happens to diet and child health when migration splits households? Evidence from a migration lottery program. *Food policy, 36,* 7-15.

Gilbert, R. A.,Sakala, W. D., and Benson, T. D. (2002). Gender analysis of a nationwide cropping system trial survey in Malawi. *African Studies Quarterly, 6(*1*),* 223-43.

Heckman, J.J., Tobias, J. L., and Vytlacil, E. J. (2001). Four parameters of interest in the evaluation of social programs. *Southern Economic Journal, 68,* 210-233.

IMO (2004). *Glossary on Migration*. Geneva: International Organization for Migration. Available at: *www.iom.int*.

Jayatissa, R., and Wickramage, K. (2016). What effect does international migration have on the nutritional status and childcare practices of children left behind. *International Journal of Environmental Research and Public Health, 13*(2): 218.

Kaninda, S. (2014). Migration, Remittances, Public Transfers and Technology Adoption: The case of Cereal Producers in Kenya. Unpublished. Available at: https://doi.org/10.1111/1477-9552.12295.

Kuschminder, K. (2014). *Shattered Dreams and Return of Vulnerability: Challenges of Ethiopian Female Migration to the Middle East*. (IS Academy Policy Brief No. 18)Maastricht: Maastricht Graduate School of Governance. Available at: *http://www.merit.unu.edu/publications/uploads/1389627443.pdf*.

Macours, D., and Vakis, R.(2010). Seasonal migration and early childhood development. *World Development, 38(*6*), 857-869.*

Maddala, G.S., and Nelson, F. D. (1975). Specification Errors in Limited Dependent Variable Model. *NBER Working Paper Number 96*.

Manda, J., Gardebrock, C., Khonje, M. G., Alene, A. D., Mutenje, M., and Kassie, M. (2016). Determinants of child nutritional status in the eastern province of Zambia: the role of improved maize varieties. *Food Security, 7,* 239-253.Available at: *http://doi.org/10.1007/s12571-015-0541-y*.

Mansur, E.T., Mendelsohn, R., and Morrison, W. (2008). Climate change adaptation: A study of fuel choice and consumption in the US energy sector. *Journal of Environmental Economics and Management, 55,* 175-193.

McFadden, D. (1973). "Conditional Logit Analysis of Qualitative Choice Behavior", in P. Zarembka (ed.), *Frontiers in Econometrics.* Academic Press, 105-142.

Mckenzie, D., and Rapoport, H. (2009). Network effects and the dynamics of migration and inequality: Theory and evidence from Mexico. *Journal of Development Economics, 84 (*1*),* 1-24.

Mendola, M. (2006). Migration and technological changes in rural households: Complements or substitutes? *Journal of Development Economics, 85,* 150-175.

MoLSA. (2012-13). *Labor Migration in Ethiopia*. Government of Ethiopia.

Mundlak, Y. (1978). On the pooling of time series and cross-section data. *Econometrica, 46(1),* 69-85.

Peterman, A., Agnes, R., and Lauren, P. (2011). Understanding the complexities surrounding gender differences in agricultural productivity in Nigeria and Uganda. *Journal of Development Studies, 47(*10*),* 1482-1509.

Pfeiffer, L., and Taylor, J. E. (2007). *Gender and the Impacts of International Migration: Evidence from Rural Mexico*. Available at: elibrary.worldbank.org.

Quinn, A.M. (2009). Estimating the impact of migration and remittances on agricultural technology. *Journal of Development Areas, 43(*1*),* 200-216.

Ramirez, C., Dominguez, M. G., and Morais, J. M. (2005). *Developing a framework to understand the Relationships between Migration, Gender, Remittances and Development.* United Nations International Research and Training Institute for the advancement of women. Santo Domingo, República Dominicana.

Reis, M. (2012). Food insecurity and the relationship between household income and children's health and nutrition in Brazil. *Journal of Health Economics, 21,* 405-427.

Richter, S. (2008). The insurance role of remittances on household credit demand. In *Selected paper prepared for presentation at the American agricultural economics association Annual Meeting, Orlando, Florida, July 27-29.*

Slavchevska, V. (2015). Agricultural production and the nutritional status of family members in Tanzania. *Journal of Development Studies, 51(*8*),* 1016-1033. Available at: *http://doi.org/10.1080/00220388*.

Skoufias, E. (1998). Child health during the economic transition in Romania. *World Development, 26(11),* 2045-2056.

Thapa, S. (2008). Gender Differentials in Agricultural Productivity: Evidence from Nepalese Household Data. *MPRA Paper.* Available at: *http://mpra.ub.uni-muenchen.de/13722/.*

Thomas, D., and Strauss, J. (1992). Prices, infrastructure, household characteristics and child height. *Journal of Development Economics, 39,* 301-331.

Thomas, D., Strauss, J., and Henriques, M. H. (1991). How does mother's education affect child height? *Journal of Human Resources, 26,* 183-211.

Tiruneh, A., Tesfaye, T., Mwangi W., and Verkuijl, H. (2001). *Gender Differentials in Agricultural Production and Decision-making among Smallholders in Ada, Lume, and Gimbichu Woredas of the Central Highlands of Ethiopia.* CIMMYT.

WHO (1995). *Physical Status: The use and interpretation of Anthropometry.* WHO Technical Report Series. Available at: http://doi.org/854.

WHO (1997). *Global data base on Child Growth and Malnutrition*. Available at: http://onlinelibrary.wiley.com/.

Wooldridge, J. M. (2010). *Econometric Analysis of cross section and panel data*. MIT Press. Cambidge.

Wouterse, F. (2010). Migration and technical efficiency in cereal crop production: Evidence from Burkina Faso. *Agricultural Economics, 41(*5*),* 385-395.

Wu, J. J., and Babcock, B. A. (1998). The choice of tillage, rotation, and soil testing practices: Economic and environmental implications. *American journal of Agricultural Economics, 80,*494-511.

Zahonogo, P. (2011). Migration and agricultural production in Burkina Faso. *African Journal of Agricultural Research, 6(*7*),* 1844-1852.

Appendix A3

Table A3.1 Origin of Migrants

Region	Gender of migrants		Of total stock of Migrants' (%)
	Male (%)	Female (%)	
Oromia	20.5	24.3	23
Amhara	35	25.9	28
SNNP	19.7	15.5	19
Tigray	9.8	9.9	9
Other regions	15	16.3	21
Total Migrants	356	188	544

Source: Author's computations using data from LSMS 2013-14 and 2015-16 rounds.

Table A3.2 Type of occupation in destination areas

Occupation in destination areas	Gender of migrants		Of total stock migrants (%)
	Female (%)	Male (%)	
Elementary occupations (dom. worker, construction, etc.)	43	42	44.2
Service work & shops & mkt. sale, etc.,	9	11	11.1
Other low paying jobs	48	47	44.7
Total Migrants	188	356	544

Source: Author's computations using data from LSMS 2013-14 and 2015-16 rounds.

Table A3.3 Descriptive statistics of relevant explanatory variables used (N=4,447)

Variable Description	Migrant HHs	Non-Migrant HHs	Difference b/n means	Standard error
Household head is male (1=yes)	0.733	0.809	0.076	0.018***
Age of head (in years)	52.110	45.599	-6.511	0.665***
Head comp. secod. educ (1=yes)	0.031	0.038	0.007	0.009
Size of household	5.832	5.492	-0.340	0.103***
Number of children< 15yrs of age	1.775	2.333	0.557	0.075***
Number of adults>=65	0.230	0.162	-0.068	0.019***
Household asset wealth index	0.422	0.345	-0.077	0.227
Tropical livestock units (TLU)	3.788	3.773	-0.015	0.450
Head employed off-farm (1=yes)	0.064	0.048	-0.017	0.010
Dummy access to animal plow (1=yes)	0.180	0.248	0.068	0.019***
Household used unpaid labor (1=yes)	0.230	0.168	-0.062	0.017***
Proportion of flat land	0.611	0.542	-0.069	0.019***
Proportion of fertile land	0.271	0.323	0.052	0.019**
Land under irrigation (in ha)	0.022	0.019	-0.003	0.006
Land under farming (in ha)	1.929	1.109	-0.820	0.317**
Log(non-farm income excld. remit)	0.668	0.788	0.121	0.108
Distance to nearest mkt. (km)	6.821	6.974	0.153	0.534
Dummy HH access to advisory services (1=yes)	0.705	0.649	-0.056	0.022**
Age of a child <5yrs (in months)	33.890	34.903	1.013	1.068
Sex of a child (1=male)	0.487	0.480	-0.007	0.032
Dummy access to improved water sou.(1=yes)	0.729	0.611	-0.118	0.031***
Dummy access to waste disposal (1=yes)	0.509	0.534	0.025	0.031
Lag of migration prevalence (inst)	0.317	0.256	-0.060	0.009***
Observations	544	3903		

Note: significant at *** p<0.01, ** p<0.05, and * p<0.1.

Table A3.4: Parameter estimates for the selection model for gender specific migration (Multinomial logit model) (reference category non-migrant HHs)

VARIABLES	Male migration	Female Migration
Household head is male (1=yes)	-0.810***	-0.229
	(0.165)	(0.196)
Age of household head (in years)	0.011*	0.042***
	(0.006)	(0.008)
Dummy household head has no educ.	-0.152	-0.151
	(0.145)	(0.160)
Household size	0.361***	0.266***
	(0.033)	(0.042)
Number of children <15years old (in number)	-0.501***	-0.356***
	(0.057)	(0.065)
Number of HH members >=65 age(in number)	-0.044	-0.879***
	(0.169)	(0.254)
Asset wealth index	0.010	0.010
	(0.012)	(0.016)
Dummy household has access to credit	0.182	0.112
	(0.152)	(0.189)
Dummy household used unpaid labor	0.425***	0.146
	(0.133)	(0.175)
Land owned in ha	0.007**	0.002
	(0.003)	(0.009)
ln(non-farm income excluding remittances)	-0.061**	0.021
	(0.030)	(0.031)
Distance to nearest mkt. in km	0.003	-0.006
	(0.005)	(0.007)
Year_dummy (year=2013/14)	0.001	0.011
	(0.110)	(0.128)
lag_migration preva (**Instrument**)	1.080***	1.438***
	(0.287)	(0.342)
Control Region (all_other_region)		
Tigray	-0.099	-0.359
	(0.245)	(0.356)
Amhara	0.236	0.419
	(0.203)	(0.274)
Oromia	-0.212	-0.191
	(0.218)	(0.274)
SNNP	-0.332	0.053
	(0.208)	(0.260)
Constant	-3.742***	-5.884***
	(0.418)	(0.586)
Observations	4,447;	Wald $\chi^2(36)=326.99$*

Note: Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, and * p<0.1.

Table A3.5: Estimates of technology adoption equation by multinomial endogenous switching regression model: For adoption of chemical fertilizers, adoption of better seeds, and their combined use

	Chemical fertilizer use			Better seeds			Combined used		
VARIABLES	(1) Non-Migrant	(2) Male Migrant HH	(3) Female Migrant HH	(1) Non-Migrant HHs	(2) Male-Migrant HHs	(3) Female- Migrant HHs	(1) Non-Migrant HHs	(2) Male Migrant HHs	(3) Female Migrant HHS
Household head is male (1=yes)	0.067*	-0.000	-0.068	0.038	-0.272	0.081	0.029	-0.082	0.104
	(0.035)	(0.192)	(0.205)	(0.026)	(0.234)	(0.205)	(0.025)	(0.163)	(0.166)
Age of household head (yrs)	0.000	0.003	-0.005	0.009***	0.007	0.005	0.008***	0.009	0.000
	(0.002)	(0.008)	(0.010)	(0.002)	(0.009)	(0.013)	(0.002)	(0.006)	(0.009)
Dummy HH head has no educ.	0.009	-0.044	-0.093	0.021*	-0.036	-0.047	0.024**	0.002	-0.043
	(0.015)	(0.067)	(0.072)	(0.012)	(0.080)	(0.087)	(0.011)	(0.048)	(0.074)
Household size	-0.020	-8.18e-05	0.056	-0.013	0.094	0.006	-0.008	0.052	0.023
	(0.015)	(0.073)	(0.067)	(0.012)	(0.074)	(0.063)	(0.012)	(0.055)	(0.048)
No. of children <15yrs of age	0.023	0.025	-0.083	0.016	-0.163	-0.041	0.009	-0.069	-0.091
	(0.019)	(0.098)	(0.089)	(0.013)	(0.103)	(0.078)	(0.013)	(0.066)	(0.068)
No. of HH members > 65 yrs of age	-0.033	0.236	0.176	-0.038	0.163	-0.159	-0.044**	0.145	-0.098
	(0.038)	(0.190)	(0.225)	(0.025)	(0.180)	(0.275)	(0.022)	(0.117)	(0.211)
Asset wealth index	-0.001	0.009	-0.017	0.002	-0.002	0.001	0.002	0.000	-0.003
	(0.002)	(0.007)	(0.012)	(0.001)	(0.011)	(0.009)	(0.001)	(0.008)	(0.008)
Household has access to credit	0.210***	0.220***	0.150**	0.020	0.110	-0.022	0.030*	0.042***	0.0545***
	(0.023)	(0.073)	(0.010)	(0.018)	(0.086)	(0.108)	(0.017)	(0.005)	(0.007)
Dummy HH head employed off farm	-0.027	-0.042	0.035	-0.005	0.110	-0.123	0.001	-0.042	0.007
	(0.032)	(0.099)	(0.119)	(0.019)	(0.113)	(0.127)	(0.018)	(0.054)	(0.114)
Dummy HH access animal plough	-0.145***	-0.200***	-0.053	-0.027***	0.062	0.021	-0.021***	-0.012	0.162**
	(0.016)	(0.060)	(0.073)	(0.010)	(0.070)	(0.104)	(0.008)	(0.048)	(0.082)
Dummy HH used unpaid labor	0.005	0.039	0.031	0.094***	0.248**	0.011	0.086***	0.159*	0.123*
	(0.030)	(0.123)	(0.111)	(0.021)	(0.125)	(0.137)	(0.019)	(0.087)	(0.028)
Land under farming (in ha)	0.001	0.001	-0.000	-0.002	0.001	0.002	-0.002*	-0.000	-0.004
	(0.002)	(0.064)	(0.033)	(0.001)	(0.033)	(0.076)	(0.001)	(0.022)	(0.052)
ln(non-farm income excluding rem.)	0.003	-0.022	-0.016	0.005	-0.038	-0.001	0.000	-0.017	0.003
	(0.006)	(0.022)	(0.038)	(0.005)	(0.026)	(0.039)	(0.004)	(0.018)	(0.026)
Distance to nearest mkt. (in km)	-0.001	-0.005	0.013	-0.000	-0.000	0.004	-0.000	0.002	0.008
	(0.001)	(0.004)	(0.008)	(0.000)	(0.004)	(0.007)	(0.000)	(0.003)	(0.006)
Dummy access to advisory services	0.282***	0.361***	0.353***	0.079***	0.116***	0.025	0.076***	0.136***	0.037
	(0.015)	(0.055)	(0.078)	(0.009)	(0.038)	(0.078)	(0.008)	(0.028)	(0.053)

Table A3.5: Estimates of technology adoption equation by multinomial endogenous switching regression model: For adoption of chemical fertilizers, adoption of better seeds, and their combined use (continued)

