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# Do Remittances Increase Agricultural Productivity? The Case of Ghana

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*Abstract:* Over the last decades, remittances have significantly gained in importance for developing countries. Using recent household data, this thesis assesses the impact of remittances on agricultural productivity for the case of Ghana. Accounting for sample selection bias and endogeneity concerns, an overall positive but modest impact of remittances emerges. Yet, this estimate discerns crucial differences arising due to a household's socio-economic background. In particular, quartile regressions reveal a non-linear pattern, pointing to the strongest impact of remittances among lower-medium income classes. Further, this thesis estimates the impact of remittances on the expenditure on crop inputs as one potential channel to explain the differential impact of these monetary flows across income classes. As remittances are found to also influence crop expenditure stronger in lower income classes, this pattern complements the previous results. Our findings illustrate the need for a more comprehensive approach to assess the impact of remittances in the agricultural context.

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## List of abbreviations

GHS	Ghanian Cedis
GDP	Gross Domestic Product
GLSS 6	Ghanian Living Standard Survey Round 6
IV	Instrumental Variable
MDG	Millenium Development Goals
NELM	New Economics of Labour Migration
OLS	Ordinary Least Squares
SSA	Sub-Saharan Africa

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# 1 Introduction

Over the last decade, the amount of remittances - the money and goods transmitted by migrants working outside of their origin communities to their families - has increased substantially within developing countries. Even though concrete estimations vary greatly, they all point to a substantial increase in quantity and importance of those monetary flows. This trend is especially remarkable for Sub-Sahara Africa (SSA), where remittances have increased up to 21 billion in 2011, which constitutes an increase of 254% over the period from 2003 to 2008 (Baldé 2011).<sup>1</sup> A new stream of literature has emerged exploring potential benefits for the region both on a micro and macro level. As the majority of remittance receiving households are located in rural areas, several authors have pointed to a potential influence of remittances on agricultural productivity as one out of many potential benefits. Such a positive association would be of great importance as the agricultural sector plays - due to many linkages from farming to the rest of the economy and its direct impact on the real cost of food - an important role for the overall economy.

Realizing potential benefits of remittances is, however, not as straight forward as it seems. Firstly, ample evidence points to the major use of remittances as extra funds to increase consumption. Secondly, remittances could simultaneously impact negatively on labour market behaviour of relatives left behind by decreasing their incentives to work. Moreover, the impact of remittances has been proved to be largely influenced by environmental markets and economic policy contexts and therefore to be context-specific (Taylor 1999). Yet, no previous study has considered the possibility that the impact of remittances does not only differ across countries, but that their effectiveness on agricultural productivity is also determined by a household's socio-economic background. Further, also the national vs. international origin of remittances could be of importance, but has hardly been tested, as the recipients of both types of remittances differ fundamentally in their household characteristics as the data of this underlying thesis shows.

By applying econometric estimation techniques that account for potential endogeneity and sample selection concerns of remittances, this thesis conducts a country-specific study for the case of Ghana. Using recent household survey data, it is the contribution of this thesis to firstly analyze the overall relationship between remittances and agricultural productivity to establish an overall relationship between the receipt of remittances and agricultural output. In a second step, this research goes one step further and assesses the possibility of a differential impact due to national vs. international originating remittances. As significant differences emerge, one factor is examined that might explain the differential impact between both subgroups, namely the individual farm's socio economic background. In some final estimations, first insights should be gained concerning one first transmission channel of socio-

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<sup>1</sup> Moreover, such flows are likely to be underreported, and remittances through informal channels are estimated to add at least another 50 percent to the already recorded flows (World Bank, 2006). Remittances captured by the data used of the GLSS6 surveys are underestimated also as remittances sent for building own houses or for investing of the migrant in their own businesses will not be registered.

economic differences, namely the investment in crop inputs. Hence, this thesis addresses the following research questions:

- Do remittances play an overall role in determining agricultural output in Ghana?
- In how far differs the impact of remittances stemming from national vs. international migrants?
- How does the impact of remittances vary across household's income levels?
- In how far can differential spending on crop inputs be considered as a potential channel to explain arising differences in the impact of remittances across income levels?

While this thesis finds an overall positive association between the receipt of remittances and the total value harvested by a farm, national remittances seem to be used more effectively than it is the case for internationally originating remittances. When looking at the household characteristics of both subgroups, it seems likely that this differing impact of remittances can be explained by substantial differences in the socio-economic backgrounds of farms that exist between both subgroups. And indeed, when applying quartile regressions, it can be observed that the coefficient estimated from the overall sample hides substantial differences across income classes. In particular, within the lowest-income quartile, the effect of remittances is small but increases substantially when looking at slightly better off households in the second lowest income quartile. This effect, however, reverses when moving to higher income classes. These results are in line with a shifting development paradigm, arguing that poor households do spend additional income effectively. In a final step, this thesis examines one potential channels to explain the observed impact pattern, namely the expenditure on crops inputs. The emerging pattern complements the results derived in the first estimations, as households belonging to income classes that use remittances in the most efficient way also seem to invest a higher share of these monetary flows on crop inputs. These findings point to the importance of discussing the impact of remittances in a more differentiated way.

The remainder of this thesis proceeds as follows: Section II contextualizes this study by providing an overview on Ghana's challenges and opportunities within the agricultural sector. Section III reviews the literature on remittances, before section IV describes the data employed. Section V explains the underlying theoretical and methodological framework. Section VI presents the results, before a brief discussion are provided in section VII. Finally, section VIII concludes.

## 2 Ghana: The local agricultural context

### 2.1 Challenges within the agricultural sector

With a population of around 29.6 million, Ghana is considered a middle-income country in West Africa. After two decades of persistent and strong economic growth, Ghana became the first country in SSA to achieve the first Millennium Development Goal (MDG1) of halving poverty by the target year 2015.<sup>2</sup> Nevertheless, the number of people living below the poverty line has only declined by 10 per cent, as poverty reduction has not been able to keep pace with overall population growth<sup>3</sup>. Further difficulties of translating economic growth into poverty reduction arise through increasing inequality, as indicated by a rise of the Gini index from 37% in 1992 to 43.3% in 2013. Besides other regional inequalities, a large rural/ urban income gap can be observed. Thereby, households in urban areas show poverty rates of 10.6 per cent, while those in rural areas are estimated to be set at 37.9 per cent. This gap has even been rising over the last years, as urban poverty has been managed to bring down faster than in rural areas (Cooke et al. 2016).

Nevertheless, the agricultural sector still constitutes the backbone of the economy, contributing around 40 percent of the country's Gross Domestic Product (GDP) and employing over 60 percent of the labour force. It is further a crucial source of inputs for the manufacturing sector, as more than two thirds of all non-petrol production depends on raw-material stemming from the agricultural sector, and makes up 3/4 of all export earnings (Breisinger et al. 2008). However, it was the industrial sector that has been driving high overall growth rates, especially through mining and petroleum industries. This rise in extractive industries has to be seen with caution as it constitutes an emerging sign of the Dutch disease and simultaneously a constraint to the agricultural sector. For instance, when oil production started to be commercialized in 2011, the industrial sector grew by 41 percent, while the agricultural sector showed a growth rate of 0.8 percent. Even though some signs of recovery have been observed since then, these again have to be seen with caution. More specifically, a decomposition of Breisinger et al. (2008) shows that agricultural growth has been driven by extensive growth (e.g. land expansion) instead of improving productivity levels. A second "distortion in line with Dutch Disease symptoms" is the rising share of food imports, which increased from 13 percent in 2000 to 17 percent in 2010 (World Bank 2018).

Moreover, few progress has been achieved to pull labor out of the agricultural sector into more productive jobs and overall employment dynamics have hardly changed. The agricultural sector in Ghana lags still far behind the goals desired to achieve and is especially problematic when considering the growing population pressure in SSA. Almost 80 percent of the overall agricultural output stems from smallholder farms. Within the small-scale sector,

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<sup>2</sup> In particular, Ghana managed to bring down its poverty rate from 52.6% to 21.4% between 1991 and 2012 (GLSS 6, 2013).

<sup>3</sup> Thereby, poverty is defined by the national poverty line set at 1,314 GHS per adult per year for 2013.

irrigation hardly exists and dependence on rain-fed agriculture therefore high. The employment of simple farm tools is accompanied by storage, infrastructure and poor management of post-harvested yields. Further, the education attainment in the farm sector is low, which prevents the application of new farm technologies. Also insurance companies perceive the sector as very risky, leaving the sector widely uninsured. A final important point are existing insecurities within the land tenure system. Consequently, yields in Ghana lie substantially underneath the potential estimated yields (Ministry of Food and Agriculture 2016).

Nevertheless, yields, agricultural structure and productivity differ substantially across the individual agro-ecological zones and administrative regions. Especially the North of Ghana, consisting of the Northern, the Upper East, and the Upper West regions, is lagging far behind the Southern regions which accounts for the remaining seven states. Since Ghana's independence, the South has always been richer and more dynamic. This existing difference in terms of both poverty and development can partly be explained by geographic and climate advantages of the South over the North, amongst them include low rainfall, disadvantageous savannah vegetation, and hard accessibility of some parts of the region. Nevertheless, to some extent the difference can also be traced back to political origins, as development projects have commonly neglected the North of Ghana (Wolter 2009). Moreover, the largest concerns exist concerning the cultivation of basic food crops. Hence, while progress can be observed in the export sector, developments in the food crop sector are less encouraging. This can be explained by investments of both the government and private donators that are strongly biased towards the export sector (Wolter 2009).