	Chemical fertilizer use			Better seeds			Combined used		
VARIABLES	(1) Non-Migrant	(2) Male Migrant HH	(3) Female Migrant	(1) Non-Migrant HHs	(2) Male-Migrant HHs	(3) Female Migrant HHs	(1) Non-Migrant HHs	(2) Male Migrant HHs	(3) Female Migrant HHS
Mundlack's time average									
Mean of age of head	-0.000	-0.009	-0.005	-0.009***	-0.012	-0.005	-0.008***	-0.015***	-0.000
	(0.002)	(0.008)	(0.008)	(0.002)	(0.008)	(0.008)	(0.002)	(0.005)	(0.006)
Mean of household size	0.013	-0.024	-0.035	0.006	0.015	0.026	0.003	-0.017	0.009
	(0.012)	(0.031)	(0.040)	(0.007)	(0.034)	(0.037)	(0.006)	(0.019)	(0.028)
Mean asset wealth index	0.031***	0.029**	0.047***	0.005**	0.004	-0.059***	0.007***	0.023*	-0.028*
	(0.004)	(0.013)	(0.016)	(0.003)	(0.015)	(0.020)	(0.002)	(0.012)	(0.015)
Mean ln(non-farm income excd. remit.)	-0.004	0.019	-0.0042	0.005	0.026	0.021	0.007	0.008	0.0123
	(0.006)	(0.016)	(0.028)	(0.005)	(0.022)	(0.031)	(0.005)	(0.015)	(0.022)
Mean land under farming	0.022**	0.013	-0.021	0.009	-0.023	-0.018	0.011*	-0.017	0.031
	(0.010)	(0.059)	(0.049)	(0.006)	(0.042)	(0.082)	(0.006)	(0.026)	(0.068)
Mean distance in km from nearest mkt	-0.006***	0.0024	-0.018**	-0.001	0.002	-0.008	-0.001**	-0.003	-0.012**
	(0.001)	(0.006)	(0.009)	(0.001)	(0.006)	(0.007)	(0.001)	(0.003)	(0.005)
Year_dummy (1=2013/14)	-0.017	-0.000	-0.003	-0.005	0.093	0.101	-0.004	0.085*	0.061
	(0.014)	(0.051)	(0.080)	(0.012)	(0.067)	(0.083)	(0.010)	(0.046)	(0.075)
Control region (other regions)									
Tigray	0.110***	0.344***	0.379	-0.071***	-0.120	-0.000	-0.055***	-0.075	0.188
	(0.038)	(0.114)	(0.235)	(0.022)	(0.131)	(0.165)	(0.019)	(0.096)	(0.159)
Amhara	-0.073***	-0.041	0.018	-0.017	0.116	0.355*	-0.011	-0.009	0.347***
	(0.028)	(0.106)	(0.124)	(0.022)	(0.146)	(0.195)	(0.019)	(0.080)	(0.106)
Oromia	0.004	0.143	0.149	0.002	0.058	0.379*	0.002	-0.067	0.370***
	(0.036)	(0.109)	(0.147)	(0.022)	(0.130)	(0.201)	(0.020)	(0.068)	(0.121)
SNNP	0.040*	0.204*	0.286**	0.032	-0.137	0.183	0.036**	-0.099	0.273**
	(0.023)	(0.120)	(0.134)	(0.023)	(0.154)	(0.217)	(0.018)	(0.118)	(0.136)
Selection bias correction terms									
_m1	-0.226	0.779	1.415	-0.212	-0.589	0.848	-0.139	0.466	1.265
	(0.243)	(1.549)	(2.053)	(0.202)	(1.075)	(2.145)	(0.176)	(0.912)	(2.064)
_m2	-0.927*	0.160	2.217	-0.458	0.366	0.392	-0.377	0.186	1.264
	(0.494)	(0.216)	(2.141)	(0.340)	(0.243)	(2.291)	(0.303)	(0.167)	(2.019)
_m3	0.299	-1.391	-0.203	0.028	-0.796	0.116	0.147	-0.291	0.115
	(0.367)	(1.409)	(0.209)	(0.261)	(1.423)	(0.230)	(0.243)	(1.176)	(0.169)
Constant	0.174**	0.585	3.314	-0.049	-1.683	0.319	-0.042	0.040	0.812
	(0.072)	(1.881)	(2.776)	(0.060)	(1.633)	(3.217)	(0.053)	(1.221)	(2.798)

Note: Robust standard errors in parentheses; Significant at *** p<0.01, ** p<0.05, and * p<0.1

Table A3.6: Estimates of Child nutritional status equation by Multinomial Endogenous Switching Regression Model: For Child Wasting and Child Stunting

	Child Wasting			Child Stunting		
	(1)	(2)	(3)	(1)	(2)	(3)
VARIABLES	Non-Migrant	Male Migrant HH	Female Migrant	Non-Migrant HHs	Male Migrant HHs	Female Migrant HHs
Household head is male (1=yes)	0.059***	-0.001	0.078	0.018	0.174	0.225*
	(0.013)	(0.070)	(0.120)	(0.029)	(0.108)	(0.131)
Age of household head (yrs.)	-0.001	0.003	-0.020	-0.003	0.018	-0.005
	(0.001)	(0.007)	(0.025)	(0.003)	(0.013)	(0.031)
Dummy HH head has no educ.	0.014	0.097*	0.098*	0.085***	0.371***	0.075
	(0.009)	(0.050)	(0.053)	(0.021)	(0.076)	(0.184)
Household size	0.017*	0.156***	-0.052	-0.005	0.189***	0.072
	(0.009)	(0.040)	(0.049)	(0.014)	(0.054)	(0.063)
No. of children <15yrs of age	0.020**	0.156***	0.880***	0.040**	-0.082	0.035
	(0.008)	(0.047)	(0.066)	(0.020)	(0.074)	(0.071)
No. of HH members > 65 yrs. of age	-0.022	-0.032	-0.076	-0.049	-0.861**	-0.967
	(0.028)	(0.209)	(0.577)	(0.069)	(0.411)	(0.615)
Asset wealth index	-0.003***	-0.018***	-0.023***	-0.005**	-0.037***	-0.032***
	(0.001)	(0.006)	(0.004)	(0.002)	(0.011)	(0.010)
Land owned in hectares	-0.002	0.033	-0.089*	-0.005	0.020	0.044
	(0.001)	(0.043)	(0.052)	(0.003)	(0.069)	(0.090)
Dummy HH used unpaid labor	-0.049***	-0.122**	-0.124	-0.054***	0.073	0.045
	(0.011)	(0.057)	(0.098)	(0.018)	(0.099)	(0.134)
Dummy for use either chemical fertilizers or better seeds	-0.027***	-0.079	0.103	-0.023*	0.073	-0.011
	(0.008)	(0.059)	(0.129)	(0.012)	(0.081)	(0.138)
ln(non-farm income excluding rem.)	-0.002	0.028***	-0.024	0.002	0.052***	-0.023
	(0.002)	(0.010)	(0.017)	(0.003)	(0.016)	(0.032)
Dummy access to improved water source	0.006	-0.106**	0.151	-0.096***	0.012	0.036
	(0.008)	(0.050)	(0.111)	(0.014)	(0.055)	(0.103)
Dummy access to waste disposal	-0.043***	-0.012	-0.081***	-0.040***	-0.016	-0.300**
	(0.007)	(0.047)	(0.002)	(0.015)	(0.063)	(0.129)
Dummy community in a 'woreda' town	0.002	0.005	0.044	-0.026	0.029	-0.588***
	(0.013)	(0.087)	(0.145)	(0.019)	(0.164)	(0.192)
Age of child (in months)	-0.002***	-0.005***	-0.000	-0.002***	-0.003**	-0.0002
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.002)
Dummy sex of a child (1=male)	0.022***	0.027	0.008	0.030**	0.229***	0.275*
	(0.008)	(0.036)	(0.087)	(0.012)	(0.063)	(0.144)

Table A3.6: Estimates of Child nutritional status equation by multinomial endogenous switching regression model: For child wasting and child stunting (**continued**)

VARIABLES	Child Wasting (1) Non-Migrant	(2) Male Migrant HH	(3) Female Migrant HHs	Child Stunting (1) Non-Migrant HHs	(2) Male-Migrant HHs	(3) Female Migrant HHs
Mundlack's time average						
Mean of age oh head	0.003**	-0.004	0.023	-0.001	-0.016	0.008
	(0.001)	(0.005)	(0.021)	(0.003)	(0.010)	(0.030)
Mean of household size	-0.024***	0.100***	0.010	-0.008	-0.139***	-0.042
	(0.007)	(0.030)	(0.046)	(0.013)	(0.051)	(0.039)
Mean of children under 15 yrs of age	0.017**	-0.114**	0.018	-0.013	-0.037	-0.025
	(0.008)	(0.049)	(0.090)	(0.017)	(0.066)	(0.086)
Mean of older household members >65 yrs of age	-0.028	0.055	0.152	0.160**	0.805**	0.877
	(0.029)	(0.184)	(0.458)	(0.068)	(0.381)	(0.617)
Mean of total land hectares owned	-0.001	-0.0058	0.072*	0.002	0.005	-0.123**
	(0.002)	(0.040)	(0.042)	(0.004)	(0.052)	(0.049)
Mean of household asset wealth index	-0.001	0.058***	-0.004	0.010***	-0.027	-0.009
	(0.001)	(0.014)	(0.015)	(0.003)	(0.017)	(0.026)
Mean of child age	-0.003***	0.003	0.006	0.001	0.002	0.007
	(0.001)	(0.003)	(0.007)	(0.001)	(0.003)	(0.008)
Year_dummy (1=2013/14)	0.008	0.0297	-0.177**	0.014	0.008	-0.200**
Control region ('other region')	(0.009)	(0.041)	(0.070)	(0.016)	(0.094)	(0.099)
Tigray	-0.024	-0.080	0.169	-0.156***	-0.238**	-0.478**
	(0.020)	(0.090)	(0.147)	(0.026)	(0.119)	(0.243)
Amhara	-0.077***	-0.283***	-0.099	-0.177***	-0.241*	0.232
	(0.016)	(0.087)	(0.105)	(0.028)	(0.125)	(0.146)
Oromia	-0.102***	-0.191*	-0.097	-0.079***	-0.234	0.049
	(0.015)	(0.098)	(0.184)	(0.029)	(0.149)	(0.260)
SNNP	-0.099***	-0.011	0.106	-0.122***	-0.184	0.074
	(0.013)	(0.075)	(0.135)	(0.024)	(0.136)	(0.184)
Selection correction terms						
_m1	0.385***	-1.115**	-0.525	-0.511***	0.464	-2.071
	(0.109)	(0.474)	(1.561)	(0.118)	(1.028)	(1.529)
_m2	0.154	-0.193***	-0.798	-0.322*	0.256**	0.517
	(0.118)	(0.056)	(1.035)	(0.180)	(0.108)	(1.150)
_m3	0.291**	-0.330	0.006	-0.874***	-0.397	0.038
	(0.117)	(0.508)	(0.087)	(0.200)	(0.959)	(0.160)
Constant	0.277***	-0.175	-0.607	0.402***	-0.340	-1.962
	(0.035)	(0.426)	(1.962)	(0.054)	(0.914)	(1.761)

Note: Robust standard errors in parentheses; Significant at *** p<0.01, ** p<0.05, and * p<0.1.

Chapter Four

International Remittances, Gender, and Household Expenditure Behavior*

Abstract

In sub-Saharan Africa in general, and in Ethiopia in particular, international migration and inflow of remittances is growing. However, the effects of remittances on households' budget allocations are not well documented. Specifically, the extent to which remittances and gender affect recipient households' expenditure patterns has been neglected in existing research. This study examines this issue in urban Ethiopia. To this end, a unique representative household survey data was collected covering four major urban areas in the country. While, controlling for self-selection bias and endogeneity, the study finds strong evidence that remittances enhance the expenditure share of housing but decrease the share of food expenditure, suggesting substitution between the two major components of households' expenditure. However, expenditure patterns for households receiving remittances are not statistically different from those that do not receive such money in terms of spending on education and health. This finding contradicts the hypothesis that remittance inflows result in a stronger human capital accumulation and therefore improved long run productivity and production possibilities. Moreover, we did not find considerable differences in the expenditure patterns of female and male headed households receiving remittances and neither can any heterogeneous impact be attributed to the gender of the remitters. Hence, this finding can be used as an input for formulating policies for channeling remittances towards productive investments.

Keywords: Migration; Remittances; Gender; Household Expenditure; Engle's Curve

JEL Classification Codes: J61; I31; C31;

***** An earlier version of this paper was published as a chapter in *Poverty and Well-Being in East Africa.* Almas Heshmati (ed.), Springer, 2016.

4.1 Introduction

In many African countries, international remittances have become a major and stable source of foreign exchange revenues. With a 22.5 percent increase compared to remittance inflows in 2010 the official net inflow of remittances to sub-Saharan Africa (SSA) reached $36.4 billion in 2016. These inflows were more than three times the official development aid and were even bigger than foreign direct investments in developing countries (World Bank, 2016). Studying the welfare implications of these remittances for households left behind is crucial. More specifically, how remittances are spent or used by households in origin countries is central to any attempt at evaluating the overall effects of remittances in developing countries because the impact of remittances largely depends on their use. Literature also shows that preferences for using the money are gender specific.

Evidence on the impact of remittances on household expenditure behavior remains scanty with mixed findings. Studies by Adams (2006) in Ghana; Ahmed (2000) in Somaliland; and Adams and Cuecuecha (2010) in Guatemala found that remittances were spent proportionately more on investment type goods such as education, health, and housing as compared to consumption goods. However, Chamital et al. (2003) reached the opposite conclusion that remittances were spent proportionately more on consumption goods such as food and luxury items than on investments in human and/or physical capital. Moreover, though studies show that remittance inflows and expenditure patterns can be highly gender-specific, there is a dearth of research on the relationship between gender and remittances. This is at least true in the context of Ethiopia as most household surveys do not account for gender differences and most data collected on remittances is not disaggregated on the basis of gender. As a result, little is known about the impact of remittances and gender on household expenditure in SSA countries, especially in Ethiopia, one of the poorest countries in the world with high migration rates.

External remittances have been increasing over time and are sequentially taking a central position in the Ethiopian economy. Ethiopia's diaspora is estimated to be around 2 million, and is one of the largest in SSA (Frous, 2015). The amount of international remittances coming to Ethiopia has been increasing at very high rates. According to the National Bank of Ethiopia (2016), external remittances increased sharply from $2 billion in 2012 to $4.5 billion in 2016-17; this exceeded the size of the country's export earnings in the same period. This data does not include

remittance inflows through informal channels. This inflow possibly leads to a decline in households' poverty, liquidity constraints, and income volatilities. Moreover, remittances may increase household expenditure on health, education, and housing which are considered to be particularly essential for economic development.

Consequently, this chapter studies the effect of international remittances on household expenditure patterns. Moreover, analyzing the relationship from an Ethiopian gender perspective makes it possible to grasp the overall effects of migration. This information is necessary when implementing policies related to migration and remittances.

Thus, the objectives of this study are investigating the impact of: (i) international remittances on household expenditure patterns, (ii) the gender of the household head who receives remittances, and (iii) the gender of the migrant who sends the remittances.

This study uses unique representative household survey data collected from four major urban areas in the country. While controlling for selection bias and endogeneity, the study found strong evidence that remittances enhanced expenditure on housing but it decreased the share of food expenditure, suggesting substitution between the two. However, the effect of remittances on expenditure patterns (mainly on education and health) is not statistically different from zero. Moreover, we did not find any considerable difference in the expenditure patterns of female and male headed households, nor any heterogeneous impact related to the gender of the remitters. Hence, this finding can be used as an input while formulating policies for channeling remittances towards investments.

This chapter is organized as follows. The literature on remittances, gender, and expenditure patterns is in the next section. Section 3 deals with data and descriptive statistics while Section 4 focuses on the empirics and estimation strategy. Section 5 discusses the results and Section 6 gives a summary of the analysis with concluding comments and the policy implications of the findings of the study.