The agricultural sector in Ghana only received 5.2 percent of the total government spending from 2001 to 2014. This is considered as low both by regional and international standards and lies far below the amount agreed upon under the 2003 Maputo Declaration<sup>4</sup>, where the obligatory share of national budget to agriculture was set to 10 percent by 2008. This neglect of the agricultural sector is not a recent phenomenon as the government has long given priority to industrialization in order to catch up with more developed countries and taxation of primary goods was a common tool to finance industrial development of governments. It can be seen that severe deficits remain within the agricultural sector, especially among farm-scale farmers. Solving these problems, however, is crucial as achieving economic and social progress is hardly possible without an increase in productivity of small-scale producers - as the next sections demonstrate.

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<sup>4</sup> Launched in 2003, the declaration was a response to stagnating African agriculture, obligating signatories to spend 10% of public expenditure to increase agricultural productivity.

## 2.2 Importance of agriculture to fight poverty: Opportunities for Ghana

The importance of agriculture for poverty reduction and economic growth has been vastly analyzed within the associated development literature, dating back to Jorgenson (1961) and Kuznets (1966), who were the first to stress the importance of agricultural growth for economic growth and development. Since then, many authors have concluded that the highest growth multiplier effects can be found within the agricultural sector, which is therefore the most effective to fight poverty (Diao et al. 2007; Johnston and Mellor 1961). Tiffin and Irz (2006) strengthen the argument that agriculture can work as the engine of growth, by concluding from their cross-country analysis that causality generally runs from agricultural growth to overall economic growth. Hence, agricultural productivity growth does not only rise farm incomes and therefore the demand for non-farm goods and services, but also provides cheaper food and numerous employment opportunities that benefit both the farm and non-farm sector.

Recently, the importance of agriculture is theoretically acknowledged by the Ministry for Food and Agriculture, stating that the need "for accelerated development of the (agricultural) sector to realize its potential cannot be overemphasized" and that the "agricultural sector continues to hold the promise for the economic and social transformation of Ghana". In this context, the Ministry of Agriculture stresses that growth opportunities do exist within the agricultural sector, despite the numerous problems and challenges. Firstly, given the diverse agro-ecological zones, a diversity of commodities is cultivated, which increases overall food security. The government also points to a well-established research system that has already achieved improvements in certain crops. Further, Ghana's recently obtained lower middle-income status in combination with the emerging oil production paves the way for an increasing middle class. Through urbanization and income growth, new market opportunities are projected to emerge for staple crop producer. Also the income growth in many Asian countries has the potential to create new demand for Ghana's traditional agricultural exports (Breisinger et al. 2008). Finally, international food prices are expected to remain high in the medium run. Considering these great potential ways to improve the problematic agricultural situation, a broad perspective on future development possibilities is needed. In this context, also the increasing importance of remittances deserves special consideration.

## 3 Literature review

### 3.1 Increasing importance of remittances

Remittances have not only increased in absolute terms, but also relative to other sources of external finance and are considered the most important and direct positive impact on migrant sending areas (Taylor 1999). Most importantly, they constitute a stable source of external income and even seem to increase within countries that have recently suffered a macro-economic shock (Kapur 2003). Thereby, remittances provide a social security network for

many countries plagued by economic and political crises. The increase of remittances could greatly impact on both the migrants' home household and home region by reducing poverty, smoothing consumption, providing working capital, and exerting multiplier effects through increased household spending. On the macro level, remittances have been found to foster economic growth in countries with under-developed financial markets by offering an alternative way to finance investment and by mitigating liquidity constraints (Fayissa and Nsiah 2010; Giuliano and Ruiz-Arranz 2009). These findings are complemented by research that claims a positive relationship between higher remittances inflows and lower poverty levels (Fajnzylber and Humberto 2007; Adams and Page 2005).

Yet, other authors point to social and economic costs that could come along with the receipt of remittances. An empirical analysis by Chami et al. (2003), for instance, finds remittances to be negatively associated with growth within their sample of both developing and developed economies in the 1970s. This assumption has been confirmed by an observed declining labor force participation of remittance recipients in El Salvador (Acosta 2006) and in the Philippines (Rodriguez and Tiongson 2001), especially among women. Finally, fewer working hours and less spending on the education of children has also been found for remittance-receiving households in Armenia (Grigorian and Melkonyan 2011). Hence, the implications of remittances are not as straight forward as could be assumed at the first sight. In particular, there is one crucial question around them, namely how these additional income transfers are spent by the individual households - which has also important implications from a development point of view.

### 3.2 Spending and investment of remittances

The related literature provides contrasting findings when it comes to the use of remittances. For instance, Lipton (1980) states that purchases of consumer goods absorb around 90% of remittances received. This is hardly surprising for the case of poor families where remittances may be used to raise subsistence consumption. A similar high result has been obtained by Massey et al. (1987), who estimate that 68% to 86% of the Mexican migrants' remittances are used for consumption. A more pessimistic stream of literature also points to purely negative changes in spending behaviour independent from basic needs. In particular, according to Chami et al. (2003), a significant part of remittances is spent on what the authors call status-oriented consumption that might imply a lower development impact of income stemming from remittances compared to income stemming from any other source. In addition to changes in spending behaviour, remittances could also give rise to behavioural changes of the remaining family members by decreasing their incentives to work. This can be explained through decreased opportunity costs of leisure, often leading to decreasing labour market participation (Antman 2012). As argued by Chami et al. (2003), recipients from remittances might moreover face the danger of moral hazard problems, as the remaining family members may have incentives to reduce their work effort.

Nevertheless, there is also a contrasting view of associating remittances with increased investment. Thereby, remittances are considered as transitory income with a larger saving proportion. This would attribute remittances a higher marginal investment in human and physical capital compared to other income sources, both constituting a form of "productive investment" (Taylor 1999). As formalized by Stark (1991), migrants could have the potential to function as financial intermediaries and help households to overcome credit constraints in the course of the transformation from familiar to commercial production. This can be achieved by relaxing a household's credit constraint or allaying the risk constraint, leading to more productive investment and saving behavior. Remittances could further function as substitutes for under-developed markets, for the absence of collateral, or could relax a household's budget constraint (Mahé and Naudé 2016).

That remittances can indeed change preferences and influence the allocation of household resources towards more productive uses has been shown throughout numerous studies. Firstly, Cattaneo (2005) states that receiving international remittances leads to higher investment in entrepreneurial activities. Also Dustmann and Kirchamp (2001) find that remittances and savings of returning migrants constitute an important capital source for microenterprises. Similar results have been found in a study of 30 communities in Mexico, where earnings from workers in the United States are important startup capital in 21% of the new enterprise formations (Massey and Parrado 1998). In Samoa and Tonga, Brown and Walker (1995) find a significant proportion of remittances to be used for both business and farm investment. Simultaneously, Brown and Leeves (2007) conclude that in Fiji and Tonga, receiving remittances enables households to shift away from subsistence activities towards more market-oriented businesses.

As pointed out by Cattaneo (2005), besides investing in physical capital, remittances are also used for long-term investments in human capital. This results finds support especially within the Latin-American context. Within a sample of eleven countries in Latin America, Acosta et al. (2007) provide evidence that remittances rise obtained education of children particularly from family backgrounds with low level of schooling. In Mexico, Lopez-Cordova (2004) provides evidence that child illiteracy and school attendance increases with higher remittances among children between 6 and 14 years. In El Salvador, Edwards and Ureta (2003) have associated remittances with lower drop-out rates from school. Moreover, Adams and Cuechuecha (2010) provide evidence for Guatemala, where remittance-receiving households spend less on consumption and more on education than their non-receiving counterparts. Similar results have been found in the Philippines, where remittances result in higher educational spending and less child labor (Yang, 2004). Besides higher educational attainment, remittances are also associated with positive influence on the health outcome of receiving families (Yang 2003). In this context, De and Ratha (2005) provide evidence for Sri Lanka, where remittances are found to be positively related to the weight of children under five. Hildebrant and McKenzie (2005) find that Mexico–US migration improves health outcomes of children, amongst them both higher birth weight and lower infant mortality. Acosta et al. (2007) confirm these results particularly for households in the lower-income

class in Nicaragua and Guatemala. As it can be observed, implications of received remittances seem to be both context- and time specific. Therefore, it is interesting to analyze the evidence given more specifically for the agricultural context, as well as summarizing the broader empirical evidence available for the case of Ghana, as will be done in the next two sections.

### 3.3 Remittances in the agricultural context

Looking at the broader empirical evidence reveals that potential implications are not clear-cut. However, we start to get an understanding for the big potential remittances have for sectors commonly suffering a high degree of credit constraint. Such constraint is especially prevalent for small-scale farmers, commonly exposed to high external risks, such as weather and price fluctuations. A few previous studies provide evidence that the inflow of remittances (combined with an outflow of labor) has implications also for the agricultural sector. One paper by Rozelle et al. (1999) has connected the topics of migration, remittances and productivity for the Chinese context, where a combination of urbanization, an outflow of resources of the agricultural sector, as well as rising demand for food increases the need to foster agricultural productivity. Within their sample of 31 villages in the North-East of China, the overall impact of receiving remittances on agriculture is positive, although it cannot make up for a loss of human capital due to migration. In contrast, within a sample for the North-West of China, Li et al. (2013) conclude that the negative impact of losing family labor can be expected to be offset by investments in capital-intensive and more profitable cash crop production due to remittances. The connection between the receipt of remittances and agricultural practices has also been examined in the Philippines by Gonzalez-Velosa (2011). The author concludes that receiving remittances indeed changes practices and improves productivity within agriculture. Accordingly, by rising working capital and fulfilling an insurance purpose, remittances rise the cultivation of more specialized crops, the production of higher value commercial crops and the adoption of more elaborated technologies. Moreover, a study conducted by Adams (1998) concludes that the receipt of remittances helps to increase investment in rural assets in Pakistan, fostering the productivity within the agricultural sector.