4.2 Remittances and Gender: A Review of Literature

Remittances refer to money that is sent by migrants (who are living outside their origin) to their families or relatives (Ratha, 2005). In most developing countries, remittances have become very important. In the last two decades, remittances and their impact have been a topic of interest and

have drawn the attention of researchers. In literature, the effects of remittances have been analyzed at both the micro and macro levels and some studies show that remittances affect: (i) poverty and income inequalities (Adams, 2006; Adams and Cuecuecha, 2010; Clement, 2011; Lisa, 2012; Portes, 2009; Wouterse, 2008); (ii) human capital (Bansak and Chezum, 2009; Kroeger and Anderson, 2011; Mim and Ali, 2012); (iii) household consumption behavior (Clement, 2011; Yameogo, 2014; and others); (iv) investments (Adams, 1998); and (v) consumption (Chami et al., 2008; Pushpangadan, 2003).

The relationship between remittances and household expenditure can theoretically be explained by treating remittances as a source of income for the households receiving them. There is, however, a growing interest in how remittances are spent and whether their use affects economic development (Adams and Cuecuecha, 2010). The role that remittances can play at the household level and their consequent effects on the local community depend on how remittances are used by households because a household is the first unit which takes decisions on the use of remittances and therefore, in essence, it determines the role that remittances will play in the development process of the receiving country. Remittances are received under imperfect information, uncertainty, and with differing regularity (Chami et al., 2005; Seshan, 2012). How they are perceived by households is not straightforward. Based on previous empirical studies, the impact of remittances on households' expenditure decisions has been interpreted mainly according to three different views.

The first view sees remittances as transitory income which can be used for productive activities such as investments, housing, education, health, and other human and physical capital. According to this view, remittances have a positive effect on the growth and development of the receiving country. Table 4.1 gives some studies that support this argument.

Table 4.1 Review of literature

Study	Conclusion
Edwards and Ureta (2003)	A household survey in El Salvador concluded that remittances had a larger positive effect on school retention both in urban and rural areas.
Kifle (2007)	Using household survey in Eritrea, the study concluded that remittances had a positive impact on children's education.
Castaldo and Reilly (2007)	Households that received remittances in Albania spent more on durables and less on food as compared to households who did not receive them.
Airola (2007)	The study concluded that households that received remittances in Mexico spent more of their total income on investment goods like housing, healthcare, and durable goods.
Yang (2008)	Receiving more remittances is associated with a positive effect on the ownership of various types of durable goods, hours worked in self-employment, and investments in capital-intensive enterprises like transportation, communication, and manufacturing.
Taylor and Mora (2006)	This study in Mexico concluded that households that received international remittances spent more on investments and those who received internal remittances spent more on services, health, and housing as compared to those who did not receive remittances.
Adams and Cuecuecha (2010)	A national survey in Guatemala concluded that households receiving internal and external remittances spent more on human capital and investment goods - like education and housing - and less on food.
Tabuga (2007)	A cross-sectional survey in the Philippines showed that remittance receiving households invested more on education, housing, medical care, and durable goods.
Adams (2006)	A survey in Ghana concluded that remittance-recipient households spent less on consumption but more on education as compared to non-recipient households.
Nair (2009)	This study in Nepal concluded that households which received remittances increased the budget share of schooling, health, and durable goods and the share devoted to food decreased when remittances were both sent and received by women.
Randazzo and Piracha (2014)	A study in Senegal concluded that international remittances had a significant negative impact on expenditure on food and a positive impact on durables, investments, and education.
Mahapatro et al. (2015)	A study in India found that compared to non-recipient households, households receiving internal and international remittances spent proportionally less on food and more on education and healthcare.

The second view is more pessimistic and sees remittances as compensatory income. Those who support this view argue that remittances are spent more on consumption than on investment goods

and have no significant positive effect on the development of a remittance receiving country. Chami et al. (2005) found that remittances were negatively correlated with GDP, but contributed to smooth consumption. Adams and Cuecuecha's (2010) study in Indonesia concluded that remittances positively affected marginal expenditure on food consumption, but negatively affected marginal expenditure on investment goods like housing. Clement (2011) showed that in Tajikistan international remittances significantly increased household consumption but had a negative impact on investment expenditure. Three studies in Ethiopia by Lisa (2012), Berhe (2012), and Solomon (2012) support this view. Lisa (2012) concluded that remittances had a positive impact on poverty and consumer asset accumulation, but no effect on productive assets. Similarly, using a survey in urban Ethiopia, Berhe (2012) concluded that remittances had a positive impact on poverty. Solomon's (2012) study in Ethiopia using the Ethiopian Rural Household Survey (ERHS) concluded that remittances had a positive impact on consumption expenditure but not on productive investment expenditure.

The third view sees remittances as a fungible income (just as any other source of income) and therefore makes no difference to households' expenditure behavior. According to this view, if a dollar of income in remittances is treated by a household as a dollar of wage/salary income, then migrants' transfers do not change the way households allocate their expenditure. For example, Adams et al. (2008) concluded that in Ghana remittance incomes were treated just like any other source of income and households' marginal spending patterns did not depend on remittance incomes. Castaldo and Reilly (2007) came to a similar conclusion in Albania and Ang et al. (2009) in the Philippines. However, studies by Tabuga (2007) in the Philippines and Sherpa (2010) and Dhakal (2012) in Nepal show mixed results. They found that remittances were the main source of income and they were spent on consumption (food) and productive activities (such as education, health, housing, or investment goods).

A possible explanation for these different views regarding remittances could be due to differences in the level of development and investment opportunities in the receiving countries. In studies on Africa, the effect of remittances on household expenditure behavior is mixed. This study explores the impact of remittances and gender on household expenditure behavior.

To examine how remittance behavior of women and men differs and what the impact of these differences is, one strand of literature mainly examines the remitting behavior of migrants abroad. Because female migrants tend to earn lower incomes and often have lower rates of labor market

participation in the host country, it is expected that they will remit less than their male counterparts. However, the key question is not the amount, but the share of income that is remitted to the origin family. Osaki (1999) analyzed data from the Thai National Migration Survey and found that female migrants remitted a relatively higher proportion of their incomes as compared to male migrants. Abrego (2009) reached a similar conclusion for Salvadoran migrants in the United States. Interviews with children in El Salvador showed that a much larger proportion of children in mother-away households were thriving economically as compared to those in father-away households. A study by Eloundou-Enyegue and Calves (2006) using a representative sample of 3,369 women from Cameroon, Benin, Malawi, Mali, Rwanda, Uganda, Zambia, and Zimbabwe, investigated whether women in this sample remitted significant amounts and whether the remittance amounts depended on their level of education. The findings from the multivariate logit model showed that women had a substantial capacity to remit and these remittances increased with their education levels.

Another strand of literature picks up on the latter theme, focusing on the impact of gender on the use of remittances by recipients in the origin country, that is, female recipients channel a larger proportion of the received remittances to health, nutrition, and educational investments for the origin family. Allocations for household expenditure may possibly be affected as bargaining power within a family is modified subsequent to migration and remittances. Though the findings are country specific, studies have found that remittances sent and /or received by females are spent proportionately less on physical investments and savings and more on household well-being, specifically on children's education and nutrition (Mason and King, 2001; Quisumbing and Maluccio, 2000). For example, a World Bank study in Sri Lanka found that remittances received by male headed households were spent proportionately more on asset accumulation while those received by female household heads had a positive impact on education and health (De and Ratha, 2005). A study in Cote d'Ivoire by Hoddinott and Haddad (1995) found that household incomes controlled by women were spent more on food and less on alcohol and cigarettes. Doss (2006) found a similar relationship between gender and household expenditures in Ghana.

Thus, in most countries a stronger female intra-household bargaining power seems to increase expenditure on education, health, and food, while male remitters or male household heads prefer investing in housing and other assets (see, for example, Guzman et al., 2008). However, at least one study comes to the opposite conclusion. In a case study in Mexico, Pfeiffer and Taylor (2008)

found that female remitters invested a smaller share of the total income on education as compared households with a male remitter. This may be related to a principal agent problem as the migrant is not physically present in the origin household and therefore cannot fully monitor the recipient's behavior.

4.3 Data

This study uses two repeated cross-sectional datasets for 2013 (round 1) and 2017 (round 2).[43] In both the rounds not only is detailed information on migration and remittance experiences of the households and the migrants collected, but there are also questions related to the household head's characteristics, human capital, income, consumption expenditure, and well-being of the household.

The first round covered 636 households and was completed in March 2013. The sample was drawn from a list of woredas (districts) selected from four major urban areas in the country (Addis Ababa, Gonder, Hawassa, and Mekelle). A combination of non-probability and probability sampling design was used for collecting the data. More specifically, sampled urban areas were selected using purposive sampling based on the prevalence of migration and population size. However, to select sub-cities, woredas, kebeles, or the lowest administrative areas according to Ethiopia's administrative structure and households simple random sampling technique were applied. Thus, a total of five kebeles from the sampled cities were selected.[44] All the households in the selected kebeles were asked whether they had a family member(s) outside Ethiopia and whether he/she remitted money or not. Using a filter questionnaire this helped in constructing the sampling frame.[45] The sample included households that had received remittances in the last 12 months and who had migrants abroad, and households which had not received remittances and had no migrant members abroad. From this, remittance receiving households and non-remittance receiving households were selected using a simple random sampling technique. All the households

[43]Data for round 1 was collected with the support from the Organization of Social Science Research for Eastern and Southern African Countries (OSSREA) for a project on migration and development. Data for round 2 was collected support from the Commercial Bank of Ethiopia.

[44]Two kebeles namely '*Kebele* 08/16' from Gulele sub-city and 'Kebele 16/18/21/22' from Bole sub-city were randomly selected from Addis Ababa. One kebele from each of the three cities was also selected in a similar fashion: from Gonder '*Medihaniyalem',* Hawassa '*Mehal ketema'* and from Mekelle '*Adihaki'.*

[45]The data collectors did a door-to-door survey and put a code on the household's main gate that stated that the household received international remittances and an 'X' was put to show the households that did not receive any international remittances. This coding system helped the data collectors in their second visit when they administered the main questionnaire.

in the sampling frame were interviewed. In round 2, using the same sampling procedure as in round 1, a total of 605 households were interviewed from the same kebeles in the urban areas between October and November 2017.

4.3.1 Descriptive Statistics

Table 4.2 shows the aggregate expenditure categories based on the survey datasets. These categories include two categories of human capital investments (education and health), two consumption categories (food and housing), and one 'other' category (miscellaneous expenditure).[46] These categories constitute more than 90 percent of the consumption aggregate constructed by the World Bank and used as the main welfare indicator for most developing countries. These are the broad categories of budget shares used for the empirical analysis as shown in Table 4.2.

Table 4.2 shows that of the total household expenditure a lion's share – not less than 80 percent -- was allocated to food and 'other' categories irrespective of the household's status (remittance receiving / non-receiving). This kind of expenditure behavior is expected in countries such as Ethiopia which are at a low stage of development.

Table 4.2 Dependent Variables: Share of Expenditure categories

Category	Category Description	Mean
Food	Purchased products, food eaten outside home	0.510
Housing	Real estate, rent with related costs	0.110
Education	Education expenses such as school fees and books	0.025
Health	Health expenses such as doctor fees and medicines	0.054
Other/Miscellaneous/	Durable, non-durable goods, luxuries.	0.301

Source**:** Author's analysis based on the data used for the study.

Table 4.3 gives the summary statistics of the explanatory variables used in the regressions which are disaggregated by gender and remittance receipts. Of the 1,159 urban sampled households in both the rounds, 39 percent of the households in the sample were female headed, and there were differences between male and female headed households: women had higher expenditure levels in remittance receiving households (18,203 Birr per annum).[47] Moreover, compared to non-receiving

[46] Among others it includes expenses on non-durable goods such as clothes, shoes, entertainment, and other durable goods.
[47] On average $1 = 25 Birr in 2017.

households, remittance receiving households had higher per capita expenditure (17,561 Birr per annum).

On average, remittance receiving households had fewer children below the age of 15, a smaller household size, and a lower proportion of educated adults in the cycle of primary and secondary education compared to non-remittance receiving households. The share of adults with tertiary education was higher in remittance receiving households as compared to the other households.
A control variable for city differences in prices was introduced for capital Addis Ababa because the cost of living is a higher there compared to regional cities such as Mekelle, Hawassa, and Gonder. Table A4.1 in Appendix A4 gives a list of the variables used in the regression.

Table 4.3 Descriptive Statistics

	All Households		Male headed households		Female headed households	
Remittance recipient	Yes	No	Yes	No	Yes	No
Per capita expenditure (in birr*)	17561	14531	17933	16233	18203	12547
Household size	4.20	4.30	4.00	4.07	4.14	4.12
Prop. of children <15 years of age	0.18	0.21	0.19	0.21	0.17	0.20
Head completed schooling (in years)	9.00	9.30	9.09	9.51	8.89	9.15
Prop. of adults >= 15 with prim. educ. (%)	0.10	0.10	0.07	0.09	0.09	0.08
Prop. of adults >= 15 with secd. educ. (%)	0.28	0.32	0.27	0.34	0.27	0.27
Prop. of adults >= 15 with tertiary educ.(%)	0.31	0.27	0.35	0.28	0.29	0.27
Household head married (%)	63.0	68.0	0.62	0.67	0.65	0.68
Addis Ababa	0.37	0.40	0.39	0.38	0.36	0.45
Mekelle	0.27	0.26	0.23	0.26	0.36	0.28
Gonder	0.21	0.18	0.26	0.20	0.12	0.15
Hawassa	0.14	0.17	0.12	0.16	0.17	0.13
Observations	545	614	297	340	217	233

Notes: *Ethiopian currency for both rounds on average 1 USD is exchanged for 25 Ethiopian Birr.
Source: Author's computations using survey data.

4.4 Empirical Analysis

4.4.1 Empirical Approach

Among other factors, the effect of remittances on household welfare depends primarily on how the money is spent. The aim of this study is investigating if remittance receiving households spent

proportionately more on human capital investments such as education and health, and how this relationship was affected by whether the household heads were males or females. To understand the effect of remittances looking at where incomes from remittances are spent directly would be misleading because remittances may not be directly invested in human capital, but can reduce liquidity constraints and thus income from other sources may be invested in human capital. Consequently, one has to examine households' entire expenditure patterns. The second methodological issue that arises when analyzing the impact of remittances is endogeneity. Migration (and consequently remittance receipts) has both observable and unobservable characteristics. To deal with the endogeneity of remittances, an appropriate instrument needs to be used.

Once the impact of remittances on households' budget allocations is analyzed, a gender perspective is taken into account. Gender (as remittances) is endogenous as some of the explanatory variables may be correlated with the gender of the household head. A sound instrument for gender is difficult to get, hence endogeneity of the gender is mitigated by applying a matching procedure. This helps obtain female and male headed households which are comparable and thus we can run separate regressions.

The last section of the analysis deals with the impact of the remitter's gender. This study focuses on a sub-sample of 545 remittance-receiving households. A challenge in this analysis, as discussed earlier, is the principal-agent problem that may arise since households in the origin country are the ones who spend the transferred money. Regardless of possibly gender-specific preferences of the remitters, these may not be reflected in the use of the money that they send back.

4.4.2 Econometric Model

To explore the impact of international remittances and gender on households' spending patterns a proper functional form is desirable. We use the Working-Leser approach relating budget shares linearly to the logarithm of total household expenditure (Working 1943; Leser 1963). The Working-Leser approach is preferred for two main reasons. First, with only cross-sectional data like in this study, it is simple to estimate the relation and many researchers have established their

results based on the Engel Curve.[48],[49] Second, compared to models such as AIDS, the Working-Leser model suffers less regarding the specification of the model.