### 3.4 Remittances in the Ghanaian context

In the Ghanaian context, several studies have addressed the topic of remittances in association with distinct national developments. One such study is conducted by Kabki et al. (2004), who examine how remittances of migrants based in the Netherlands impact on the economic and social developments in rural areas of the Ashanti region, both at the family and village level. The authors find besides benefits for the remaining family members an indirect positive impact on the community and village-level, due to migrant-financed activities. Moreover, Guzman et al. (2008) focus on the expenditure behavior of female-headed households in Ghana. The author finds these household leading women to use a higher share of remittances on food and education, whilst spending a lower share on consumer goods and housing than their male counterparts.

Adams et al. (2008) provide evidence for both international and national remittances to significantly lower not only the level, but also the depth, and severity of poverty. Yet, the authors find differences according to the origin of remittances, as international remittances seem to significantly stronger reduce poverty levels. Furthermore, the authors associate both types of remittances with increasing inequality in Ghana. Also Joseph and Plaza (2010) find a differential impact of remittances depending on the local origin of these monetary transfers. On the one hand, the authors attribute international remittances to potential to positively impact on child labour. More specifically, the authors claim the receipt of remittances to reduce the probability, as well as the amount of hours worked for children. In contrast, the author do not find a significant impact on the probability to work associated with domestic remittances, that rather seem to be part of a coping strategy of the receiving households.

Finally, a relevant study by Quartey and Blankson (2004) finds that migrant remittances are effective in helping to smooth household consumption and welfare over time. In this context, the authors point to the special relevance for food crop farmers, often belonging to the most disadvantaged socioeconomic group. This indication of how important remittances can actually be for credit-constraint small-scale farmers, will be analyzed in the remainder of this thesis. One other take away of the empirical evidence are signs for differential implications for national and international remittances, which will also be part of this study. The next chapter summarizes some theoretical and methodological foundations on which the upcoming analysis will be based.

## 4 Data

The underlying data stems from the Ghana Living Standards Survey 6 (GLSS 6), which constitutes a national representative survey conducted in the years 2012/2013. It assesses the living conditions of 16,772 households in 1,200 enumeration areas and has turned into an important tool for the Ghanaian welfare monitoring system by having improved its measurement standards every round since first established in 1987.

Before conducting an empirical analysis, it is important to gain a better understanding of what agricultural productivity refers to throughout this study. In particular, within the scope of this thesis, we refer to the output attributable to a certain area of land. This output depends not only on the use of land, but also on the intensity with which it is operated and hence, the quantity of other production factors applied. With an increase in input factors, the total production is supposed to increase, yet with a diminishing rate. In order to assess agricultural productivity from an economic point of view, it is necessary to consider physical quantities of inputs and outputs in monetary values in order to draw conclusions and enable comparisons of land productivity (Pine 1948). Thus, to capture a household's productivity, we rely on the economic definition of productivity and follow Verschelde et al. (2013) amongst many other authors, by using the value harvested in order to assess productivity. This definition of agricultural outcome is best captured by a question in the GLSS 6 survey that provides information on the monetary value the household would obtain in case all crops harvested

within the last 12 months were sold. Simultaneously, we control for the land size and household characteristics to obtain a comparable measurement across households. To test the validity of our results, we further construct a second indicator to capture agricultural productivity levels, namely the net agricultural income of a household.

When looking at the data on agricultural outcome in Figure 2, it is striking to see how many farms conduct farm activities on a subsistence level. Yet, this is not surprising due to the common notion that farming in Ghana predominantly takes place on a smallholder basis.

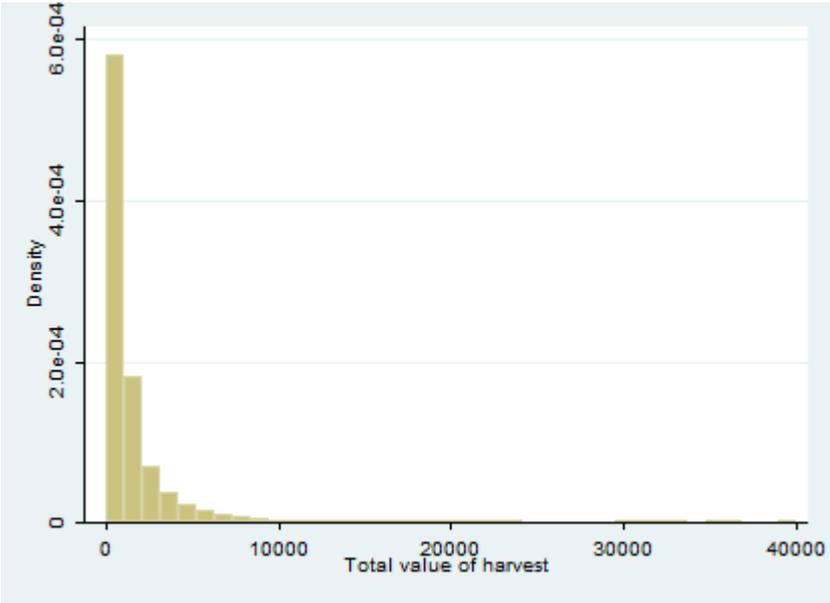


Figure 1: Distribution of value harvested  
Source: GLSS 6

Secondly, as this thesis focuses on remittances, it is important how to define these transfers and which flows of cash or goods to incorporate in the analysis. The GLSS6 survey includes data on remittances in three different forms, namely cash, food and non-food goods. Additionally, the data provides information on whether remittances are generated by a nationally or internationally migrating household member. We assess the data from the GLSS6's section "Income Transfers and Miscellaneous Income & Expenditures", which captures all such transfers received by a household. Overall, remittances are received by around 30 percent of all households. As cash remittances constitute by far the largest part of remittances, the following analysis focuses on the impact of monetary transfers.

All further independent control variables are merged from different sections of the survey and are shown in more detail in section A1 of the appendix. Besides the importance to control for the possibility for them to mitigate the relationship between remittances and agricultural productivity levels, it is further interesting to have a more detailed look at the household

characteristics, as they are - according to our theoretical framework - relevant in determining the receipt of remittances.

In fact, in Table 1, first evidence for this hypothesis can already be found when looking at the differing household characteristics of national remittance receiving households, international remittances receiving households, and no remittance receiving households.

Table 1: Characteristics of Non-Remittance and Remittance Receiving Households

Variable	National remittances	International remittances	Non- receiving households
Sex (binary)	0.679	0.741	0.856
Age	53.424	54.825	46.605
Marital Status (binary)	0.621	0.683	0.740
Amount of remittances	373.179	1177.702	n.a.
Non-farm income (gross)	11.610	11.286	16.002
Agricultural Income (net)	2144.414	2656.065	2721.480
Total HH Income (gross)	7197.199	9477.905	8279.231
Household size	4.872	4.783	5.330
Urban/Rural (binary)	0.146	0.323	0.148
No. of HH members with no education	1.848	1.624	1.955
No. of HH members with primary education	0.468	0.476	0.411
No. of HH members with secondary education	0.897	1.444	0.863
No. of HH members with tertiary education	0.068	0.143	0.063
Expenditure on crops	408.480	697.316	556.380
Total value harvested	1490.681	1945.225	1776.303
Number of males employed	5.933	4.349	5.169
Number of females employed	6.188	4.095	6.067
Farm size	4.238	6.059	4.732
Ownership (Binary)	0.713	0.693	0.701

*Notes: Ownership, Sex, and Marital Status are dummy variables, where "1" indicates farm owned by household, married, male, and urban respectively. Monetary values are given in Ghanaian Cedis (GHS). 1 GHS amounted to 0.397 Euros at the end of 2012.*

Source: GLSS 6

Firstly, a large difference in mean value remitted can be observed. In particular, remittances stemming from national migrants only amount to around a third of the mean value received by international migrants. Moreover, it is striking how the financial background differs between both subgroups. While international remittances receiving households show a value of 9477

GHS (3762.36 Euros) of gross household income, this value lies slightly under 7197 GHS (2727.66 Euros) for national receiving households. Also other household characteristics differ between these two sub-samples. For instance, the overall household size of the international group is higher, while the number of children under 15 is lower. When turning towards total value harvested, the dependent variable of interest, also substantial differences emerge in favor of households with receipt of international remittances. This goes in line with the observation that international remittances receiving households operate significantly larger farms. Also when comparing both receiving subgroups with average values within the non-receiving household sample, it becomes obvious that all three kind of households differ structurally.

Hence, as intuitively expected, internationally migrant-sending households represent the most advantaged group as sending a migrant abroad requires substantial resources. In contrast, and not as straight forward, nationally sending households are the most disadvantaged group, also compared to non-sending households. Thus, sending a family member to other national parts of Ghana seems rather to be a coping strategy to make ends meet.