The model specification for this study is given as:

$$S_{ij} = \beta_{0j} + \beta_{1j} \ln(x_j) + \beta_{2j}\boldsymbol{\theta}_i + \beta_{3j}R_i + \varepsilon_{ij} \quad (4.1)$$

where S_{ij} is household *i*'s expenditure share of category good j (that is, expenditure on good j divided by total household expenditure), x_i is per capita total household expenditure, and $\boldsymbol{\theta}_i$ is a vector of household level variables such as human capital, demographic, and location variables. R_i is a dummy variable equal to 1 when the household receives international remittances, and 0 otherwise, and ε_{ij} is the error term. In short, we can write Equation 4.1 as:

$$S_{ij} = \beta_j \mathbf{X}_i + \varepsilon_{ij} \quad (4.2)$$

In this shorter notation, $\mathbf{X}_i$ denotes all explanatory variables of the model including the intercept. The dependent variable S_{ij} as defined earlier reflects the categories of household expenditures as that on food, housing, health, education, and others which are censored dependent variables. Accordingly, a participation equation is added to Equation 4.2 as:

$$S_{ij}^{*} = \gamma_j \mathbf{Z}_i + u_{ij} \quad (4.3)$$

S_{ij}^{*} is a latent dependent variable taking a value of 1 if S_{ij} takes a positive value and 0 otherwise. $\mathbf{Z}_i$ is a vector of explanatory variables included in Equation 4.2 and other variables to allow identification and u_{ij} is the error term.

To obtain unbiased parameter estimates of the above equation 4.3, two major estimation issues arise. First, the dependent variable S_{ij} as defined earlier reflects the categories of household expenditure as food, housing, health, education, and others; they are censored dependent variables. This is so because every household may not have expenditure in each category. The model is an equation system with dependent variables censored by latent variables. The second estimation

[48] The use of cross-section data from the survey for estimating demand systems simplifies the demand analysis as it assumes constant prices (that is, all households have the same prices).

[49] Recent studies such as those by Taylor and Mora (2006), Zarate-Hoyos (2004), and Adams (2005) have applied this approach.

issue is that the error terms are correlated across equations since expenditure shares are not independent of each other because a price shock affecting food items, for example, increases expenditure on food so that food's share goes up which leads to a decline in at least one other budget's share.

For getting unbiased estimates it is important to solve these estimation issues. Till 1999 a two-step estimation procedure by Heien and Wessells (1990) was the standard approach. However, as shown by Shonkwiler and Yen (1999), this standard estimator performs poorly in Monte Carlo simulations and is found to be inconsistent. Hence, as an alternative they recommended a consistent and easy to implement two-step estimator procedure with solid theoretical foundations and wide applicability in empirical work. In the first step, a probit for a household's participation in each budget expenditure equation is estimated. The dependent variable takes a value equal to 1 if $S_{ij} > 0$ and 0 if the reported expenditure on the category equals 0. The results are then used for constructing a selection term, the inverse Mills ratios, in addition to weighting the expenditure equations in the system.[50] Thus, the equation to be estimated in the first step is given by:

$$P(S_{ij}^{*} = 1 \,|\mathbf{Z}_i) = F_j(\beta_j \mathbf{Z}_i) \qquad (4.4)$$

In the second step, the following systems of equations are estimated:

$$S_{ij} = \widehat{F}_j(\hat{\beta}_j \mathbf{Z}_i)\left(\beta_j \mathbf{X}_i + \lambda_i(\hat{\gamma}_j \mathbf{Z}_i)\right) + \varepsilon_{ij} \qquad (4.5)$$

All variables are as defined before, $\lambda_i(.)$ is a selection control function --- the Heckman (1979) control term --- given by $\pi_i \frac{\phi(\hat{\gamma}_j \mathbf{Z}_i)}{\Phi(\hat{\gamma}_j \mathbf{Z}_i)}$, where $\phi(.)$ is the normal probability density function (PDF), $\Phi(.)$ represents the cumulative distribution function (CDF), and π_i are coefficients to be estimated. The system of equations is estimated jointly for the full household sample using iterative non-linear SUR,[51] so as to exploit the information contained in the cross-equations error correlations.[52]

[50]This method has been criticized since as it relies on the assumption that the residuals follow a normal distribution and are homoscedastic in the participation equation. Any violation of the assumptions is expected to result in biased and inconsistent estimation results.

[51] The SUR/SURE Seemingly Unrelated Regression Equations model was proposed by Arnold Zellner in (1962).

[52] For a complete demand equation system, the matrix for the variance and covariance matrix is singular following the additivity criterion. The budget shares are almost equal to one as a result of which convergence becomes difficult. The usual procedure is deleting one of the equations from the system, in this case the miscellaneous category 'other.' No censoring is present in the categories food and housing hence both enter the system as in Equation 4.1.

4.4.3 Endogeneity of Remittances

Studies such as those by McKenzie et al. (2010) and others using natural experiments found that migration selects on both observable and unobservable characteristics. These observable and unobservable household characteristics may affect the decision to migrate. As migration is a precondition for remittance receipts, remittances are expected to be correlated to the residual and are thus endogenous.

To tackle this issue of endogeneity and for avoiding biased estimates an appropriate instrument should be used. In a sense, we need to select an instrument variable which is highly correlated with the probability of migration and hence remittances, but uncorrelated with the dependent variable budget share (S_{ij}). For example, Nnaemeka et al.'s (2012) study in Nigeria used 'ethnicity' and 'religion' as instruments for migration and remittances. Berhe (2012) used 'religion' in his study in Ethiopia while Adams (2005) used 'age of household head' in his study in Ghana. As a source of identification, in this study a variable 'lag of migration prevalence' is constructed from the second round of the Ethiopian Living Standard Survey (LSMS)[53] in 2013-14. It is defined as the proportion of remittance receiving households in the community of the study areas. This variable is interacted with the proportion of household members with secondary and higher levels of education. This allows the instrument to vary at the household level (Amuedo-Dorantes and Pozo, 2006; Hanson and Woodruff, 2003; Kristin, 2013). The justification is that historic migration rates are exogenous and are unlikely to have a direct effect on households' current consumption but historical migration developed networks that can promote future migration and hence remittances.

4.4.4 Endogeneity of the Gender

We now move to the gender dimension of our investigation. As shown in the descriptive statistics in Table 4.3, household characteristics differ in male and female headed households. Gender is endogenous as the gender of the household head is likely to be correlated with the residual. To account for this endogeneity and making female and male households comparable this study used

[53] This is collected by the Central Statistical Agency (CSA) of Ethiopia with support from the World Bank Living standard survey collected every two years since 2011-12.

a matching procedure.[54] This matching procedure helped identify for each treated observation (male headed households) its non-treated or control counterpart (female headed households) with equal characteristics. If the variables take on many values (like total per capita expenditure in our case), or if the number of variables is large, exact matching is not possible.

As an alternative we used inexact matching, a common practice that balances the covariates as much as possible. As developed by Blackwell et al. (2009), coarsened exact matching helps coarsening each variable into groups. For instance, total household expenditure is split by quartiles and thus a set of strata which contains all observations with same values of the coarsened data are created. Observations in strata are retained if they contain at least one treated and one control unit; otherwise they are removed from the sample. To obtain the same number of observations for treated and control units in a stratum the observations are randomly excluded.

4.5 Results

4.5.1 Impact of international remittance receipts

To address issues of endogeneity, in the first stage, a probit is estimated for the receipt of remittances. Table A4.2 in Appendix A4 gives the results of the first stage of the procedure (see Column 1). The coefficient of the instruments used for remittances has the expected sign and there is a strong correlation with the endogenous regressor, implying that the instrument used is relevant. The results also suggest that variables such as per capita expenditure positively affect the probability of migration and thus remittances. Perhaps this is because migration is an expensive activity and hence wealthier households can afford it. Moreover, as stressed in other studies, migration is positively influenced by education, implying that more educated people are more likely to migrate. Moreover, looking at remittances location wise as compared to our control region Addis Ababa, households in regional cities had a higher probability of receiving remittances. This may be due to the relative pervasiveness of migration in these cities.

Table A4.3 in Appendix A4 gives a range of Wu-Hausman tests for each expenditure category. The tests confirm that for each expenditure category, the remittances are strongly correlated with

[54]Matching is a procedure that eliminates endogeneity insofar as both groups end up having exactly the same characteristics, that is, observables. But matching does not eliminate any bias due to unobservable. Yet it will be very difficult to find a reasonable instrument for gender and therefore matching is chosen as a technique here.

the error terms. This confirms the necessity of identifying causal effects. Further, the F-statistics of the instruments (F-test=112) in the first stage are well above the critical values outlined by Stock and Yogo (2002) to detect weak instruments.

Table A4.4 gives the results of the non-linear SUR estimations of the budget share equation system based on Equation 4.5. The estimates are bootstrapped to account for the additional variability introduced by the two-step nature of the estimation process. Quite a few variables have the expected signs and their coefficients are significant. Thus, household characteristics such as household size, educational status, number of children, log of per capita household expenditure, and location seem to affect households' expenditure behavior. In line with our expectations an increase in the log of household size is associated positively with a higher budget share for human capital goods mainly for education (approximately by 5 percentage points) but a decline in housing's share (by 11 percentage points). Similarly, the share of the food budget is affected by the number of adults and the location of the household. Note, however, that surprisingly food's budget share increases by 5 percentage points when there is an increase in the proportion of adults with university education. Though this appears to be counter-intuitive it also fits urban households in Ethiopia. This may be because with high levels of youth unemployment, adult household members may not be engaged in income earning activities and may be dependent on the household for their expenses. Compared to households in Addis Ababa (our control region) households in Mekelle and Gonder had a higher budget share for food approximately by 9 and 10 percentage points respectively. This may probably be due to Addis Ababa's proximity to surplus agricultural areas compared to Mekelle and Gonder. However, it may also be the case that compared to the regional cities, housing prices are more in Addis Ababa and thus households may use a higher budget share on housing and a smaller share on food.

The share of human capital investments (mainly education) increases with the proportion of children in the household, and with the log of household size. However, the share of housing decreases with human capital variables (proportion of household members with primary and secondary education), and the log of household size.

Lastly, an increase in the log of per capita total household expenditure is associated with a decrease in the share of food but an increase in the share of investment type goods such as housing. This is in line with Engle's law which states that as household income (expenditure) increases, the share of necessary goods such as food decreases but the share of non-food and investment goods

increases.

Turning to our variable of interest which is the effect of international remittances on household expenditure patterns, one sees that the estimated coefficient corresponding to the variable capturing the receipt of external remittances is statistically significant for food and housing expenditure's shares and is negative for the former. On average remittance leads to a decline in food expenditure by 21 percentage points but an increase in housing by 18 percentage points. The increase in housing expenses is in line with the findings of Soruco et al. (2008) who analyzed remittances in Ecuador and found that the first investment financed by remittances was usually directed towards housing. Studies by Taylor and Mora (2006) and Zarate-Hoyos (2004) provide evidence that remittances result in lower expenditure on food, and substantially higher expenditure on housing. On the other hand, there is no significant difference in expenditure patterns between both groups of households in terms of spending on health and education.

4.5.2 The impact of Gender

Matching is used for making female and male headed households comparable. However, matching reduces the number of observations. Female headed households are different from their male counterparts, and 295 of them were in a stratum without any control observations. Consequently, they were excluded, which left 864 female and male headed households.

Columns 2 and 3 of Table A4.2 in Appendix A4 gives the first stage results for both household types. The gender specific first-stage results are similar. Receiving remittances is more likely if the incidence of remittances in the community is higher.

The results of the non-linear seemingly unrelated regression's (SUR) estimations are shown in Table A4.5 and A4.6 in Appendix A4. The remittance instrument is significant for food and housing expenditure categories and has the same sign for both genders. Both household types show similar expenditure behavior. Female headed households spend slightly less on food, but more on housing, more or less like their male counterparts. Remittances decrease expenditure on food by around 38 percentage points but increase spending on housing by 22 percentage points for female headed households (see Table A4.6 in Appendix A4). For male headed households, remittances result in an 18 percentage point lower food share, while the share of housing increases by 22 percentage points (see Table A4.5 in Appendix A4).

Table A4.7 in Appendix A4 gives the results of the impact of the remitter's gender using a sub-sample of 545 remittance receiving households. We introduce an additional covariate, a dummy variable for the gender of the remitter. The estimation results for the other covariates are more or less similar to those obtained in previous estimations. There is no statistically significant difference in the expenditure behavior of both the groups of households, implying that the gender of the person who remits may not be important in effecting expenditure behavior. However, this result does not take into account the principal-agent issue, that is, the fact that the remitter may not enforce his/her preferences about how the money should be spent due to his/her absence. Thus, this finding could be reversed, or even more intensified once appropriate variables are used to proxy a remitter's capacity to follow up on the intended use of the remittances.

In conclusion, unlike literature on the link between remittances and gender and consumption expenditure which suggests that including a gender perspective is crucial our findings like those of Kristin (2013), disagree with this perception as gender specific effects are rather small in Ethiopia.

4.6 Conclusions and Policy Implications

4.6.1 Conclusions

The growing inflows of migrants' remittances show that these remittances now have an important and central position in the Ethiopian economy. The effects of these transfers on the development of the country of origin depend, among other factors, on how remittances are perceived and used by recipient households. This study examined the effect of remittances on households' budget allocations and how the gender of the remitter or receiver shaped these allocations. It used the Working-Lesser model derived from Engel's curve. For addressing the issue of endogeneity and self-selection we also used a non-linear SUR estimation technique.

Our findings show that except for the housing and food budget categories, the average impact of remittances was not clear-cut. Though remittances increased expenditure on housing; there were no noticeable differences in expenditure on education and health. As a result, remittances might not result in stronger human capital accumulation with positive external effects for the rest of the economy. On the other hand, when the effect of remittances is disaggregated on the basis of gender,

which literature on remittances suggests is crucial, our findings show that the gender specific effect is rather small. Compared to their counterparts, female household heads spent slightly more on housing and less on food; yet there is no statistically significant difference in human capital formation between these two groups. In addition, evidence shows that the gender of the remitter did not have an important impact on expenditure behavior, as there is no statistically significant difference in any of the budget categories.

In general, the findings of this study can be further extended by disaggregating the broad category 'other goods' into utility, durable, and other goods which will possibly yield more detailed results. Moreover, with availability of rich household level migration data it will also be more insightful to see if the gender effect varies depending on a migrant's destination and type of employment at the destination because females and males often go to different countries and do different activities.

However, this study's contribution is worthwhile as there is a research gap in investigating the role of Ethiopian migrants' remittances at the household level. Thus, studies like this one are important for understanding how households behave in response to remittances so that the government can facilitate the transfer of remittances and their channeling into productive uses.

4.6.2 Policy Implications

Policy interventions should focus on the ways in which external remittances are channeled to productive investments and on how recipient households and their family members working abroad could have less costly and better ways of sending money back home. Therefore, the following interventions are of a high priority:

1. **Remittance Policy:** Given the recent intensification of international remittances to Ethiopia and their multiplier effect on production, income, and employment, the Ethiopian government should have a specific remittance policy aimed at maximizing the impact of these inflows on national economic growth and development. As such governments may find it difficult to design and implement policies which could typically increase these transfers. However, there are possibilities for governments to implement indirect policies, which can stimulate growth

of remittances on the one hand and harnessing these towards investments on the other.[55] Such as devising mechanisms aimed at mobilizing remittances for investments through higher interest rates on term deposits, foreign currency denominated bank accounts, and tax incentives should be developed. Such initiatives exist in Ethiopia. Moreover, the Ethiopian government should work towards getting remittance inflows in foreign currencies through legal channels.[56] This can be done through promoting a rewarding system for banks and enhancing competitive and less costly money transfer technologies thus enhancing remittances. Hence, a coherent remittance policy which is continuously assessed and improved will help the country in benefiting from the remittances.

2. **Training programs in the Management of Remittances:** Policymakers should devise an optional training mechanism for helping migrants managing their remittances before departure and after returning home. This could take the form of capacity building and campaigns to encourage better use of international remittances. Financial institutions such as banks and money transfer operators can provide leaflets and short explanations/documentaries on available investment options in the country. In this regard, the experience of Latin American countries shows that providing training programs for returning migrants and schemes for using seed money by migrants' start-up businesses helps in channeling remittances to less risky and more productive investments.

   Further, to redirect some of the remittances to investments, the migrant countries' experience shows that the creation of social funds and savings and credit plans for financing home purchases and small business start-ups are crucial. Moreover, Philippines experience shows that the provision of technical assistance programs for developing small-scale productive projects for promoting a productive use of remittances among poor households is useful. In this respect, the Philippines-based NGO, Unlad Kabayan is worth mentioning. It mobilizes and pools migrants' savings, identifies appropriate investments, and facilitates credit applications with the objective of creating jobs through sustainable business start-ups and their development.

[55]The experience of several Latin American and Asian countries such as El Salvador, Nicaragua, Honduras, Guatemala, India, and Pakistan show the importance of having a remittance policy.

[56] I believe it is better to use to a policy than the police to stop informal channels of remittance inflows to the country.

3. **Creating an enabling business environment:** The overall business environment can be improved through better quality of public services, institutions, promoting infrastructure, and reducing uncertainty among others. This will help foster a more productive use of remittances by channeling them to investments. This may also create new job opportunities and growth thus enhancing Ethiopia's competitiveness.

References

Adams, R. (1998). Remittances, investment, and rural asset accumulation in Pakistan. *Economic Development and Cultural Change*, 47, 155-173.

Adams, R. (2005). "Remittances, Poverty and Investment in Guatemala. International Migration, Remittances and the Brain Drain", in C. Ozden and M. Schiff (eds), Washington, DC: The World Bank.

Adams, R. (2006). *Remittances and poverty in Ghana. World Bank Policy Research Working Paper 3838.* Washington, DC: The World Bank.

Adams, R. H., and Cuecuecha, A. (2010). Remittances, household expenditure and investment in Guatemala. *World Development*, *38* (11), 1626-1641.

Adams, R., Richard, A., and Page, J. (2008). *Remittances, consumption and investment in Ghana.* Washington, DC: The World Bank.

Abrego, Leisy (2009). Economic well-being in Salvadoran transnational families: How gender affects remittance practices. *Journal of Marriage and Family, 71*, 1070–1085.

Ahmed, I. (2000). Remittances and their Economic impact in post-war Somaliland. *Disasters, 24(4)*, 380-389.

Amuedo-Dorantes, C., and Pozo, S. (2006). Migration, remittances, and male and female employment patterns. *American Economic Review, 96(2), 1626-1641*.

Airola, J. (2007). The use of remittance income in Mexico. *International Migration Review*, *4*, 850-859.

Ang, P. A., Sugiyarto, G., and Jha, S. (2009). *Remittances and household behavior in the Philippines.* Asian Development Bank, ADB Economics Working Paper Series.

Bansak, C., and Chezum, B. (2009). How do remittances affect human capital formation of school-age boys and girls? *American Economic Review*, *99*(2), 145-148.

Berhe, M. (2012). The Effect of international remittances on poverty and inequality in Ethiopia. *Journal of Development Studies*. 50. 10.1080/00220388.2014.940913.

Blackwell, M., Lacus, S., King, G., and Porro, G. (2009). CEM: Coarsened Exact Matching in stata. *Stata Journal*, *9*(4), 524-546.

Castaldo, A., and Reilly, B. (2007). Do migrant remittance affect consumption patterns? *South Eastern Journal of Economics*, 1, 25-54.

Chami, R., Barajas, A., Cosimano, T., Fullenkamp, C., Gapen, M., and Montiel, P. (2008). *Macroeconomic consequences of remittances. Occasional paper 259.* Washington DC: The International Monetary Fund.

Chami, R. Fullenkamp, C., and Jahjah, S. (2005). Are immigrant remittance flows a source of capital for development? *IMF Staff Papers*, *52*(1), 55-81.

Chami, R., Jahjah, S., and Fullenkamp, C. (2003). *Are immigrant remittances flows a source of capital for development?* IMF Working Papers 03/189, International Monetary Fund.

Clement, M. (2011). Remittances and household expenditure patterns in Tajikistan: A propensity score matching analysis. *Asian Development Review*, *28*(2), 58-87.

DE, P., and Ratha, D. (2005). Remittance income and household welfare: evidence from Sri Lanka Integrated Household Survey. The World Bank, Mimeo.

Dhakal, S. (2012). International remittances, household expenditures and saving: evidence from Nepal. Mimeo.

Doss, C. (2006). The effects of intrahousehold property ownership on expenditure patterns in Ghana. *Journal of African Economies*, *15*(1), 149-180.

Eloundou-Enyegue, P. M., and Calvés, A. E. (2006). Till marriage do us part: education and remittances from married women in Africa. *Comparative Education Review, 50*(1), 1-20.

Edwards, A., and Ureta, M. (2003). International migration, remittances and schooling: evidence from El Salvador. *Journal of Development Economics, 72*, 429-461.

Frous, B. (2015). *A certain Catalyst: An Overview of the (mixed) migration and Development Debate with Special focus on the horn of Africa.* Nairobi: The Regional Mixed Migration Secretariat (RMMs).

Guzman, J. C., Morrison, A. R., and Sjoblom, M. (2008). "The Impact of remittances and gender on household expenditure patterns: Evidence from Ghana", in A.R. Morrison, M. Schiff, and M. Sjoblom (eds), *The international Migration of women*. World Bank and Palgrave Macmillan, pp. 125-152.

Hanson, G.H., and Woodruff, C. (2003). Emigration and Educational attainment in Mexico. Mimeo.

Heckman, J. (1979). Sample Selection Bias as a Specification Error. *Econometrica, 47*(1), 153-161. doi:10.2307/1912352.

Heien, D., and Wessells, C. R. (1990). Demand systems estimation with micro data: A censored regression approach. *Journal of Business and Economic Statistics, 8*(3), 77-96.

Hoddinott, J., and Haddad, L. (1995). Does female income share influence household expenditure? Evidence from Cote d'ivoire. *Oxford Bulletin of Economics and Statistics, 57*(1), 77-96.

Kifle, Temesgen (2007). Do remittances encourage investment in education? evidence from Eritrea. *Journal of African Studies, 4*(1), 2007.

Kristin, Gobel (2013). Remittances, expenditure patterns, and gender: parametric and semi parametric evidence from Ecuador. *IZA Journal of Migration 2013, 2*(1). Available at: http://www.izajom.com/content/2/1/1.

Kroeger, A., and Anderson, K. (2011). *Remittances and children's capabilities: new evidence from Kyrgyzstan, 2005-2008. CASE Network Studies & Analyses, No. 430/2011*. Warsaw: Center for Social and Economic Research.

Leser, C. E. V. (1963). Forms of Engel functions. *Econometrica, 31*(4), 694-703.

Lisa, A. (2012). Migration, remittances and household welfare in Ethiopia. PhD Dissertation. Mimeo.

Mahapatro, S., Bailey, A., Jame, K. S., and Hutter, I. (2015). Remittances and household expenditure patterns in India and selected states. *Migration and Development, 6*(1), 83-101. Mason, A. D. and King, E. M. (2001). *Engendering Development: Through Gender Equality in Rights, Resources, and Voice*. A World Bank policy research report. Washington DC; World Bank.

McKenzie, D., Gibson, J., and Stillman, S. (2010). How important is selection? Experimental vs non-experimental measures of the income gains from migration. *Journal of the European Economic Associations, 8*(4), 913-945.

Mim, S. B., and Ali, M. S. (2012). Through which channels can remittances spur economic growth in MENA countries? *The open-access e-journal*. Available at: htp://hdl.handle.net/10419/62006.

National Bank of Ethiopia (NBE) (2016). Annual Report 2016-17. Addis Abeba, Ethiopia.www.nbe.bank.com.

Nair, P. R. (2009). The Impact of gender and remittances on household expenditure patterns in Nepal. An Unpublished thesis submitted to Georgetown University. Mimeo.

Nnaemeka, C., Ebele A., Sunday E., and Benjamin O. (2012). *Analysis of impact of remittances on poverty in Nigeria*. Working Papers PMMA 2012-09, PEP-PMMA.

Osaki, Keiko (1999). Economic interactions of migrants and their households of origin: are women more reliable supporters? *Asian and Pacific Migration Journal, 8*(4), 447–471.

Pfeiffer, L., and Taylor, J. E. (2008). "Gender and the impacts of international migration: evidence from rural Mexico", in A.R. Morrison, A. R., M. Schiff, and M. Sjoblom (eds), *The International Migration of Women*. World Bank and Palgrave Macmillan, pp. 99-124.

Portes, L. S. (2009). Remittances, poverty and inequality. *Journal of Economic Development, 34*(1), 127-140.

Pushpangadan, K. (2003). *Remittances, Consumption and economic growth in Kerala: (1980-2000).* Centre for Development Studies. Trivendrum, India.

Quisumbing, A. R., and Maluccio, J. A. (2000). Intrahousehold allocation and gender relations. FCND Discussion Papers 84, International Food Policy Research Institute (IFPRI).

Randazzo, T., and Piracha, M. (2014). *Remittances and household expenditure behavior in Senegal.* IZA DP No. 8106.

Ratha, D. (2005). *Remittances: A lifeline for Development*. The World Bank. *http://lst-iiep.iiep-unesco.org/cgi-bin/wwwi32.exe/[in=epidoc1.in]/?t2000=024511/(100).*

Seshan, K. Ganesh. (2012). Does more time spent calling home correlate with higher Remittances? evidence from migrants in the state of Qatar. *The B.E Journal of Economic Analysis and Policy*, *12*(1), Article 36.

Sherpa, D. (2010). *Labor migration and remittances in Nepal*. Kathmandu: International Centre for Integrated Mountain Development.

Shonkwiler, J. S., and Yen, S. T. (1999). Two step estimation of a censored system of equations. *American Journal of Economics, 81*(4), 972-982.

Solomon, M. G. (2012). Migrant remittances and expenditure patterns of rural households in Ethiopia: Evidence from ERHS. Mimeo.

Soruco, X., Piani, G., and Rossi, M. (2008). What emigration leaves behind: The situation of emigrants and their families in Ecuador. RES Working papers 3244, Inter-American Development Bank, Research Department.

Stock, J. E., and Yogo, M. (2002). Testing the Weak Instrument in Linear IV regression. NBER, Technical Working Papers 0284, National Bureau of Economic Research, Inc.

Tabuga A. D. (2007). International remittances and household expenditures – the Philippine Case. Discussion Paper Series 2007-18.

Taylor, J.E., and Mora, J. (2006). *Does migration reshape expenditures in rural households? evidence from Mexico.* World Bank Policy Research Working Paper 3842, Washington, DC: The World Bank.

Working, H. (1943). Statistical laws of family expenditure. *Journal of the American Statistical Association, 38*(221), 43-56.

World Bank Group (2016). *Migration and remittances recent development outlook*. Washington, DC: The World Bank.

Wouterse, F. S. (2008). Migration, Poverty, and Inequality: Evidence from Burkina Faso. International Food Policy Research Institute (FPRI) Discussion Paper 00786.

Yameogo, N. D. (2014). Analysis of household expenditures and the impact of remittances using a latent class model: Case of Burkina Faso. African Development Bank Group, Working Paper No. 200.

Yang, Dean (2008). International Migration, Remittances and Household Investment: Evidence from Philippine Migrants' Exchange Rate Shocks. *The Economic Journal*, 118. 591-630.
Zarate-Hoyos, G. (2004). Consumption and remittances in migrant households: Toward a productive use of remittances. *Contemporary Economic Policy*, *22*(4), 555-565.
Zellner, A. (1962). An efficient method of estimating seemingly unrelated regression equations and tests for aggregation bias. *Journal of the American Statistical Association*, 57, 348-368.

Appendix A4

Table A4.1 Description of Explanatory Variables used

Variables	Description
Household Head's Characteristics	
Sex of household head (1=male)	Dummy for sex of household head (1=male)
Married (1=yes)	Household head is married
Human Capital Variables	
Propo. of adults >= 15 with primary educ.	Proportion of adult households who completed primary education
Propo. of adults >= 15 with secondary educ.	Proportion of adult households who completed secondary education
Propo. of adults >= 15 with tertiary educ.	Proportion of adult households who completed tertiary education
Household level variables	
Propo. of children <15 years of age	Proportion of children less than 15 years of age in a household
Log of household size	Logarithm of household size
Location (control group: Addis Ababa)	
Mekelle	Dummy for households who lives in Mekelle
Gonder	Dummy for households who lives in Gonder
Hawassa	Dummy for households who lives in Hawassa
Treat_dummy (1=yes)	Dummy for households who receive international remittance (1=yes)
log of total household expenditure	Logarithm of per capita expenditure
Instrumental variable	
Lag of prevalence of migration in the area in 2013	Prevalence of migration in the community in 2013
Lag of migration prevalence*prop. of HH members secondary educ and above	Interaction of lag of migration prevalence interacted with proportion of HH members with secondary educ. and above

Table A4.2 First stage prediction of remittances

Dependent variable: Remittance Receipts	(1)	(2)	(3)
VARIABLES	Both	Male	Female
Log(per capital expenditure)	0.150***	0.182***	0.168***
	(0.025)	(0.042)	(0.038)
Log(household size)	0.052*	0.084	0.121**
	(0.031)	(0.0521)	(0.052)
Prop. of children <15yrs	-0.184**	-0.192*	-0.262**
	(0.074)	(0.116)	(0.125)
Prop. of adults >=15 with primary educ.	-0.030	-0.180	0.008
	(0.081)	(0.156)	(0.156)
Prop. of adults >= 15 secondary educ.	0.420***	0.615***	-0.291*
	(0.103)	(0.180)	(0.162)
Prop. of adults >=15 tertiary educ.	0.306***	0.432**	-0.346**
	(0.097)	(0.172)	(0.157)
Location (Addis Ababa control region)			
Gonder	0.452***	0.565***	0.404*
	(0.096)	(0.153)	(0.216)
Mekelle	0.377***	0.437***	0.500**
	(0.090)	(0.141)	(0.211)
Hawassa	0.402***	0.499***	0.535**
	(0.108)	(0.178)	(0.243)
Lag of migration prevalence	0.473**	0.853**	0.401
	(0.226)	(0.376)	(0.468)
Secondary educ. & above*log of mig. prev	0.682***	0.847**	0.622**
	(0.196)	(0.371)	(0.281)
Constant	-1.337***	-1.792***	-1.612***
	(0.318)	(0.541)	(0.537)
Observations	1,159	432	432
R-squared	0.057	0.090	0.086
F-statistics of the instruments F(2, N-K-1)	112.70	57.22	38.40

Note: Significant at *** p<0.01, ** p<0.05, and * p<0.1.