Based on these substantial differences, we try to paint an even broader picture of the existing differences and sub-divide the overall sample by income quartiles in Table 2. Thereby, when focusing on the receipt of remittances, a clear pattern arises: the mean average of remittances substantially increases with income. While the mean value of received remittances lies at 171.5 Ghanaian Cedis in the lowest income quartile, households situated in the highest quartile receive on average remittances amounting to 733,65 GHS. Further increasing trends can be observed when focusing on the total value harvested, the expenditure on crops, education, ownership and farm size, which all seem to increase with the household's income.

**Table 2: Household characteristics across income classes**

Variable	Q 0.25	Q 0.5	Q 0.75	Q 1
Sex (Binary)	0.69	0.78	0.84	0.91
Age	48.78	48.42	48.93	48.30
Marital Status (Binary)	0.61	0.68	0.73	0.81
Amount of remittances	171.46	296.57	460.01	733.65
Non-farm income (Gross)	6.49	6.49	11.68	25.34
Agricultural income (Net)	155.92	762.92	1915.24	7399.23
Tot. HH income (Gross)	980.38	2627.51	5469.18	22918.35
Household size	4.13	4.93	5.47	6.24
Urban/Rural (Binary)	0.13	0.13	0.16	0.18
No. of HH members with no education	1.49	1.79	2.06	2.34
No. of HH members with primary education	0.25	0.36	0.47	0.62
No. of HH members with secondary education	0.54	0.73	0.99	1.27
No. of HH members with tertiary education	0.03	0.04	0.06	0.13
Crop Expenditure	198.03	298.02	484.78	1045.04
Total value harvested	685.82	1057.10	1514.83	3534.12
Males employed	4.60	5.05	5.65	6.14
Females employed	5.22	6.07	6.39	6.57
Farm size	2.64	3.43	4.90	7.41

*Notes: Ownership, Sex, and Marital Status are dummy variables, where "1" indicates farm owned by household, married, male, and urban respectively. Monetary values are given in Ghanaian Cedis (GHS). 1 GHS amounted to 0.397 Euros at the end of 2012.*

Source: GLSS 6

Based on these differences across household groups, it is likely that overall household characteristics are not only relevant for the probability of receiving remittances, but differences might well be possible to exist also for the impact remittance have for each subgroup in an agricultural context. Even though the data base provides due to both its comprehensiveness and completeness a good basis for micro-economic research on rural and urban households, some challenges have to be met in order to derive meaningful conclusions. Most importantly, while in developed countries the existence of standardized units of measurement has become self-evident, these measures are far from universal in many rural areas of Africa (Capéau and Dercon 2005). Therefore, a first issue that needs to be addressed is the conversion of locally measured data - such as plot sizes, for instance - into standardized units. Therefore, section A4 of the appendix presents the conversion strategy applied. Based on the previously outlined data, the next chapter explains the underlying methodology of our analysis.

## 5 Theory and Methods

It is the aim of this thesis to estimate the potential influence remittances exert on agricultural productivity. Therefore, the required model specification takes the following form:

$$Agr.Productivity_i = \alpha_0 + \alpha_1 Remittances_i + \alpha_2 X_i + \alpha_3 E_i + \alpha_4 S_i + \alpha_5 Z_i + \epsilon_i \quad (1)$$

with  $i$  representing the household index, respectively. Thereby,  $Remittances_i$  captures the amount of received remittances and constitutes the main variable of interest. By estimating its coefficient  $\alpha_1$ , we test whether the receipt of remittances is associated with changing levels of agricultural productivity.

We follow Verschelde et al. (2013) amongst numerous other author by using the value of harvest to capture agricultural productivity. The vector  $X_i$  incorporates a range of control variables at the household level found to be relevant in the agricultural context. These family characteristics firstly employ the overall size of a household, of which the influence is a priori not completely straight forward. While larger households tend towards a greater diversification of household activities, it has simultaneously been pointed towards incentive problems in larger households (Shapiro 1990). Secondly, we employ a range of personal characteristics of the head of the household, as he or she is commonly assumed to take the important decisions. In particular, we start by employing the head of the household's sex. Despite several authors do not find significant differences in output of farms controlled by women or men, Udry (1996) states that land operated by women is less intensively operated than it is the case by their male counterparts. Thereby, the author points out that women might still be more restricted in their access to land, labour, credit and further inputs. We also control for her or his age, as it might influence land productivity due to increasing farm experience. Finally, we follow several other authors who employ the marital status as an important household characteristic that determines farm activities.

Hence, in order to capture the potential impact education might have on agricultural productivity, we employ the total number of household members  $E_i$  with either no, primary, secondary or tertiary education. Previous literature points to a positive relationship between education and agricultural outcome as education may influence agricultural productivity through the formation of cognitive and non-cognitive skills. Thereby, cognitive skills capture improvements in literacy and numeracy, which in turn have been shown to positively impact on the adaption of modern farm technologies as well as better dosage and facilitate planning decisions. Furthermore, non-cognitive effects address changes in farmers' attitudes and practices. These might include more openness to new ideas or technologies and the awareness of actually being able to achieve improvements in one's living standard (Appleton and Balihuta 1996).

In a next step, we turn towards overall farm characteristics  $S_i$ . In this context, we first of all control for the total farm size. While it is quite obvious to argue that it is necessary to employ

the size of a farm to obtain a meaningful output measurement, in previous literature two different ways of controlling for farm size have emerged. While several authors directly use the output per unit employed, this thesis adds the size of a farm as a control variable to all of our estimation specifications. This seems especially interesting as the relationship between farm size and productivity is highly debated within the associated literature and so far no consensus has emerged. Hence, to gain further insights in the farm size and productivity nexus, it is interesting to observe the coefficient on farm size for the case of Ghana. Moreover, a farm's location in either a rural or urban area might exert differential impact on agricultural outcomes due to large differences in infrastructure. Additionally, we control for the number of males and females employed on the farm to account for labour input in a farm's agricultural activities.

The vector  $\mathbf{Z}_i$  stands for demographic factors that are likely to impact on agricultural productivity. We distinguish between several ecological zones, namely coastal, savannah, forest and Gama. We further employ dummies for regions, as we expect productivity to differ fundamentally between the individual regions. Especially, the Northern part of Ghana is supposed to have worse demographic conditions for agricultural activities. Finally,  $\epsilon_{i,t}$  constitutes the conventional error term.

Yet, receiving remittances is likely to face a non-random treatment assignment as households with a person that migrates and remits may differ systematically from control households in their unobservable characteristics, which would bias the regression results. Hence, it is necessary to account for sample selection bias, commonly done by employing a Heckman two-stage model of sample correction. The first stage of the Heckman model estimates the probability of receiving remittances, given a set of variables. A probit model is applied that accounts for the non-linear probability of receiving remittances.

In order to determine the probability of receiving remittances, our methodological strategy is based on some important assumptions derived from the New Economics of Labour Migration (NELM) theory (Rozelle et al. 1999). One of the most important novelties within this framework is to analyze migration as a social and strategic decision made at the household level in order to achieve agreed family goals. This turns against neoclassical migration models, that have traditionally explained the migration decision as the result of an individual cost-benefit calculation. The NELM theory, in contrast, finds a household member to migrate to a non-correlated labor market in order to deal with local market failure and to diversify risks. Simultaneously, he or she agrees on a type of coinsurance agreement with the remaining household members. Thereby, resources should be optimally allocated "across space, time, and states of nature" (Azam 2006). The strategy of examining decisions at the household level has further been advertized by Lucas and Stark (1985), who formalize the family as a "cohabiting group, eating from a common pot". Hence, within the NELM framework and its adaption of several authors, remittances are considered as an important direct return to migration for the non-migrating family members. Thereby, the costs (eg. of moving to another place) and returns of migration are considered to be shared (Stark and Bloom, 1985).

Accordingly, when households decide to send out a migrant, this constitutes a common decision concerning investment in household resources that determine long-term production (Taylor et al. 2003). Hence, all in all, NELM theory considers remittances "as the outcome of a self-enforcing contractual arrangement between migrants and their families from which both parties expect to gain" (Mazzucato 2009). Applied to our empirical strategy, this means that we use overall household characteristics to estimate the probability of receiving remittances. This probability is used in the second stage of the Heckman model (2), to finally apply a linear OLS regression that accounts for the overall size of the remittances. Besides the probability of receiving remittances, the size of remittances is determined by household and farm characteristics.

$$Remittances_i = \alpha_0 + \alpha_1 P(\beta_0 + \beta_1 X_i + \beta_2 S_i)_i + \alpha_2 X_i + \alpha_3 S_i + \epsilon_i \quad (2)$$

To address further endogeneity concerns, we run additional robustness checks accounting for variables previously not incorporated in our main specification due to the loss of observations. In a first robustness specification, instead of accounting for the education level of all individual household members, we control for the highest degree obtained by the head of the household. To account in more detail for differences in the productive capital of other household members, we follow Adam (2006) and incorporate the number of children below 15, as well as adult males within a household. We also account for non-farm income of a household, that might be used for productive investments, helping a particular household to rise overall productivity levels. Finally, we employ a binary variable for ownership, as the incentives to invest might increase when owning the operated plot. Afterwards, we re-estimate the main specifications, substituting the total value harvested, our dependent variable of interest, by a farm's net agricultural income. In comparison with the total value harvested, this indicator also entails rental income, income generated by own processing of agricultural goods, or income from livestock. As stated by Akudugu et al. (2012), age might also influence the willingness to adapt new technologies and therefore exert a non-linear impact. Hence, all of these specifications employ a squared term of age to account for this potential non-linearity.