Table A4.3 IV tests

	Food	Housing	Health	Education
All Households				
Wu-Hausman test F(1, N)	7.89	1.10	2.71	0.060
P-value	0.005	0.029	0.099	0.080
Male Headed Households				
Wu-Hausman test F(1, N)	5.72	1.35	1.10	0.710
P-value	0.010	0.240	0.029	0.040
Female Headed Households				
Wu-Hausman test F(1, N)	8.93	2.63	0.00	1.01
P-value	0.003	0.010	0.98	0.031

Source: Own computation using survey data

Table A4.4 Results of full estimates for the sample selection models (SUR estimation)

VARIABLES	Food		Housing		Health		Education	
Predict. HH Receive remittance (1=yes)	-0.205***	0.055	0.180***	0.058	0.023	0.030	0.028	0.026
Log of per capita total HH expd.	-0.033***	0.009	-0.040***	0.009	0.003	0.008	0.015*	0.008
Log of household size	0.044***	0.008	-0.111***	0.009	0.002	0.006	0.053**	0.022
Proportion of children with age <15 in the HH	-0.096***	0.023	-0.017	0.029	-0.020**	0.009	0.120***	0.040
Proportion of adults age >=15 with primary educ.	0.022	0.023	-0.049**	0.022	0.010	0.011	-0.022*	0.013
Proportion of adults age >=15 with second. educ.	0.015	0.021	-0.045*	0.023	-0.014	0.010	0.008	0.010
Proportion of adults age >=15 with tertiary educ.	0.049***	0.019	-0.062***	0.020	-0.015*	0.008	0.002	0.010
Location (Addis Ababa, control area)								
Gonder	0.106***	0.015	-0.050***	0.017	-0.004	0.006	-0.037***	0.009
Mekelle	0.086***	0.010	-0.038***	0.013	-0.006	0.004	-0.011	0.007
Hawassa	-0.011	0.013	0.003	0.016	0.004	0.005	-0.003	0.011
IMR					-0.018	0.016	0.039	0.038
Constant	0.752***	0.075	0.757***	0.088	0.015	0.080	-0.220	0.139
Observations	1159		1159		1159		1159	
R-square	0.231		0.136		0.066		0.144	

Note: Bootstrap standard errors in parentheses. Significant at *** p<0.01, ** p<0.05, and * p<0.1.

Table A4.5 Full estimates of sample selection models: Gender specific for Male headed households

VARIABLES	Food		Housing		Health		Education	
Predict. HH Receive remittance (1=yes)	-0.182***	0.068	0.220***	0.058	0.027	0.029	-0.010	0.037
Log of per capita total HH expd.	-0.045***	0.014	0.009	0.016	-0.006	0.010	0.035**	0.014
Log of household size	0.059***	0.017	-0.088***	0.017	-0.013*	0.007	0.081**	0.038
Proportion of children with age <15 in the HH	-0.140***	0.036	-0.044	0.041	-0.010	0.010	0.160**	0.076
Proportion of adults age >=15 with primary educ.	-0.032	0.045	-0.004	0.049	-0.003	0.013	-0.038	0.024
Proportion of adults age >=15 with second. educ.	-0.023	0.039	-0.119***	0.042	0.008	0.013	-0.013	0.023
Proportion of adults age >=15 with tertiary educ.	0.031	0.030	-0.113***	0.039	-0.110***	0.010	-0.018	0.014
Location (Addis Ababa, control area)								
Gonder	0.084***	0.019	-0.012	0.020	-0.002	0.007	-0.038**	0.016
Mekelle	0.070***	0.018	-0.020	0.016	0.003	0.007	-0.012	0.009
Hawwasa	-0.024	0.020	-0.006	0.024	0.003	0.010	0.002	0.016
IMR					-0.024	0.019	0.088	0.072
Constant	0.890***	0.120	0.361***	0.134	0.107	0.092	-0.466*	0.256
Observations	432		432		432		432	
R-square	0.289		0.144		0.033		0.199	

Note: Bootstrap standard error in parentheses. Significant at *** p<0.01, ** p<0.05, and * p<0.1.

Table A4.6 Full estimates of sample selection models: Gender specific for female headed households

VARIABLES	Food		Housing		Health		Education	
Predict. HH Receive remittance (1=yes)	-0.389***	0.112	0.221*	0.125	0.033	0.057	0.064	0.054
Log of per capita total HH expd.	0.012	0.018	-0.091***	0.021	0.007	0.015	0.100***	0.016
Log of household size	0.078***	0.017	-0.160***	0.018	0.008	0.013	0.030	0.041
Proportion of children with age <15 in the HH	-0.108**	0.048	-0.013	0.048	-0.016	0.018	0.800**	0.074
Proportion of adults age >=15 with primary educ.	0.032	0.044	-0.061*	0.035	0.007	0.019	-0.022	0.021
Proportion of adults age >=15 with second. educ.	0.046	0.035	-0.047	0.032	-0.028*	0.016	0.016	0.017
Proportion of adults age >=15 with tertiary educ.	0.040	0.029	-0.030	0.040	-0.023*	0.010	0.009	0.016
Location (Addis Ababa, control area)								
Gonder	0.102***	0.027	-0.065***	0.023	0.000	0.009	-0.027	0.017
Mekelle	0.139***	0.025	-0.093***	0.029	-0.010	0.008	-0.011	0.011
Hawwasa	0.019	0.025	-0.012	0.028	0.010	0.013	-0.013	0.019
IMR					0.003	0.025	0.001	0.068
Constant	0.341**	0.149	1.248***	0.167	-0.042	0.141	-0.030	0.264
Observations	432		432		432		432	
R-square	0.215		0.210		0.058		0.073	

Note: Bootstrapped standard errors in parentheses. Significant at *** p<0.01, ** p<0.05, and * p<0.1.

Table A4.7 Gender Differential effect of remittances on household expenditure patterns- Based on the Gender of the Remitter

VARIABLES	Food		Housing		Health		Education	
Remitter is female (1=yes)	0.013	0.014	0.009	0.014	-0.003	0.005	0.002	0.008
Log of per capita total HH expd.	-0.046***	0.013	-0.049***	0.012	-0.005	0.007	0.002	0.012
Log of household size	0.051***	0.012	-0.123***	0.012	-0.002	0.007	0.032	0.03
Proportion of children with age <15 in the HH	-0.105***	0.03	-0.017	0.028	-0.019	0.012	0.107**	0.049
Proportion of adults age >=15 with primary educ.	0.006	0.033	-0.039	0.028	0.009	0.013	-0.015	0.014
Proportion of adults age >=15 with second. educ.	0.046*	0.028	-0.051*	0.029	-0.028***	0.011	0.009	0.012
Proportion of adults age >=15 with tertiary educ.	0.061**	0.027	-0.052**	0.021	-0.025**	0.01	0.007	0.014
Location (Addis Ababa, control area)								
Gonder	0.102***	0.019	-0.049***	0.018	-0.007	0.007	-0.028**	0.014
Mekelle	0.091***	0.014	-0.032**	0.015	-0.016***	0.006	-0.009	0.009
Hawwasa	0.009	0.017	-0.003	0.014	0.013	0.009	-0.019	0.014
IMR					-0.003	0.013	0.009	0.051
Constant	0.734***	0.126	1.001***	0.115	0.123*	0.075	-0.022	0.199
Observations	545		545		545		545	
R-square	0.250		0.200		0.078		0.172	

Note: Bootstrap standard errors in parentheses. Significant at *** p<0.01, ** p<0.05, and * p<0.1.

Chapter Five

The Impact of Governance Quality on Food Security: Evidence from sub-Saharan African Countries

Abstract

This paper analyzes the effect of governance quality on food security in sub-Saharan African countries using annual data for the period 1996 to 2016. It uses panel data models to investigate this effect in sample countries. The study concludes that out of the two governance indicators used *controlling corruption* has a positive and significant effect on food security. However, the second indicator of governance measured as the *composite governance index*, which is a combined measure of 'voice and accountability', 'political stability and absence of violence', 'government effectiveness', 'regulatory quality', and 'rule of law', has no significant effect on food security in the sample countries. Moreover, the study also shows that GDP per capita, exports, and human capital variables have a positive effect on per capita food supply, while inflation is negatively related to per capita food supply. This finding is consistent with the findings of some other existing studies on the effect of governance on food security. Hence, governments in sub-Saharan African countries should focus more on curbing corruption thus raising food security levels in the region.

Key Words: Governance quality; Composite index of governance; Corruption; Food security; SSA;

JEL Classification Codes: O55; H11; I38;

5.1 Introduction

Subsequent to the 2007-08 and 2010 world food price crises food security has attracted the attention of the academia and development agents worldwide (Allen, 2013; Lang and Barling, 2012). Moreover, food insecurity continues to be a big challenge despite attempts being made to eradicate hunger and malnutrition across the world. For at least these two reasons food security concepts have a wide resonance among research institutions and policymakers (Candel et al., 2014).

The world is making substantial progress in alleviating poverty. However, Africa, mainly sub-Saharan Africa, continues to lag behind in relative terms. As a result, food insecurity continues to be a major challenge in these countries. The prevalence of acute food insecurity varies considerably across the world. According to a FAO report, one out of nine people in the world experienced hunger and famine (FAO, 2017a). In 2016 around 27.4 percent of the population in Africa was categorized as severely food insecure, which is nearly four times higher as compared to any other continent; 35 percent of the population in SSA was undernourished. This is alarming as this problem is rising amid a moderate growth being registered in the region in the last decade. For example, food insecurity increased by about 3 percent during 2014-16 (FAO, 2017a).

Many intertwined factors are responsible for this situation. Several studies including those by Benson (2004), Kidane et al. (2006), Maxwell and Slater (2003), Mwaniki (2005), and Regmi and Paudel (2016) found poverty, conflict,[57] climate, and weather,[58] lack of investments in agriculture, population growth,[59] unstable markets, and handicapping government policies among the main factors for responsible for food insecurity in the region. In some ways, these factors are related to poor governance (Nyanjom, 2011; Paarlberg, 2002).

Currently, the classical approach -- where the food security issue is reduced to strictly agricultural productivity-- is being challenged. The classical approach ignores governance which undoubtedly is a more important part of the equation. In general, agricultural systems are affected by bad designs and implementation of government policies, poor institutional capacity, and conflicts, and this has implications for food security via poverty reduction and facilitating growth. Lack of good

[57] For instance, due to conflicts in 2017 in 18 countries of which 11 are in Africa, around 74 million people faced hunger and food insecurity (FAO, 2017a).

[58] Bad weather and climate conditions in 2017 alone lead to food crises for around 32 million people in 23 countries, out of which two-third are in Africa.

[59] In 2018, Africa's population reached around 1.2 billion with the highest annual growth rate for a continent at 2.5 percent in the world. This has implications for poverty and hunger (United Nations, 2018).

governance is seen as a primary reason for millions of people being hungry although empirical evidence on this link is scarce.

Moreover, what aspects of governance matter in this condition are still controversial. In this regard there are three dominant theoretical perspectives on the link between governance and food security. Their arguments are summarized as:

The first and dominant view is that 'democracy prevents famines,' as argued by Sen (1983), because it reduces corruption and stimulates technological change and thus growth. Studies conducted to test this hypothesis have come up with mixed findings (see, for example, Kirk, 2014; Rubin, 2009). The second view argues that there is a need to look beyond democracy as an indicator of governance. Therefore, both formal and informal institutions, which are proxies for governance, are important factors in achieving food security (Burchi, 2011; Rothstein, 2011; and Sacks and Levi, 2010). The third and more recent view is that food insecurity is nothing but a political phenomenon, thus emphasizing the role of political will in eradicating hunger (De Waal, 1990; Devereux, 2000). These sets of theories linking governance to food security provide a point of departure for our empirical inquiry.

The main research question is: to what extent does governance quality affect food security? Specifically, the purpose of this study is analyzing the relationship between different governance indicators and food security in the context of SSA. Addressing this question is important for the following reasons. First, according to Crush (2013) there is a considerable gap between the two global development agendas -food security and governance. As a result, macroeconomic determinants of food insecurity in Africa, and particularly in SSA, are not well-documented. There are quite a few studies on the determinants of food security at the regional, national or household levels, but studies focusing on the effect of governance on food security in the region are quite limited and inadequate, even though Africa is the most food insecure region in the world. Hence, an in-depth and systematic enquiry is needed for a deeper and meaningful understanding of the effect of governance on food security. Second, empirical studies in the area show mixed findings.[60] Studies such as those by Florence and Thaddeus (2015), Kirk (2014), and Sen (1983) found that governance quality had the capacity to promote food security. However, studies such as those by Rubin (2009),

[60] Among other reasons this may partly emanate from the proxy used for governance as the concept is broad with different dimensions.

Sacks and Levi (2010), among others, found that it has no or a negative impact on promoting food security. Our study fills this gap in existing research.

This study uses an econometrics approach based on panel data for 1990-2016. Panel data models are used for mitigating possible issues of endogeneity and for getting both robust and unbiased estimates of the effect of governance on food security. The results of this study show that improving governance in terms of controlling corruption enhances food security via reducing poverty and facilitating growth. Accordingly, governments in SSA should invest in curbing corruption to raise the food security levels in the region. Moreover, our findings suggest that solutions for removing food insecurity require a holistic approach. Besides addressing the technical and environmental dimensions of the issue, appropriate attention should be given to the social, economic, and political aspects as well.

The rest of this chapter is organized as follows. In the next section, conceptual and theoretical literature on the links between food security and governance is reviewed. The empirical methodology and data are described in Section 3 and the regression results are presented in Section 4. Concluding remarks and policy implications are given in Section 5.

5.2 The Food Security-Governance Quality Nexus – A Review of Literature

This literature review assesses the concepts of governance and food security and the mutual linkages between them both theoretically and empirically.

5.2.1 Defining Food Security

As a concept, the term food security was coined in the mid-1970s. Since then close to 200 definitions have been proposed. Food security has different dimensions and can be measured at the national, household, or individual levels (Bickel et al., 2000; FAO 2009; Radimer et al., 1990). The concept of food security has also evolved since the 1970s. Pre-1980 food security was only linked to total food supplies at the national and global levels, ignoring demand side variables such as accessibility, stability, and utilization of food. As a result, during this period, food security was defined as the amount of food available in a country and the extent to which it provided the recommended minimum calorie intake per person per day (Jacobs and Sumner, 2002).

Food availability at the national level is, however, a necessary but not a sufficient condition for guaranteeing food security at the household and individual levels. This is why during the 1980s the focus and definition of food security shifted towards household and individual levels (Smith and Subandoro, 2007). Accordingly, food security was redefined as a situation that exists when "*all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets dietary needs and food preferences for an active and healthy life*". (*World Food Summit, 1996*)

5.2.2 Defining Governance

Even though governance occupies center stage in the development discourse today, there is no agreement about a single definition of governance. Different authors and organizations have suggested different definitions, some of which are narrow while the others are broad.[61] In addition, the indicators used for governance also vary from one organization to another.

Among the many definitions of 'governance' that exist, the one that appears the most appropriate from the point of view of SSA is the definition used by Kaufman et al. (2010) which is drawn from the existing notions of governance, and is neither too broad nor too narrow. These authors define governance as "*the traditions and institutions by which authority in a country is exercised. This includes (a) the process by which governments are selected, monitored and replaced; (b) the capacity of the government to effectively formulate and implement sound policies; and (c) the respect of citizens and the state for the institutions that govern economic and social interactions among them*" (Kaufman et al., 2010, p. 4).

This definition of governance is used in this study and is expressed in terms of the overall governance system in a country. However, it does not necessarily refer explicitly to food security related governance.

5.2.3 Linkages between Governance and Food Security: Views and Perspectives

Following the 2007 and 2008 global food crises greater importance was given to the need of integrating governance at all levels in the food security debate. This was mainly because

[61] Definitions and concepts of governance vary across disciplines (for an overview see, Kjaer, 2004).

governments are primary actors in the physical and socioeconomic aspects of a nation's food security (Grindle, 2011).

Literature on the links between governance and food security shows that governance is a driver, if not a potential solution for food insecurity. Poor governance, which is observed when there is a conflict, lack of institutional capacity, or poor policy design and implementation, can cause severe harm to food production and distribution. Boyd and Wang (2011) show that food insecurity is primarily driven by the governance quality, rather than differentials in resource endowments. A natural example of this is North and South Korea, as no substantial differences exist in their natural conditions and yet there are sizeable differences in their levels of food security. Such differences are clearly related to differences in governance. Similarly, studies such as those by Pereira and Ruysenaar (2012) and Sahley et al. (2005) in Malawi contend that lack of good governance is a significant factor in food insecurity.