Yet, the estimation approach might face potential endogeneity concern due to omitted variable bias that cannot be ruled out by previous additional robustness checks. In particular, remittances might constitute an endogenous variable in itself as there may well be unobserved characteristics that simultaneously drive both the level of remittances and agricultural productivity. Hence, households receiving a higher level of remittances may receive them due to other, unobserved dynamics, such as ability and motivation. To alleviate such concerns as well as possible, instrumental variables (IV)s are a common method for dealing with the econometric problems caused by endogeneity. It implies the search for a variable that affects the selection variable (receipt of remittances), but not the outcome (agricultural productivity).

We rely on the importance of networks for both migrating and remitting in order to use their exogenous differences to account for the potential endogeneity of remittances and construct the IV. In particular, there are two mechanisms through which networks have the potential to influence upon a migration decision, namely direct assistance by network members and the flow of information from previous to potential migrants. Besides reducing the cost of migration, those two channels influence positively on both the expected return and insecurity associated with migration. Therefore, networks can be seen as a form of social capital, which enhances economic mobility.<sup>5</sup> Network theory has not only been associated with the actual migration decision, but has also been explored in the context of remitting. For instance, Roberts and Morris (2003) find that it is necessary for migrants to send back remittances in order to participate in the employment network provided by ethnologic or religious group. As the authors argue, network membership requires a tight affiliation with the community, which in turn requires reaffirmation, such as visits and sending remittances. Especially remittances "are the strongest evidence to the community that the migrant is providing support for close relatives at home" (Roberts and Morris 2003). Building on past research that has found migration networks to be relevant for both the actual migration decision and the receipt of remittances, we follow Adams et al. (2008) and use remittances received as a percentage of income in the ethno-religious group, as well as migrants as a percentage of the population of the ethno-religious group as two instruments to identify the second-stage structural model. A more detailed explanation of this approach can be found in the appendix. However, before determining with which estimation strategy to move on, we perform a Hausmann test to observe if the estimations performed with IVs are systematically different from our main specifications.

In a second set of estimation specifications, we try to assess whether national and international remittances differ in their relationship with productivity increases. In order to do so, we use the specification (1) just differencing the explicative variable remittances by national and international remittances. Furthermore, in order to get a better understanding of the role played by a household's income, we apply quartile regressions to examine potentially differential impacts across income classes. Again, we use the specification (1) replacing the total remittances by the remittances of each quartile and keeping the rest unchanged.

Finally, using the same specification (1), we replace the total value harvested by the expenditure on crop inputs as the dependent variable of interest to examine one possible channel that drives the substantial differences that exist in the impact and therefore most likely in the usage of remittances. The variable of interest is constructed by adding up all costs related to crop inputs a farm has indicated to pay. These costs most importantly comprise expenditure on (organic) fertilizer, pesticides/insecticides, local and imported hand tools, renting equipment, irrigation, repairs, and storage facilities, renting animals and the storage of

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<sup>5</sup> Also for Ghana empirical evidence provided by Mazzucato (2009) supports the notion that networks can function across long distances, when studying remittances sent from a Ghanaian migrant community based in the Netherlands.

crops. Hence, with this new dependent variables, again quartile regressions are employed to assess potential differences across income classes.

## 6 Results

This section presents the results derived from Heckman corrected OLS estimations. In a first step, we employ the overall sample to estimate the impact of remittances on agricultural productivity. As illustrated in Table 3, we formulate the most basic specification in column (1), when only controlling for farm and household size. Afterwards, we subsequently add further control variables throughout estimations (2) - (4) to control for other household and farm characteristics that might drive the relationship between remittances and the total value harvested.

**Table 3: Results from OLS regressions, estimating the total value of harvest**

	Total value of harvest			
	(1)	(2)	(3)	(4)
Remittances	1.312*** (0.285)	2.388*** (0.437)	2.360*** (0.436)	3.226*** (0.822)
Farm size	70.988** (28.197)	92.914*** (32.113)	88.339*** (31.473)	78.423*** (28.619)
Household size	154.445*** (52.690)	119.609* (68.148)	141.786** (69.529)	95.575 (68.323)
Sex (Binary)		613.410*** (108.692)	571.834*** (100.564)	530.077*** (103.794)
Age		-7.074*** (2.684)	-5.721** (2.877)	-7.427** (3.119)
Marital status (Binary)		62.515 (98.508)	137.478 (104.207)	153.429 (102.747)
Urban/Rural (Binary)				-888.461*** (272.103)
Males employed				30.218** (12.303)
Females employed				25.045*** (7.231)
Educational Controls		YES	YES	YES
Regional Controls			YES	YES
Eco. Zone Controls				YES
<i>N</i>	7577	7577	7577	7572
<i>R</i> <sup>2</sup>	0.030	0.091	0.113	0.159

Notes: Ownership, Sex, and Marital Status are dummy variables, where "1" indicates farm owned by household, married, male, and urban respectively. Robust standard errors are reported in parentheses, \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

We find evidence of a positive and significant correlation between remittances and the total value harvested in the basic specification in column (1). When adding further control variables, the coefficient remains significant at the one percent level and even increases in magnitude. Hence, we can conclude that an increase in received remittances is associated with

an increase in the total value harvested. This result would support the stream of literature pointing to a positive impact of remittances in the agricultural context. When turning towards one of the most important control variables, namely farm size, it is interesting to note that its coefficient emerges as a positive and significant predictor of total value harvested throughout all the four specifications. Although this variable in itself needs further research in the context of Ghana before it is possible to draw sound conclusions, this is important empirical evidence to consider in the farm size/ productivity debate.

To address further endogeneity concerns as good as possible before continuing the analysis, we conduct several robustness checks. As pointed out within the methodology section, there are a range of other variables brought forward in the associated literature to impact on agricultural productivity not incorporated in the main specifications. Therefore, we follow Adams (2006) and run additional robustness checks by subsequently adding a binary variable for ownership, the gross non-farm income, as well as the number of males and children under 15 years to our previous estimation specifications. Moreover, instead of controlling for the total number of household members with a certain educational degree, we employ the education level of the head of the household. Across all these specifications, we furthermore employ a quadratic term of age to account for potential non-linear effects. As illustrated in Table A6 of the appendix, none of these variables decreases the significance level of our variables.

A second robustness check of our main specifications consists in substituting the total value harvested, our dependent variable of interest, by a farm's net agricultural income. The positive association found between remittances and economic land productivity seems to hold, as can be seen in Table A7 of the appendix. Finally, we employ the previous developed IV strategy to address the potentially endogenous nature of the remittance variable. As can be seen in Table A8 of the appendix, the derived results are very similar to the previous OLS estimations. Therefore, we apply a Hausman test in order to decide which overall estimation strategy to continue with. In particular, the Hausman test is used to detect an endogenous regressor, testing the null hypothesis that the estimates from the OLS estimator are not systematically different from the consistent estimator (IV). As we obtain a p-value of 0.29, we do not reject this hypothesis. Thus, we will continue to rely on OLS estimations due to their commonly lower standard errors and therefore higher efficiency.

However, even though we can rule out several endogeneity concerns, these first estimations do not address the differences that might exist between the effect international and national remittances can exert on the total value harvested. Hence, in a next step, we re-run the estimations for both sub-samples separately. Table 4 provides the estimated coefficients stemming from the most complete specification for both subgroups.

Table 4: Results from OLS regressions, national and international sub-sample

Total value of harvest		
	National Migration	Internatoinal Migration
Remittances	4.557 <sup>***</sup> (1.133)	0.579 <sup>***</sup> (0.150)
Farm size	57.451 <sup>**</sup> (27.775)	54.679 <sup>*</sup> (32.239)
Household size	70.160 (47.557)	60.842 (60.662)
Sex (Binary)	616.921 <sup>***</sup> (95.377)	870.576 <sup>***</sup> (148.241)
Age	-10.567 <sup>***</sup> (3.744)	9.693 <sup>**</sup> (4.908)
Marital status (Binary)	120.581 (118.654)	40.017 (166.334)
Urban/Rural (Binary)	-851.285 <sup>***</sup> (243.300)	-419.765 <sup>***</sup> (158.901)
Males employed	30.817 <sup>**</sup> (12.348)	63.191 <sup>***</sup> (21.601)
Females employed	23.149 <sup>***</sup> (6.658)	26.716 <sup>***</sup> (7.585)
Educational Controls	YES	YES
Regional Controls	YES	YES
Eco. Zones Controls	YES	YES
<i>N</i>	7383	5428
<i>R</i> <sup>2</sup>	0.149	0.168

Notes: Ownership, Sex, and Marital Status are dummy variables, where "1" indicates farm owned by household, married, male, and urban respectively. Robust standard errors are reported in parentheses, \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

And indeed, differences emerge when it comes to the impact of remittances on agricultural productivities as can be seen in columns (1) and (2). More specifically, the effect stemming from national remittances amounts to more than seven fold the value of international remittances. Furthermore, both coefficient turn out to be significant at the one percent level. That distinct results emerge between the two subgroups might not be surprising, considering the crucial differences in household characteristics existing between internationally and

nationally migrant sending households, as shown in the previous data section. Yet, the size and significance of these estimation results require future consideration.

As the survey data indicates, one of the most important differences between those two groups is the average income per household. It therefore constitutes a likely candidate to explain the differential relationship found between both subgroups. Until now, our results are based on the assumption that the corresponding direct effect is consistent across all levels of income. In a next step, we account for the possibility that the link between remittances and agricultural productivity differs across income quartiles. In particular, as illustrated in Table 5, we run quartile regressions always for the most complete specification including the main control variables of interest.