Despite all the debates on the concept of governance, there seems to be consensus that governance affects food security even though there is no strong empirical evidence that this is the case. However, more importantly what aspects of governance matter is still a controversial issue. There is no strong evidence in empirical literature that addresses this aspect. In this regard, there are three dominant theoretical perspectives on the links between governance and food security. Their arguments are summarized as:

The first and perhaps the most dominant view till today (see, Sen, 1983) is that 'democracy prevents famines.' This approach argues that democracy (which is one standard measure of governance) constrains the actions of corrupt officials and this reduced corruption stimulates technological changes and encourages economic growth, reducing the risk of famines. According to this theory, non-democratic states perform less than democratic states in terms of providing public goods which are essential for achieving food security. Following this argument, starting from Sen (1983) and going up to Kirk's (2014) recent study, researchers have looked at the impact of democracy (used as a proxy for good governance) on food security using different methodologies and data. Some results, both from cross-country studies and single country analyses, show that democratic governance plays a positive role in reducing hunger and famines (Kirk, 2014; Sen, 1999). However, some empirical studies reach very different conclusions, namely that compared to authoritarian states, democratic states might be less able to respond to famines as there is room for transferring the responsibility to other players in the political system (Rubin, 2009). For instance,

despite being authoritarian, the governments of South Korea, Taiwan, and China were able to suppress hunger among a large number of people quickly in the 1960s and 1970s (FAO, 2002). The effect of democratic governance on food security is thus mixed. This implies that democratic governance without efficient and effective service delivery may not be enough to solve the issue of food insecurity. However, no studies have been done on this issue in sub-Saharan Africa.

As a result of the different critiques forwarded by the researchers of this dominant theory, there is a need to look beyond democracy as an indicator of governance and focus on 'institutional quality' within regimes as a measure of governance (Rothstein, 2011).

The second view argues that both formal and informal institutions are important factors in achieving food security as proxies for governance (Burchi, 2011). Burchi (2011) and others, used econometric analyses covering a large number of emerging countries and found that in addition to democracy, the 'government's effectiveness' and 'control of corruption' had a significant negative effect on reducing famines. Similarly, Sacks and Levi (2010) found that institutions in terms of rule of law, bureaucratic enforcement, and infrastructure development did affect food security. A recent study on SSA by Ogunniyi et al. (2018) had similar findings.

The third and more recent approach shifts away from democracy and institutional quality as indicators of governance. It argues that food insecurity/famines are nothing but a political phenomenon. It thus emphasizes the role of political will in eradicating hunger (De Waal, 1990; Devereux, 2000). This argument emerges from the perspective that eradicating hunger is not simply a function of technical capacity in terms of food production and distribution as it also requires political will at the national and international levels.

These sets of theories, linking different indicators of governance such as 'democracy', 'institutional quality', and 'political will' to food security provide a point of departure for our empirical inquiry as they help identify different pathways through which attributes of good governance may be linked to food security.

5.3 Methodology and Data

5.3.1 Methodology

Following Ogundari and Awokuse (2016), Ogunniyi et al. (2018), and Reutlinger and Selowsky (1976), the theoretical framework for modeling the determinants of food security at the

macroeconomic level usually assumes that the variation in utility Uf(.) arising from national food supply is explained by macroeconomic variables defined by $m_{i.}$ Given the objective of this study, one can hypothesize that global food utility Uf(.) can be defined as:

$$Uf = uf\,(FSI|m: GI, Z) \qquad (5.1)$$

where *FSI* denotes the food security indicator (that is, food supply per capita); *m* is a vector of the macroeconomic determinants of *FSI*, which we assume to consist of a governance index (*GI*), and a number of macroeconomic variables represented by *Z*. Theoretically speaking, the empirical specification in Equation 5.1 is always based on the reduced form described as:

$$FSI_i = f(GI, Z; \varepsilon) \qquad (5.2)$$

where *f* represents the functional form; *FSI*, *GI* and *Z* are as defined earlier; and ε refers to the random error term.

To investigate the impact of governance on food security in SSA countries, the following simple double log-linear equation is specified. For any country *i* at time *t*, food security is a function of a number of variables:

$$FSI_{it} = \pi_0 + \boldsymbol{\beta GI}_{\text{it}} + \alpha \boldsymbol{X}_{it} + h_t + m_i + \varepsilon_{it} \qquad (5.3)$$

where FSI_{it} stands for the natural logarithm of food supply per capita for country *i* at time *t*; it is a measure of food security. $\boldsymbol{GI}_{i,t}$ represents two indicators of governance -- the 'natural logarithm of the extent of control of corruption' and the 'natural logarithm of a composite governance index' which is a combined measure of 'voice and accountability', 'political stability and absence of violence', 'government effectiveness', 'regulatory quality', and 'rule of law'. This composite index is constructed using the principal component analysis (PCA). The vector of control variables, $\boldsymbol{X}_{it}$ assumed to explain FSI_{it} includes log(GDP per capita$_{i,t}$) which is the logarithm of the GDP per capita expressed in constant 2005 US$, log(export$_{i,t}$) and log(inflation$_{i,t}$) which corresponds to exports measured in millions of US$, and the rate of inflation in percentage terms. log(Schooling$_{i,t}$) is the logarithm of secondary school gross enrolment. log(battle$_{i,t}$) is the logarithm of the number of conflict related deaths. The last variable dummy, land_lockedness$_{i,t}$, is a dummy variable indicating whether a country has access to the sea or not. m_i and h_t represent

the unobserved heterogeneity between countries and across time. Lastly $\varepsilon_{it} \sim N(0, \sigma^2)$ is a random disturbance term. Table A5.1 in Appendix A5 gives the summary statistics of the variables used.

Issues in the Measurement of Food Security: Defining a Dependent Variable

Food security is a multidimensional phenomenon. As a result, it can be measured across four different dimensions: the first and most common indicator of food security is food availability; the second is accessibility/affordability of food; the third is stability which indicates the absence of seasonal fluctuations or shortages; and the last dimension is utilization which is related to the quality and safety of food. To get a more complete and nuanced picture of food security one has to take into account each of these dimensions. However, based on FAO (2014), we can assume that in poor countries, particularly in SSA food availability remains a major element of food insecurity. Therefore, food availability which is measured in terms of food supply per capita can serve as a good indicator of food security in these countries. Hence, like Shri et al. (2013), this study also uses food supply per capita as an indicator of food security. This is the dependent variable in this study.

For every country FAO produces food balance sheets from which food supply is derived. Food balance sheet show the amount of food potentially available for human consumption, the sources of its supply, and its utilization for each primary commodity and a number of processed commodities. Food supply at a given period is the sum of total quantity of foodstuffs produced in a country and the total quantity imported with an adjustment being made to take into account any change in stocks that may have occurred since the beginning of the reference period. The per capita food supply of each food item available for human consumption is then obtained by dividing the quantity of the food item by the population partaking of it. Like in other studies, the daily calorie supply per capita is then used as a measure of food security in this paper. At the national level, this is the standard outcome indicator of aggregate food availability.[62]

Issues in the Measurement of Governance: independent variable (our variable of interest)

The World Bank has identified more than 300 indicators of various aspects of governance.[63] Depending on the objectives at hand, different studies have used different indicators of governance.

[62] Calorie supply per capita for each country available from crops can be accessed from the FAO global dataset.
[63] Many and various definitions of governance have come up since the concept of governance has many proprietors.

Some focus on larger values such as the degree of freedom guaranteed to society which is linked to the adoption of basic democratic practices or the level of corruption.

In this paper governance is proxied by two indicators.[64] The first is a 'composite governance index', which is a combined measure of 'voice and accountability', 'political stability and absence of violence', 'government effectiveness', 'regulatory quality', and 'rule of law'. This indicator primarily captures the extent of democratic governance. It emphasizes the presence of competitive electoral institutions and reflects the degree to which leaders are chosen through an open, competitive process as a measure of governance. Studies such as those by Federica et al. (2014) and Kirk (2014) used similar indicators as a proxy for governance.

The second indicator used is the level of perceived governmental corruption. Corruption as a measure of good governance is becoming a more important indicator in studies such as those on food security as it is the most important starting point for judging good governance at the national level in poor countries like those in SSA.

It should, however, be stressed that empirical research investigating the relationship between governance and food security still needs good governance indicators.

Control Variables

In addition to the measures of governance discussed till now, based on literature some control variables are also expected to influence food security outcomes. Thus, including these in our statistical models helps isolate the effects which governance may have on food security.

The use of log(GDP per capita_*i*,*t*) is consistent with previous literature using income as one of the factors influencing food security (see, Arshad, 2009). Instead of world food prices as used by Aker and Lemtouni (1999), we use the inflation rate (derived from the consumer price index) in each country in SSA. The use of exports shows the degree of openness. Based on literature these variables are assumed to affect food security.

In addition to the macroeconomic variables, a potential determinant of food security included in our analysis is armed conflicts in a country captured by log of the number of deaths in a violent conflict in a country in a particular year. This is because warfare may undermine communities' ability to meet their food needs by diverting important resources to the destructive conflicts. This

[64] Governance indicators are inter-related to one another and it is difficult to consider them as being independent of one another (Kaufman et al., 2010).

study also includes schooling as a determinant since there is ample literature which shows that human capital affects food security. It also includes the variable 'landlocked' as a dummy to indicate whether the country has direct access to the sea or not. This variable is equal to 1 if a country is landlocked and 0 otherwise.

5.3.2 Data Sources

The various macroeconomic variables used in this study were drawn from various cross-country datasets. The dependent variable is the daily calorie supply per capita which is a measure of food security obtained from the FAOSTATA database. To capture the quality of governance, which is our main independent variable of interest, we use data from the World Governance indicator database.[65] Data on GDP per capita, exports, inflation, schooling, and battle-related deaths are obtained from the World Bank database.

The sample consists of 26 sub-Saharan African countries.[66] Countries such as Somalia, Eritrea, and others are excluded due to missing or considerable incompleteness of data on one or more of the variables. The period studied is 1996 to 2016.

5.3.3 Estimation Strategy

The estimation strategy used in this paper addresses a number of econometric issues that one faces in cross-country regressions such as unobserved country specific effects, outliers, and endogeneity. It includes various specifications like the pooled ordinary least squares method (OLS), random effects (RE), and fixed effects (FE).[67]

Using a pooled OLS method for estimating our model raises several concerns. First, due to unobserved country heterogeneity there may be an omitted variable bias due to data limitations or ignorance. This approach is also vulnerable to the existence of outliers for the dependent variable thus violating OLS' assumptions and being biased. To solve this problem an alternative solution is using panel data estimators such as fixed or random effects.

[65] This is publicly available at: www.govindicators.org.

[66] The countries include Benin, Burkina Faso, Botswana, Cote d'Ivoire, Cameroon, Congo Rep., Cabo Verde, Djibouti, Ethiopia, Gabon, Ghana, Guinea, Kenya, Madagascar, Mozambique, Mauritania, Mauritius, Malawi, Namibia, Niger, Nigeria, Rwanda, Senegal, Chad, Togo, and Uganda.

[67] To investigate the macroeconomic determinants of food security, previous studies such as those by Smith et al. (2000) and Smith and Haddad (2000) among others have also applied these models.

As a general estimation strategy, all models were estimated using the three different specifications. We first estimated a baseline model (M1) containing two macroeconomic variables: GDP per capita and exports which is a measure of trade openness. Based on literature, both are expected to have a significant positive contribution to food supply per capita. In addition, 'battle related deaths' and 'whether a country is landlocked or not' are also included in the first model. In the second model (M2) governance indicators (control of corruption and combined polity score) and schooling as a proxy for human capital are included. Finally, Model 3 (M3) is tested for the robustness of the three models by introducing inflation as the control variable.

5.4 Empirical Results

This section gives the empirical results based on the estimation strategy followed. The statistical outputs for the three different estimators (OLS, FE, and RE) with different specifications (M1, M2, and M3) are given in Tables 5.1-5.3. To decide which model is appropriate between the FE and RE estimators the Hausman test is applied.[68] On the basis of the Hausman test (given in Table A5.2 in Appendix A5) a FE estimator is preferred to a RE estimator which is also the case for all the model's specifications used. But for the sake of space only the Hausman test for the first model is given and the discussion that follows is based on the regression output of the FE model.

Table 5.1 gives the results of the baseline model (M1). It shows the effects of GDP per capita, exports, battle related deaths, and the landlocked dummy on food security using the three different approaches. The results depict that food supply per capita is affected positively by a country's level of economic development (GDP per capita). These results can be explained by the fact that the level of development can increase national food availability by improving resources available for purchasing food from international markets. Similarly, the volume of exports, which measures the degree of openness of a country, generally has a positive effect on reducing hunger. Battle related deaths negatively affect food security though this impact is not significant. This result is different from that obtained in Federica et al. (2014) and other studies that concluded that conflict related deaths significantly exacerbated food insecurity.

[68] The null hypothesis underlying the Hausman test is that FEM and REM do not differ substantially.

Table 5.1 Regression results of the baseline model (M1)

	(1) OLS	(2) Fixed Effects	(3) Random Effects
Dependent variable: Log of food supply per capita			
Log of GDP per capita income	0.138***	0.092***	0.119***
	(0.055)	(0.037)	(0.033)
Log of exports	0.055***	0.026***	0.027***
	(0.003)	(0.002)	(0.002)
Log of battle deaths	-0.023***	-0.005	-0.003
	(0.005)	(0.003)	(0.003)
Dummy landlocked (1=yes)	0.023	-	-0.081
	(0.030)		(0.120)
Intercept	2.620***	3.810***	3.600***
	(0.130)	(0.253)	(0.251)
Observations	504	504	504
R-squared	0.570	0.550	0.531

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Table 5.2 gives the results of the effect of governance on food security in sub-Saharan African countries. Columns 1-3 use 'control of corruption' as an indicator of governance while in Columns 4-6 the 'composite governance index' is used. In all the columns, in addition to the variables used in M1, we have included the variable gross school enrolments. The first point to note in this table is that the inclusion of these variables has little effect on the coefficients of the other explanatory variables in the first three columns. However, in Columns 4-6 where the 'composite governance index' is used as a proxy for governance, the coefficients of the macroeconomic variables are a bit different but still have the same sign as before and remain significant.

More importantly, our empirical results support the hypothesis related to the impact of the variable 'control of corruption.' As shown in Table 5.2, this variable has a positive and significant coefficient in the FE model. This shows that a country with better control over corruption is in a better position to achieve food security because corruption hinders and hampers growth and development.[69] This finding is similar to that of Andersson (2014) and others. Yet, contrary to studies by Dreze and Sen (1991) we find that the quality of democratic institutions measured by the composite governance index has no direct impact on per capita food supply and thus on food security. This may imply that having a better democracy by itself without improving the quality of governance, say, in terms of government effectiveness, may not be sufficient for achieving food security.

[69] This is a prevailing view in literature.

Table 5.2 Regression Results for Model 2 (M2)

VARIABLES	(1) OLS	(2) Fixed Effects	(3) Random Effects	(4) OLS	(5) Fixed Effects	(6) Random Effects
Log of GDP per capita income	0.308***	0.231***	0.240***	0.090***	0.105**	0.155***
	(0.017)	(0.021)	(0.019)	(0.020)	(0.048)	(0.039)
Log of exports	0.033**	0.055***	0.053***	0.053***	0.017**	0.012**
	(0.015)	(0.013)	(0.012)	(0.005)	(0.006)	(0.005)
Log of battle deaths	-0.019***	-0.004	-0.004	-0.009	-0.002	-0.002
	(0.006)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)
Dummy landlocked (1=yes)	0.014		-0.086	0.007		-0.044
	(0.034)	-	(0.126)	(0.028)	-	(0.096)
Log of gross school enrolments	0.004	0.053***	0.050***	0.061**	0.049**	0.041**
	(0.030)	(0.019)	(0.019)	(0.026)	(0.019)	(0.019)
Log of control corruption	-0.028	0.121*	0.115			
	(0.072)	(0.072)	(0.069)			
Log of composite gov. index				0.174***	-0.044	-0.025
				(0.033)	(0.028)	(0.028)
Constant	3.650***	4.390***	4.370***	2.630***	3.840***	3.610***
	(0.281)	(0.258)	(0.272)	(0.110)	(0.189)	(0.177)
Observations	504	504	504	504	504	504
R-squared	0.597	0.272		0.689	0.253	

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Estimates including the variable inflation in the empirical equation are shown in the third set of regressions (M3) (see Table 5.3). This tests the robustness of the models. The impact of governance measured by the variable 'control of corruption' remains significant. As is the case with the other macroeconomic variables, inflation plays a significant role in the variations in food security in SSA countries. The coefficient of the composite governance index, however, remains insignificant. This may be because the composite governance index has a relatively small dispersion, hence its weak explanatory power.

Overall, the regression results given in Tables 5.2 and 5.3 show that whatever methods and specifications are used, good governance proxied by 'control of corruption' makes a positive contribution to the reduction of food insecurity. However, the composite governance index which captures the level of democracy in a country, has no significant impact. These results suggest that a decline in the degree of corruption by 1 percent leads to an increase in food supply per capita by around 0.12 percent. Moreover, the results also show that GDP per capita and exports have a positive

and significant effect on food supply per capita, while inflation has a significantly negative effect. Human capital represented by schooling has the expected sign and is positively related to food security. Other variables like whether a country is landlocked or not and the log of battle related deaths have no significant impact.

Table 5.3 Regression Results for Model 3 (M3)

VARIABLES	(1) OLS	(2) Fixed Effects	(3) Random Effects	(4) OLS	(5) Fixed Effects	(6) Random Effects
Log of GDP per capita income	0.097***	0.099**	0.139***	0.087***	0.107**	0.154***
	(0.021)	(0.048)	(0.039)	(0.02)	(0.048)	(0.039)
Log of exports	0.054***	0.0169**	0.0137**	0.053***	0.017**	0.013**
	(0.005)	(0.006)	(0.006)	(0.005)	(0.007)	(0.006)
Log of battle deaths	-0.020***	-0.001	-0.002	-0.009	-0.002	-0.002
	(0.005)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)
Dummy Landlocked (1=yes)	0.024	-	-0.072	0.001	-	-0.044
	(0.030)		(0.097)	(0.028)		(0.098)
Log of gross school enrolments	0.062**	0.049**	0.042**	0.053**	0.050**	0.043**
	(0.028)	(0.019)	(0.019)	(0.026)	(0.019)	(0.019)
Log of inflation CPI	-0.014	-0.013*	-0.014**	-0.027***	-0.009	-0.012*
	(0.010)	(0.007)	(0.006)	(0.01)	(0.006)	(0.006)
Log of control corruption	0.168***	0.127*	0.141**	-	-	-
	(0.06)	(0.073)	(0.070)			
Log of composite gov. index.				0.198***	-0.032	-0.013
				(0.034)	(0.029)	(0.029)
Constant	2.680***	3.690***	3.530***	2.590***	3.786***	3.562***
	(0.112)	(0.188)	(0.177)	(0.110)	(0.193)	(0.182)
Observations	504	504	504	504	504	504
R-squared	0.677	0.259		0.693	0.256	

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

5.5 Conclusion and Policy Implications

Understanding the determinants of food insecurity in poor countries in Africa is vital. Given that a large number of people suffer from hunger and malnutrition this is a key problem in this region. To tackle this over-riding problem in SSA, policy interventions require a priori relevant empirical evidence. This is why this study empirically analyzed the impact of governance, proxied by a variable 'control of corruption' and the composite governance index on food security in 26 SSA countries during the period 1996-2016. The methodology is based on a panel data model whose estimation results are robust in allowing for individual fixed effects, heteroskedasticity, and autocorrelation.

The results show that considering macroeconomic variables among the two governance indicators, 'control of corruption' had a positive and significant effect on food security where a decrease in corruption by 1 percent increased food security by 0.13 percent (through increasing food supply per capita). This finding fits and is consistent with empirical studies by Andersson (2014), Florence and Thaddeus (2015), and others who found that corruption prevented countries from achieving targeted food security significantly.

The second indicator of governance, a composite governance index, which measures the level of democratic institutions in a country, did not have a significant impact on food security that is, establishing democratic institutions without improving the quality of governance, did not eradicate hunger. This finding is in line with empirical studies by Diamond (2007), Rothstein (2011), and others who question the claim that democratic states perform better than non-democratic states in terms of producing human welfare including achieving food security. This conclusion contradicts with a study by Sen (1983) who stressed the importance of democracy in eradicating famines.

In general, our findings show that food insecurity is partly a governance issue in sub-Saharan Africa. Hence, good governance in terms of controlling corruption can be used as an important tool for fighting hunger in the region. At the very least, this study justifies the need for additional research in the area. Future research should consider alternate governance perspectives or paradigms. Finally, we are aware of the data limitations of this study, in particular the data used for representing governance indicators. However, despite this limitation, we are confident that the findings of this study are reliable and in conformity with those of previous studies in this area.

References

Allen, P. (2013). Facing food security. *Journal of Rural Studies*, *29*, 135– 138.

Andersson, F. (2014). Hungering for Governance: The Role of Quality of Government in Access to Food. Unpublished.

Aker, J. C., & Lemtouni, A. (1999). A Framework for Assessing Food Security in the Face of Globalization: The Case of Morocco. *Agroalimentaria, 8,* 13-26.

Arshad, F. M. (2009). Addressing Food Prices and Food security: Analysis and Policy Implication, Talking Points (keynote address) presented at the round Table Discussion organized by *Consumer Research and Resource Center,* Petaling Jaya, 31 March 2009.

Benson, T. (2004). Africa's Food and Nutrition Security Situation: Where Are We and How Did We Get Here? *2020 Discussion Paper 37.* Washington, DC: IFPRI.

Bickel, G., Nord, M., Price, C., Hamilton, W., & Cook, J. (2000). Guide to measuring household food security. Washington, DC: United States Department of Agriculture, Food and Nutrition Service, Office of Nutrition, Analysis and Evaluation.

Boyd, M., & Wang, H. H. (2011). Guest editorial: the role of public policy and agricultural risk management in food security. *China Agricultural Economic Review*, 3(4), 417–422.

Burchi, F. (2011). Democracy, Institutions and Famines in Developing and Emerging Countries. *Canadian Journal of Development Studies,* 32(1), 17-31.

Candel, J. J. L., Breeman, G. E., Stiller, S. J., & Termeer, C. J. A. M. (2014). Disentangling the consensus frame of food security: The case of the EU Common Agricultural Policy reform debate. *Food Policy*, *44*, 47–58

Crush, J. (2013). Linking Food Security, Migration and Development. *International Migration*, 51(5), 51-75.

Devereux, S., (2000). Famine in the Twentieth Century. *Working Paper*, 105, Brighton: Institute of Development Studies, University of Sussex.

Diamond, L. (2007). A Quarter-Century of Promoting Democracy. *Journal of Democracy,* 18(4), 118-120.

Drèze, J., & Sen, A. (Eds.). (1991). Political Economy of Hunger: Volume 1: Entitlement and Well-being. Clarendon Press.

FAO (1996). *Report of the World Food Summit*. Rome: FAO.

FAO (2002). *The State of Food Insecurity in the World 2001*. Rome.

FAO (2009). *The State of Food Insecurity in the World: Economic Crisis-impacts and Lessons Learned*. Rome: FAO.

FAO (2014). The State of the Food Insecurity in the World Strengthening the enabling environment for food security and nutrition. Available at: *http://www.fao.org/3/a-i4030e.pdf.*

FAO (2017a). *The State of Food Security and Nutrition in the World; Building Resilience for Peace and Food Security*. Rome: FAO**.**

FAO (2017b). *Governance of food and nutrition security Factors for viability and sustainability Case studies from seven Latin American countries*. Rome: FAO.

Federica, D. M., Cristian, M. O., Jesus, B. H., & Mulat, D. (2014). Determinants of food production in Sub Saharan Africa: The impact of policy, market access and governance. Paper prepared for presentation at the EAAE 2014 Congress 'Agri-Food and Rural Innovations for Healthier Societies', Ljubljana, Slovenia, 26 to 29 August 2014.

Florence, N. U., & Thaddeus, O. A. (2016). Corrupt Practices negatively influenced Food

Security and live expectancy in developing countries. *Pan African Medical Journal, 20:110, doi: 10.11604/pamj.2015.20.110.5311*

Grindle, M. S. (2011). Good Governance: The Inflation of an Idea. HKS Faculty Research Working Paper Series, RWP10-023, John F. Kennedy School of Government, Harvard University. Available at: https://dash.harvard.edu/bitstream/handle/1/4448993/Grindle_GoodGovernance.

Jacobs, K., & Sumner, D. A. (2002). The Food Balance Sheets of the Food and Agriculture Organization: A Review of Potential Ways to Broaden the appropriate uses of the Data. Available at: ftp://ksph.kz/Chemistry_Food%20Safety/TotalDietStudies/FBS_Rev.pdf.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2010). The World Governance Indicators: Methodology and Analytical Issues. *World Bank Policy Research Working Paper No*. 5430

Kidane, W., Maetz, M., & Dardel, P. (2006). *Food Security and Agricultural development in Sub-Saharan Africa: Building a Case for more Public Support.* Rome: FAO.

Kirk, H. (2014). Bread and Freedom: Linking Democracy and Food Security in Sub-Saharan Africa. *African Studies Quarterly*, 15 (1).

Kjaer, A. M. (2004). *Governance*. Cambridge: Polity Press.

Lang, T., & Barling, D. (2012). Food security and food sustain- ability: Reformulating the debate. *Geographical Journal*, 178(4), 313–326.

Maxwell, S., & Slater, R. (2003). Food policy old and new. *Development Policy Review*, (5-6), 531-553.

Mwaniki, A. (2005). Achieving Food Security in Africa: Challenges and Issues. Cornell University, Discussion Paper.

Nyanjom, O. (2011). Devolution in Kenya's New Constitution. Society for International Development. *Constitution Working Paper No. 4*, the Regal Press Kenya LT, Nairobi. Available at: http://sidint.net/docs/WP4.pdf.

Ogundari, K., & T. Awokuse (2016) Assessing the Contribution of Agricultural Productivity to Food Security levels in Sub-Saharan African Countries. A selected Paper prepared for presentation at the 2016 Agricultural & Applied Economics Association Annual Meeting, Boston, Massachusetts, 31 July-2 August.

Ogunniyi, A., Mavrotas, G., Olagunju, K., Fadare, O., & Rufai, A. M. (2018). The Paradigm of Governance Quality, Migration and its Implication on Food and Nutritional Security in sub-Sharan Africa: What does Dynamic Generalized Method of Moments estimation reveal? *30th International Conference of Agricultural Economists*, 28 July-2 August 2018, Vancouver.

Paarlberg, R. L. (2002). Governance and Food Security in an Age of Globalization: Food, Agriculture and the Environment. Discussion Paper 36. *International Food Policy Research Institute*, Washington DC. Available at: http://www.oda-alc.org/documentos/1307636457.pdf.

Pereira, L. M., & Ruysenaar, S. (2012). Moving from traditional government to new adaptive governance: the changing face of food security responses in South Africa. *Food Security*, 4(1), 41–58.

Radimer, K., Olson, C., & Campbell, C. (1990). Development of indicators to assess hunger. *Journal of Nutrition*, 120, 1544–1548.

Regmi, M., & Paudel, K. P. (2016). Impact of Remittances on Food Security in Bangladesh. Food Security in a Food Abundant World. *Frontiers of Economics and Globalization*, *16*, 145–158.

Reutlinger, S., & Selowsky, M. (1976). *Malnutrition and poverty: magnitude and policy options*. Baltimore: The World Bank/John Hopkins University Press.

Rothstein, B. (2011). *The Quality of Government: Corruption, Social Trust, and inequality in international perspective.* Chicago: University of Chicago Press.

Rubin, O. (2009). The merits of democracy in famine protection: fact or fallacy? *European Journal of Development Research, 21*, 699–717.

Sacks, A., & Levi, M. (2007). *Measuring Government Effectiveness and Its consequences for Social Welfare*. University of Washington, Department of Sociology.

Sahley, C., Groelsema, B., Marchione, T., & Nelson, D. (2005). The Governance Dimensions of Food Security in Malawi. USAID.

Sen, A. K. (1983). Development: which way now? *The Economic Journal*, *93*, 745–762.

Sen, A. K. (1999). Development as Freedom. ed. A. Knopf. New York: *Oxford University Press.*

Shri. D. A, Nor'Aznin A. B., & Amir, H. B. (2013). An Econometric Analysis of Food Security and Related Macroeconomic Variables in Malaysia: A Vector Autoregressive Approach (VAR*).* International Agribusiness Marketing Conference 2013, IAMC 2013, 22–23 October 2013, Kuala Lumpur, Selånger, Malaysia.

Smith, L.C., & Haddad, L. (2000). *Explaining Child Malnutrition in Developing Countries: A cross country analysis.* Washington, DC: International Food Policy Research Institute.

Smith, C., El Obeid, A. E., & Jehsen, H. H. (2000). The Geography and causes of Food Insecurity in Developing Countries. *Agricultural Economics*, *2*, 199-215.

Smith, L. C., & Subandoro, A. (2007). *Measuring Food Security in Practice*. Washington, DC: International Food Policy Research Institute.

United Nations. (2018). *Population*. Available at: http://www.un.org/en/sections/issues-depth/population/. Accessed September 5, 2019.

Waal, A. de. (1990). A re-assessment of entitlement theory in the light of the recent famines in Africa. *Development and Change, 21*, 469–490. World Food Summit (1996). World Food Summit Plan of Action, paragraph 1. In: Rome Declaration on World Food Security and World Food Summit Plan of Action; World Food Summit, 13-17 November 1996, Rome, Italy. Rome, FAO.

Appendix A5

Table A5.1 Summary of the variables used in the regression

Variable	Obs.	Mean	Std. Dev.	Min	Max
Log of food supply per capita	504	5.160	0.471	3.490	6.163
Log of GDP per capita	504	7.350	1.203	5.230	10.190
Log of exports	504	26.450	4.538	17.760	33.530
Log of battle related deaths	504	1.740	2.647	0.000	10.830
Landlocked country dummy (1= yes)	504	0.458	0.498	0.000	1.000
Log of gross secod. school enrol.	504	3.501	0.561	1.850	4.850
Log of inflation (CPI)	504	1.767	1.209	-3.210	8.329
Log of control of corruption index	504	0.771	0.267	0.086	1.433
Log of composite governance index	504	1.591	0.487	-2.180	2.370

Table A5.2 Hausman test for choice between fixed effects and random effects models

	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	FE	RE	Difference	S.E.
Log of GDP PCI	0.092	0.119	-0.027	0.016
Log_exports	0.026	0.027	-0.001	-
log_battle deaths	-0.005	-0.003	-0.002	0.001

b = consistent under Ho and Ha; obtained from xtreg

B =inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\chi^2(3)$ = (b-B)'[(V_b-V_B)^(-1)](b-B)

= 17.64

Prob>χ^2 = 0.000