Table 5. Results from quartile regressions, estimating the total value harvested

	Total value of harvest			
Remittances	1.172 <sup>***</sup> (0.416)	133.517 <sup>***</sup> (31.830)	11.794 <sup>***</sup> (3.161)	-11.227 <sup>***</sup> (3.383)
Household size	33.986 <sup>**</sup> (16.744)	1190.895 <sup>***</sup> (286.963)	11.603 (18.065)	165.580 (130.358)
Sex (Binary)	235.059 <sup>***</sup> (44.232)	12448.079 <sup>***</sup> (2890.269)	1540.381 <sup>***</sup> (376.411)	-807.417 (636.636)
Age	-1.643 (1.337)	-41.859 <sup>***</sup> (9.666)	42.022 <sup>***</sup> (11.427)	56.640 <sup>***</sup> (20.342)
Marital Status (Binary)	-13.793 (41.416)	-106.591 (90.670)	63.400 (107.154)	310.799 (346.227)
Urban /rural (Binary)	-80.412 <sup>*</sup> (45.705)	-15160.587 <sup>***</sup> (3632.789)	-2665.736 <sup>***</sup> (695.892)	6109.203 <sup>***</sup> (1960.012)
Farm size	14.316 (11.665)	113.552 <sup>***</sup> (25.244)	39.100 (27.243)	40.758 (28.359)
Males employed	0.419 (2.521)	14.669 <sup>**</sup> (6.770)	11.807 (10.574)	88.694 <sup>**</sup> (41.455)
Females employed	17.671 <sup>***</sup> (4.883)	12.418 <sup>**</sup> (4.868)	26.270 <sup>***</sup> (6.265)	6.350 (18.847)
Educational controls	YES	YES	YES	YES
Regional controls	YES	YES	YES	YES
Eco. Zones controls	YES	YES	YES	YES
<i>N</i>	1892	1892	1892	1892
<i>R</i> <sup>2</sup>	0.147	0.188	0.199	0.147

Notes: Ownership, Sex, and Marital Status are dummy variables, where "1" indicates farm owned by household, married, male, and urban respectively. Robust standard errors are reported in parentheses, \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

It can be seen that estimating the effect of remittances by income class reveals crucial new insights. While a quite modest coefficient appears in the first and lowest income quartile, it increases from 1.18 to 133.51 when moving towards the second lowest quartile. This enormous jump in magnitude is not only fascinating, but also points to the highly productive use of remittances received by families belonging to this income class. In contrast, the magnitude shrinks when moving to the third quartile, before the coefficient of remittances even turns negative for the highest income quartile. Across all the four specifications, the

coefficient remains significant at a one percent level. Hence, these estimations confirm the previous hypothesis that remittances are significantly associated with the total value harvested. However, not in a uniform way, as the quartile regressions reveal. Rather, income has also to be taken into account when trying to get a more comprehensive understanding of the remittance/ agricultural output nexus.

Even though numerous different channels might influence the impact of remittances, some last estimations are supposed to provide first insights regarding one potentially very important channel, i.e. the spending on crop inputs. Exploring the level of crop inputs is of great importance due to the substantial increases in productivity usually associated with increased usage of crop inputs, such as fertilizer or better equipment. Hence, when considering the value of crop expenditure instead of the total value harvested as the dependent variable of interest and re-running regressions across income quartiles, a pattern that complements our previous findings emerges.

Table 6. Results from quartile regressions, estimating the expenditure on crops

	Expenditure on crops			
	Q 0.25	Q 0.5	Q 0.75	Q1
Remittances	0.616*** (0.116)	47.750*** (10.866)	-3.518* (2.077)	-18.197 (14.135)
Farm size	3.536 (2.968)	23.546*** (3.693)	11.188 (8.188)	12.609 (10.208)
Household size	9.039*** (3.267)	396.618*** (91.774)	-8.720 (16.648)	102.997* (57.525)
Sex (Binary)	61.443*** (13.738)	4257.090*** (960.962)	-145.131 (175.026)	-2735.961 (2348.069)
Age	-0.384 (0.366)	-28.321*** (6.433)	-15.305* (8.337)	68.080 (56.487)
Marital Status (Binary)	12.728 (14.625)	51.191** (20.570)	-91.299 (68.808)	173.845** (85.836)
Urban/rural (Binary)	13.915 (18.715)	-5292.883*** (1205.399)	828.866* (462.705)	9484.093 (7222.674)
Males employed	0.148 (0.549)	-1.581 (1.384)	0.467 (1.666)	14.371** (6.594)
Females employed	4.056** (1.620)	5.116*** (0.925)	3.048** (1.387)	10.206* (5.650)
Educational controls	YES	YES	YES	YES
Regional controls	YES	YES	YES	YES
Eco.zones controls	YES	YES	YES	YES
<i>N</i>	1627	1627	1627	1627
<i>R</i> <sup>2</sup>	0.148	0.124	0.081	0.175

Notes: Ownership, Sex, and Marital Status are dummy variables, where "1" indicates farm owned by household, married, male, and urban respectively. Robust standard errors are reported in parentheses, \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

In the first income quartile, remittances are positively associated with the expenditure on crops, yet with a coefficient relatively small in size. The size of the coefficient increases substantially, however, when moving to the second lowest income quartile. This result complements the substantial jump in productivity associated with the receipt of remittances observed in the previous estimations. Here, it is again the second lowest income quartile where the receipt of remittances has the strongest impact on the expenditure on crops inputs.

Yet, from quartile (3) onwards, the coefficient of interest loses in statistical significance and even reverses its sign. This indicates that the expenditure on crop inputs does not seem to be significantly associated with receiving remittances in the highest income quartile. In fact, if there was a trend to be determined, it would be a reversed relationship between remittance receipt and output, at least so in quartile (3).

## 7 Discussion and limitations

When looking at the empirical results derived, we firstly confirm the stream of literature that claims a positive association between remittances and agricultural productivity. Hence, in the case of Ghana, the receipt of cash remittances is overall positively related to agricultural output. However, this finding needs further consideration as the impact attributed to remittances is not universal. Therefore, several further estimations have been conducted, complementing each other and all pointing to the importance of a household's socio-economic background. In particular, a first indication for this connection has been found when observing that remittances are associated with higher productivity gains in households receiving national remittances - households that belong on average to the lower-income group.

This presumption gets confirmed when shifting more attention towards income by applying quantile estimations across income quartiles. While in the first quartile a positive association between the overall receipt of remittances and agricultural output exists, the magnitude of the coefficient is relatively small. In fact, the potential influence of remittances to impact upon agricultural productivity stays far beyond the level of the next higher income quartile. Intuitively, this can be explained by more urgent family needs due to which a larger part of remittances is spent on consumer goods. Households belonging to the second lowest income quartile are likely to also face a high degree of credit constraint. Yet, increasing income capacities seem to arise that enable households to conduct productive investments rather than to spend remittances exclusively on basic consumption goods. This might explain the substantial increase in impact remittances exert once received by relatively better off households. However, as illustrated by income quartile (3), the positive association between remittances and agricultural productivity seems to vanish at a certain point. Hence, for wealthy households with low financial, credit and risk constraints, remittances again have a smaller effect on agricultural output. This trend even reverses in quartile (4), where a negative and significant relationship between remittances and the total value harvested emerges. This might indicate that above a certain income threshold additional money even incentivizes to turn away from agricultural activities.

Hence, it seems as if poorer households spend additional money in an agricultural context more efficiently than it is the case for richer households, at least after a certain minimum living standard has been reached. This finding is consistent with a quite recent but increasing development paradigm that advocates for direct cash transfers to address poverty. The approach is based on the believe that poor households are well able to pull themselves out of

the poverty trap. This contrasts the traditional (at least subconscious) belief that poor people are at least partly responsible for their position. Yet, as recent research shows, poor families spend "little extra money wisely and creatively" (Hulme et al. 2012). Also in the case of Ghana, it seems that farm households stemming from weaker socio-economic backgrounds are well able to spend additional income obtained in a productive way.

Considering the large size of the coefficient's increase between the first and second income quartile, the derived results further show to which large extent improvements in productivity are prevented due to severe existing credit constraints. Many credit institutions prefer to offer credit to people active in other sectors than crop farming, as crop farming is associated with high risks due to weather and price insecurities. In fact, only 19 percent of farm households have access to credit. Hence, farm enterprises still face the challenge of obtaining credit to conduct production activities.

Afterwards, a first potential explanation for this distinct impact of remittances is provided by assessing the expenditure on crop inputs across income classes. We find a strong relationship between remittances and expenditure on crops for relatively poor households - however, only after a minimum amount of income has been reached. The emerging pattern complements the estimation results on the total harvest output. In particular, the increases in agricultural output due to remittances match the input crop spending associated with remittances. Therefore, the expenditure on input crops is found as an important channel through which remittances impact on agricultural output. This indicates that the first two quartiles might lack those crop inputs, while these are already available in the higher two quartiles.

Nevertheless, this study faces several limitations that have to be kept in mind when interpreting the results. Firstly, observing a positive association between remittances and agricultural output, it would be interesting to better understand the channels leading from the receipt of remittances towards increased agricultural output. While this thesis proposes a first such channel, namely expenditure on crop inputs, one could also think of investment in education and health, amongst others. However, it is difficult to assess these channels due to endogeneity concerns and they are left beyond the scope of this study. Furthermore, even though theory and some first empirical evidence shows that migration can be analysed as a household decision, it would be interesting to have more information on direct remittance determinants on the migrant's side. However, due to the lack of these information stemming from the "sending end", it has to be relied on surveys that incorporate migrant sending households.<sup>6</sup> Additionally, we observe the household's outcome only at one point in time. Hence, we do not know anything about the sustainability of the farming techniques employed. Due to the increasing availability of GPS data, it would furthermore be interesting to employ more specific data on soil quality and rainfall on the district level. Finally, it is important to be aware of the complex interactions that exist between migration, remittances and other

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<sup>6</sup>An exception is the study by Lucas and Stark (1985), who conclude that remittances of a migrant increase with his or her earnings.

variables of socio economic development. Hence, there is also a local loss of human capital due to the emigration often of highly skilled household members. It is therefore important to note again that this study does not access the overall impact of migration, as it does not take the presence or absence of a household member into account, but exclusively focuses on the effect of received remittances. Despite these limitations, this study constitutes an important first step to look at the impact of remittances in a more differentiated way than it had been done in previous studies dealing with the topic of remittances.

## 8 Concluding remarks

The amount of remittances to household-farms not only in SSA, but also in other developing regions has gained importance over the last decades. From a development perspective, it is important how these monetary flows are spent. Especially so in the agricultural sector, as it plays an important role for the overall economy due to its many linkages to the rest of the economy and its direct impact on the real cost of food. Within the scope of this thesis, it was the aim to analyze the relationship between remittances and agricultural productivity for the case of Ghana. Beyond establishing an overall association, this study distinguishes between the impact of national and international remittances. Another important focus lies on the differential impact of remittances due to a household's financial background. Thereby, the findings of this thesis contribute to the existing literature in several ways.

Firstly, the findings confirm an overall positive relationship between remittances and agricultural output. Hence, no evidence emerges for negative behavioral changes that adversely affect agricultural productivity. Therefore, we can conclude that remittances help to increase the overall harvest output and might be helpful for Ghana's aim to increase local food security. This is of great importance considering the increasing amount of basic food the country is importing. Secondly, our results point to the importance of distinguishing between national and international migrant sending households as nationally originating remittances are associated with higher increases in harvested output. While internationally receiving households are on average better off than non-recipients, the contrary is the case for nationally receiving households, constituting the most disadvantaged group. These differences in socio-economic background, are a likely explanation for a differential usage and productivity of remittances in favor of households receiving national remittances. Third, incorporating a household's income in the remittance-productivity nexus points to a non-linear effect of remittances across income classes. Thereby, remittances seem to be most efficiently used in the second lowest income quartile. This is an important take-away, as previous studies have entirely neglected household specific differences in the spending and investment of remittances.

As a final contribution, this thesis analyses the impact of remittances on the expenditure on input crops, since it might be an important channel to explain the existing differences in remittances' impact on agricultural output. As this pattern complements the previous estimation results and seem to constitute an important channel to explain the observed

productivity differences due to remittances. This first evidence on how differently income stemming from remittances is spent across households is important to keep in mind, not only when analyzing implications of remittances, but also when designing policies that address the farm sector.

The results of this thesis contribute to the increasing stream of literature that not only stresses benefits for the destination country, but also points to positive spill-over effects for the remaining household member. Given the strongest productivity increases due to remittances among lower-medium income households, there is more to be done in order to maximize the positive impact of remittances. Hence, further research is needed in order to make remittances both less costly and more productive. Finally, several other steps are left for future research. For instance, one could surely think of other possible channels through which differential effects of remittances are transmitted. Moreover, it would be helpful to look at different other determinants that impact expenditure besides income, the focus of this thesis. Nevertheless, this thesis constitutes an important first step to show that a more comprehensive approach is needed to understand implications of remittances.

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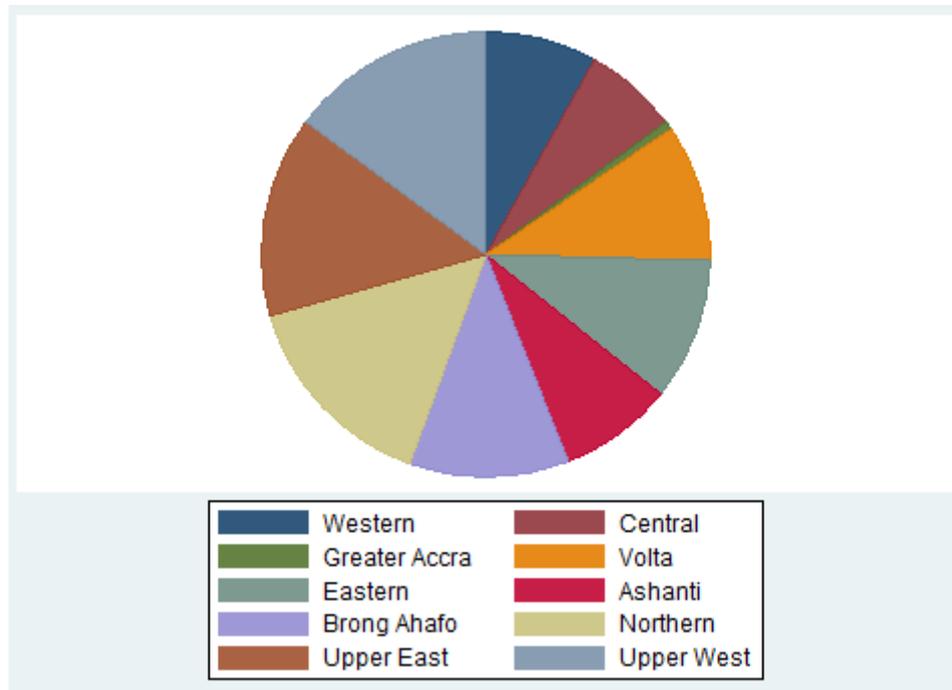
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# Appendix

**Table A1: Summary Statistics**

Variable	Mean	Std. Dev	Min.	Max.	N
Remittance Dummy	.2976112	.4584944	0	1	7,577
Remittances Food	131.7928	280.3529	5	5,800	782
Remittances Cash	423.923	913.2254	2	20,000	1,948
Value Harvested					
Value harvested in the last 12 month	1697.835	4592.913	1	264900	7,577
Household Characteristics					
HH size	5.192029	3.236214	1	29	7,577
Age	48.70159	15.44896	15	98	7,577
Married	.7035766	.7035766	0	1	7,577
Sex	0.8474473	.3595657	0	1	7,577
Total HH Income (Gross)	3597.21	13181.57	0	788249.3	7,577
Educational Controls					
HH members no educ	1.919889	1.772441	0	21	7,577
HH members Primary educ	.4280058	.7368145	0	5	7,577
HH members Sec educ	.8810875	1.13327	0	8	7,577
HH member Tert. educ	.0663851	.2896508	0	4	7,577
Farm Characteristics					
Farm size	4.590964	11.13429	0.0372853	513.5756	7,577
Females working on farm	6.061766	10.7505	0	227	7,577
Males working on farm	5.359905	11.18062	0	420	7,577
Ownership	0.6938437	.4609082	0	1	7,577
Urban/Rural	.1497954	.3568943	0	1	7,577

*Notes: Ownership, Sex, and Marital Status are dummy variables, where "1" indicates farm owned by household, married, male, and urban respectively. Monetary values are given in GHS.*



**Figure 2: Share of regions within the overall sample**  
 Source: GLSS6

**Table A2: Distribution of remittances across regions**

<b>Region</b>	<b>N</b>	<b>Mean</b>	<b>Min.</b>	<b>Max.</b>
Western	160	530.4688	5	4700
Central	170	435.3341	6	10000
Greater Accra	11	536.7273	10	2000
Volta	278	414.0396	5	7350
Eastern	247	578.5911	10	20200
Ashanti	218	585.6239	20	8400
Brong Ahafo	267	735.9648	5	11200
Northern	237	300.6118	4	3700
Upper East	365	355.8658	5	6680
Upper West	302	351.8609	3.5	2980

Source: GLSS 6

## Conversion strategy for land size

Within the survey, farmers can report the size of land not only in hectares and acres, but also in less conventional units such as plots, poles and ropes. Additionally, the transformation factors of these units are likely to vary across regions and time. We try to deal with these measurements issues in the following way: despite the high degree of uncertainty, previous papers commonly do rely on the standard definition of 1 pole = 1 acre, 9 ropes = 1 acre and one acre = 0.4047 hectares and assume its consistency across the region. Most importantly, Cogneua et al. (2014) examine in detail the evolution of land use and agricultural productivity in Ghana over the period 1991-2005 and test various conversion strategies. We rely on their strategy of applying one fixed conversion factor for urban areas, where we assume more standardized measurement systems to be more likely implemented. This conversion strategy differs in so far, that we intend to find a more comprehensive measure for rural areas, where conversions factors vary greatly and the absence of unification is more relevant. To address this issue, we make use of the GLSS6 community data questionnaire, that asked community leaders for both the most common measurement unit of land and its conversion factor to square meters. Hence, in order to find the most adequate conversion factor, we calculate average values for each region and each single measurement unit. Based on these calculations shown in Table A3, we convert all area measurements in hectares before adding up the total surface owned or operated by each household.<sup>7</sup>

**Table A3: Transformation of measurement units per region in hectares**

	<b>Acre</b>	<b>Poles</b>	<b>Ropes</b>	<b>Plots</b>
<b>Western</b>	0.940	0.463	0.056	0.093
<b>Central</b>	0.631	0.281	0.072	0.640
<b>Great Accra</b>	0.569	n.a	0.348	n.a.
<b>Volta</b>	0.277	0.155	0.049	1.166
<b>Eastern</b>	0.373	0.108	0.195	0.014
<b>Ashanti</b>	0.822	0.058	0.154	0.215
<b>Brong-Ahafo</b>	0.534	0.356	0.100	0.305
<b>Northern</b>	0.564	n.a	0.563	
<b>Upper East</b>	0.508	0.330	0.351	0.914
<b>Upper West</b>	0.514	n.a.	n.a.	n.a.

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<sup>7</sup> Note that for those units and regions not available in the community data section, hardly any observations get lost in the main sample.

## IV estimation strategy

We follow the approach of Adams et al. (2008) and employ instrumental variables (IV)s for the remittance variable<sup>8</sup>. In particular, the authors construct two IVs based on the notion that previous research has identified migration networks as an important **determinant of the decision to migrate and send remittances**. As ethnicity and religion constitute two important network forms in Ghana, the authors assume that Ghanaian households form migration networks based on these two factors. Therefore, the authors sub-divide the data according to five religious groups, namely

- 1.) Catholic and Anglican
- 2.) Presbyterian and Methodist
- 3.) Spiritualist and other Christian
- 4.) Muslim
- 5.) all others

Further, the three ethnographic groups are selected according to the percentage they represent of the total population and include

- 1.) households belonging to ethnic groups representing 17% or more of the population in 1998/99 (e.g., Asante and other Akan)<sup>9</sup>
- 2.) households belonging to ethnic groups representing between 10% and 15% of the population in 1998/99 (e.g., Fanti, Ga-Adangbe, Ewe)
- 3.) all other households

As pointed out by Langer (2010), identities can hardly be seen in isolation and usually overlap. Therefore, a combination of the above mentioned classifications is used in order to construct 15 ethno-religious subgroups. Based on this classification, Adams et al. (2008) suggest the creation of two instrumental variables: 1.) remittances received as a percent of income in the ethno-religious group as well as 2.) migrants as a percentage of the population of the ethno-religious group, to identify their second-stage structural model. This is possible as remittances and migrants are distributed unevenly among the various ethno-religious

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<sup>8</sup> The following identification strategies for remittances have been employed within the related literature: Historic state-level migration rate in Mexico (Hildebrand and McKenzie 2005), migration networks and history either at the village or household level (Mansuri 2006; Acosta 2006, Beaudouin 2005), historic Mexico to US migration (Woodruff and Zenteno (2004), and exogenous variation in the transaction costs of international transfers (Ponce et al. 2011).

<sup>9</sup> As suggested by Winters et al. (2001), current community networks play a greater role in the migration decision than historical migration, wherefore we choose data from the GLSS4 survey instead of an older one.

groups. This variation in "efficiency of migrant networks to generate remittance income" is important for these variables to work as instruments in the second estimation stage.

Yet, it is necessary to explore whether ethno-religious networks in Ghana are indeed sufficiently correlated with the receipt of remittances and hence, whether the constructed IVs are relevant. Relevance can be checked within the reduced form by regressing both IVs on remittances. Observing a value of 29.73 in the first stage F-statistic, exceeds the critical values given by Stock and Yogo (2002) for one endogenous variable. Hence, we can be reassured in instrumenting the quantity of received remittances by following their estimation strategy. Hence, when instrumenting remittances, the first stage equation uses the normal cumulative density function as a function of the explanatory vector  $Z$ .

$$\text{Pr ob}(y_i = 1) = \Phi(\beta Z_i) \quad (3)$$

Where  $\Phi$  is the standard normal cumulative density function and  $\beta$  stands for the vector of unknown parameters to be estimated. Further, the likelihood of receiving remittances at the household level is a function of the vector of controls  $Z$ , which incorporates the following variables:

$$\text{Prob (Obt. Rem}=1) = f [\text{Household Characteristics, Migration Networks (=IVs)}] \quad (4)$$

Thus, equation (2) measures the probability of receiving remittances, depending on the effectiveness of migration networks for both migration and the receipt of remittances. We focus on cash transfers, as these have the greatest potential to be directly invested in productivity enhancing inputs and make up over 75 percent of the total transfers. In a next step, the second stage, a linear OLS regression considers the respective size of the remittances, given the previous non-linearity.

$$\text{Remittances} = \alpha_0 + \alpha_1 P(\text{rem})_i + \alpha_2 X_i + \alpha_3 Z_i + \epsilon_i \quad (5)$$

**Table A4: Robustness checks, including additional control variables**

	Total value of harvest			
	-1	-2	-3	-4
Remittances	1.454*** -0.269	3.232*** -0.815	3.228*** -0.822	3.552*** -1.076
Farm size	108.401** -48.478	77.692*** -28.48	77.566*** -28.467	202.216*** -38.91
Household size	55.603* -32.319	97.924 -68.441	144.873 -133.492	-1.45 -87.982
Sex (Binary)	452.039*** -123.766	528.932*** -103.649	548.882*** -127.448	534.186*** -186.539
Age	-3.195 -3.219	-6.474 -11.891	-12.468 -14.608	-13.172 -20.705
Age <sup>2</sup>	-0.018 -0.113	-0.02 -0.112	0.016 -0.124	0.008 -0.196
Marital Status (Binary)	236.595** -118.567	139.884 -100.647	144.628 -104.405	100.268 -160.843
Urban/Rural (Binary)	-419.069** -210.453	-886.742*** -270.041	-898.170*** -282.987	-964.367*** -342.428
Ownership (Binary)		386.126*** -69.533	382.122*** -70.106	153.587 -123.803
No. male adults			-38.562 -178.622	83.784 -109.598
No. children <15			-152.851 -179.771	47.171 -110.09
Non-farm Income				0.912 -1.11
Educational Controls <sup>a</sup>	YES	YES	YES	YES
Regional Controls	YES	YES	YES	YES
Eco.Zones Controls	YES	YES	YES	YES
<i>N</i>	4190	4190	4190	4190
<i>R</i> <sup>2</sup>	0.168	0.16	0.161	0.232

Notes: Ownership, Sex, and Marital Status are dummy variables, where "1" indicates farm owned by household, married, male, and urban respectively. Robust standard errors are reported in parentheses, \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01.

a) Commonly applied educational controls in column (1) replaced by the highest degree obtained by the head of the household

**Table A5: Robustness check, employing net agricultural income as the dependent variable**

	Total value of harvest			
	(1)	(2)	(3)	(4)
Remittances	13.042** (5.918)	31.605** (14.537)	31.196** (14.718)	45.458** (22.153)
Farm size	91.152*** (33.966)	51.740 (35.462)	49.214 (36.259)	6.532 (38.488)
Household size	111.790 (98.064)	234.143* (121.870)	325.937** (133.686)	-39.223 (189.424)
Sex (Binary)		1838.158*** (677.711)	1823.238** (746.352)	1924.376** (883.456)
Age		-44.374* (24.194)	-44.021* (24.727)	-60.713* (33.672)
Marital Status (Binary)		4.380 (301.683)	124.492 (334.514)	248.575 (305.254)
Urban/Rural (Binary)				-13734.140** (6324.701)
Males employed				-7.723 (10.734)
Females employed				-0.870 (10.795)
Educ. Controls		YES	YES	YES
Regional Controls			YES	YES
Eco. Zones Controls				YES
<i>N</i>	7577	7577	7577	7572
<i>R</i> <sup>2</sup>	0.094	0.214	0.217	0.314

Notes: Ownership, Sex, and Marital Status are dummy variables, where "1" indicates farm owned by household, married, male, and urban respectively. Robust standard errors are reported in parentheses, \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Table A6: Robustness check, IV estimation**

	Total value of harvest			
	(1)	(2)	(3)	(4)
Remittances	1.351 <sup>***</sup> (0.287)	2.384 <sup>***</sup> (0.435)	2.357 <sup>***</sup> (0.435)	3.229 <sup>***</sup> (0.823)
Farm size	70.944 <sup>**</sup> (28.183)	92.922 <sup>***</sup> (32.115)	88.348 <sup>***</sup> (31.475)	78.423 <sup>***</sup> (28.619)
Household size	196.143 <sup>***</sup> (54.636)	163.319 <sup>**</sup> (69.376)	174.516 <sup>**</sup> (70.636)	92.504 (68.264)
Sex (Binary)		740.020 <sup>***</sup> (94.260)	666.025 <sup>***</sup> (89.223)	478.950 <sup>***</sup> (100.591)
Age		-4.952 <sup>*</sup> (2.654)	-2.822 (2.780)	-5.842 <sup>**</sup> (2.950)
Marital status (Binary)		111.809 (99.853)	191.884 <sup>*</sup> (104.196)	153.429 (102.747)
Urban/rural (Binary)				-891.896 <sup>***</sup> (272.876)
Males employed				30.218 <sup>**</sup> (12.303)
Females employed				25.045 <sup>***</sup> (7.231)
Educational controls		YES	YES	YES
Regional controls			YES	YES
Eco. Zones Controls				YES
<i>N</i>	7577	7577	7577	7572
<i>R</i> <sup>2</sup>	0.030	0.091	0.113	0.159

Notes: Ownership, Sex, and Marital Status are dummy variables, where "1" indicates farm owned by household, married, male, and urban respectively. Robust standard errors are reported in parentheses, \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .