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Motives, channels and migration for remittances: Evidence from Uganda, Senegal and Nigeria

Economics

Master's thesis

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2012

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Abstract

Objectives

The objective of this study is to increase and deepen the knowledge of sending remittances to Uganda, Senegal and Nigeria by examining the determinants of the probability and amount of remittances and how they reflect the motives migrants have for remitting; by investigating the determinants of the choice migrants make between using official and unofficial remittance channels and how they reflect the different features of remittance markets; by developing a theoretical model for intra-household decision making regarding migration; and by analysing the determinants of the choice households and migrants make between international and internal migration. The results of the study may be of value in aligning remittance markets with the needs and motivations of migrants and in mobilising remittances more efficiently.

Framework and methods

The several motives for remitting are discussed in terms of the microeconomic theory of remittances, the theory of remittance channels is reviewed, and a model for intra-household decisions making regarding migration is developed. The existing empirical literature on motives for remittances and on the remittance markets of the countries under study is also reviewed. In the empirical estimations based on the above frameworks, migration and remittances survey data, jointly collected by the World Bank and the African Development Bank in the countries under study, are utilised. Five empirical estimation methods – the tobit model, the Heckman selection model, the two-part model, CLAD estimation, and the probit model – are employed in the examination of the research questions.

Key findings

The empirical results of this study imply that a variety of motives influence the remittance behaviour of Ugandan, Senegalese and Nigerian migrants. In addition, the motives differ in their relative intensities between different groups of migrants. On the whole and in accordance with previous research, the generally presumed altruistic motive is not explicitly supported by the estimations for any of the countries under study, and more self-interested concerns and contractual arrangements between migrants and their families – the exchange and the investment motive, in particular – seem to override purely altruistic ones.

A diversity of factors also affect the choice migrants make between using official and unofficial channels, as well as the choice households and migrants make between international and internal migration. In terms of remittance channels, official remittance channels are generally more likely used by migrants residing in OECD countries, and by migrants with a high level of education, reflecting especially the differential access that different groups of migrants have to official channels. Other factors affecting the choice are more country-specific. The choice between international and internal migration, on the other hand, is determined by several factors – different in each of the countries under study – including, inter alia, the reason for migration, and the education and the potential occupation of the migrant. The effects of these factors reflect well the model developed to depict the migration decisions made in households.

Keywords

remittances; microeconomic theory of remittances; official and unofficial remittance channels; theory of remittance channels; international and internal migration; model for migration decisions; Sub-Saharan Africa

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1 Introduction

This chapter gives an introduction to the research topic of this study – sending remittances – by giving an overview of the aspects of remittances examined, the context in which they are studied, and the theory and methods they are investigated with. It also discusses why remittances are relevant object of study. First, the research questions, the theoretical and empirical framework and the objectives of this study are clarified. Second, the motivation for and the contribution made by this study to the existing remittance literature are discussed. Third, the empirical methods used in this study are introduced. Fourth, the key findings of this study are summarised. Fifth, a couple of definitions relevant to this study are given, and lastly, the structure of the study is outlined.

1.1. Research questions, framework and objectives

This study seeks to provide a comprehensive analysis of the sending of remittances to three Sub-Saharan African countries, Uganda, Senegal and Nigeria. First, this study examines the determinants of remittances sent by Ugandan, Senegalese and Nigerian migrants, and examines the implications of the analysis in terms of the theories of the motives for remitting. Second, this study investigates which factors affect the choice migrants make between official and unofficial remittance channels, and links this investigation to the theory and empirical knowledge of remittance channels and markets in the countries under study. Third, this study develops a theoretical model for analysing the roles that the families of migrants and expected remittances have in intra-household decisions on which household member should migrate, and where this migrant should migrate to. The latter decision is studied empirically, as well.

To be precise, there are three distinct, but highly interrelated research questions concerning the sending of remittances into which this study provides insight. First, which factors determine the probability and amount of remittances to the countries under study, and what do these factors imply in terms of the motives migrants have for remitting? Second, which factors determine the choice migrants make between official and unofficial remittance channels, and how do they reflect the different features of remittance markets in the countries under study? Third, how could the roles of the families of migrants and expected remittances in intra-household decisions on migration be modelled theoretically, and which factors determine the choice between international and internal migration from the countries under study? The analysis of the uses and impacts of remittances in the receiving country is left for future analysis.

The theoretical framework of this study is provided by the microeconomic theory of motives for remittances, which is derived from the more comprehensive and developed theory of intra-family transfers. The models chosen for this study, except for one of them, are thus not specifically developed for the context of migration and remittances. Also the theory of remittance channels is presented, and the empirical literature on the motives for remittances and on the characteristics of African remittance markets is utilised. For its part, the empirical analysis of this study employs data from Uganda, Senegal and Nigeria, collected through Migration and Remittances Household Surveys conducted for the Africa Migration Project, which was jointly implemented by the World Bank and African Development Bank in 2009 and 2010. To the author's knowledge, the data has not been used for similar estimation purposes in previous published studies. To ensure the robustness of the econometric analysis, several estimation methods are utilised, and their relative strengths and weaknesses scrutinised.

The broad objective of this study is to increase and deepen the existing knowledge of, and to provide policy-relevant information on sending remittances. First, insight into the characteristics of remitters and to their motives for remitting is instrumental in creating a more favourable financial environment for remittances, i.e. an environment better aligned with the motives and needs of remitters. Second, understanding the factors affecting the choice between official and unofficial remittance channels may allow informed measures in the financial sector to be taken to mobilise remittances more efficiently through official channels. Third, apprehending more fully the role of the families of migrants and expected remittances in intra-household decisions on migration is pivotal in terms of forming a better conception of intra-household decision making dynamics and of the resultant migration patterns. All in all, increasing the understanding of different aspects of remittances may enable the developmental impacts of remittances to expand and intensify further.

1.2. Motivation and contribution

Remittances have become a significant and growing source of external financing in developing countries during the last decades. In 2011, officially recorded remittances to developing countries are estimated to have amounted to $351 billion, up by 8 percent from 2010. Remittance flows to all six developing regions grew in 2011 for the first time since the global financial crisis, and the growth is expected to continue at an annual rate of 7-8 percent. (Mohapatra et al. 2011:1-2) Compared to other sources of financing, officially recorded

remittances to developing countries – $307 billion in 2009 – come close to foreign direct investment flows to developing countries, which in 2009 totalled $359 billion, while they clearly outpace the flows of official development aid, which in 2009 added up to $120 billion (The World Bank 2011b:21).

According to the World Bank's most recent remittance data on Sub-Saharan Africa, inward workers' remittance flows are estimated to have totalled $21.5 billion in 2010, and are estimated to have increased 7.2 percent in 2011 (The World Bank 2011b:34; Mohapatra et al. 2011:2). In terms of the countries under study, Nigeria is the region's top recipient of remittances, with its inward remittances amounting to $10.0 billion in 2010. Also Senegal and Uganda make it to the list of top 10 remittance recipients by being fourth and sixth on it, respectively, with their inward remittances of $1.2 and $0.8 billion in 2010, respectively. (The World Bank 2011b:34) In Sub-Saharan Africa and elsewhere, remittances embody vast developmental potential, as they have helped, inter alia, to reduce poverty, to increase resources of households directed to investments, and improve education and health outcomes (Ratha and Mohapatra 2011:14-6, 19, 21). Despite the hampering effects of high remittance costs, limited access to remittance service providers in rural areas, and the use of unofficial channels, innovative money transfer and other technologies are being adopted in the region, increasing the access to remittances. (Ibid: 2011:2) Thus, remittances, and those sent to Sub-Saharan Africa in particular, are worth of further scrutiny and research.

It is therefore no wonder that remittances have received attention from researchers and policy makers, who have studied their causes, uses and consequences widely in different contexts both theoretically and empirically. Especially the motives for remitting have been modelled theoretically, starting with the seminal paper by Lucas and Stark (1985) examining the motivations of remittance behaviour of Batswana migrants. However, while Lucas and Stark (1985) consider a wide spectrum of different motives, most recent studies on the motives for remittances tend to be labelled by the lack of comprehensiveness: the studies tend to take only one or two motives under scrutiny at a time, and often neglect the other aspects of sending remittances completely. Moreover, the existing theory of remittances, though it acknowledges that remittance and migration decisions are often taken jointly by migrants and their families, rarely model the role and considerations of the families explicitly.

Thus, to fully understand remittances and to mobilise them more efficiently, a broader perspective is needed. On a positive note, a rather encompassing approach to remittances in

the context of Sub-Saharan Africa is taken by two recent publications by the World Bank and the African Development Bank, *Leveraging Migration for Africa: Remittances, Skills and Investments* (2011) and *Remittance Markets in Africa* (2011). However, they are primarily descriptive in their approach and lack a detailed theoretical and econometric analysis of the motives for remitting.

This study stems from and contributes to the previous remittance literature by its similar, but more encompassing approach. Firstly, this study addresses all the theoretically modelled motives for remitting with its empirical estimations, making the resultant analysis richer and more comprehensive than many a previous analysis of similar empirical studies. Moreover, various econometric estimation methods are employed in the empirical investigation, providing an analytic approach to studying remittances. Secondly, unlike many a previous study, this study also elaborates on the financial context where remittances occur by examining the channels used for remitting. Third, the newly-developed model describes the roles of families of migrants and expected remittances in intra-household decisions on migration more intricately that has been done so far.

1.3. Methodology

In terms of the procedures of inquiry employed in this study, the theoretical frameworks and previous empirical research providing the basis for the empirical estimations of this study are discussed through a comprehensive literature review. In the empirical analysis of this study, different econometric estimation methods are used. To examine the determinants of the probability and amount of remittances, the tobit model, the Heckman selection model, the two-part model and CLAD estimation are employed. They all attempt to capture the sample selection problem that is inherent in the data on migrants and their remittances, and have all been widely used in previous empirical studies of the issue. Employing all of them and comparing their results with one another brings robustness to the results. The simple probit model is utilised in the investigation of the choice between official and unofficial remittance channels, and in the examination of the choice between international and internal migration. The model is appropriate for these kinds of research questions, where the dependent variable depicts two discrete outcomes.

1.4. Key findings

The empirical results of this study imply that there are a variety of motives influencing the remittance behaviour of Ugandan, Senegalese and Nigerian migrants. On the whole and in accordance with previous studies in the field, the generally presumed altruistic motive for remittances seems to be overridden by more self-interested and contractual concerns of migrants. Also the factors influencing the choice between official and unofficial remittance channels, and the choice between international and internal migration are diverse and different from country to country.

In terms of the motives for remitting, what is common to all of the countries under study is that remittances tend to increase with the income of the migrant, which is in accordance with most of the motives for remitting. When it comes to the analysis of Ugandan migrants, partial support is found to the exchange motive and particularly to the investment motive, under which remittances act as repayments of loans used to finance the education and/or migration of the migrant. However, there are differences in motivations and their intensity between male and female migrants and between migrants in OECD countries and those in African countries.

The motives of Senegalese migrants seem to be even more mixed than those of Ugandan migrants, as none of the motives receive indisputable evidence. There is, however, some grounds for the exchange and inheritance motives: under the latter, migrants aim to ensure the receipt of a future inheritance with remittances. One possible reason for the ambiguity is that the remittances of Senegalese male and female migrants, and those of migrants in OECD and in African countries, seem to be motivated by rather different considerations. In turn, among Nigerian migrants, there is also evidence of the presence of both the exchange and the investment motive. Further, while the intensity of certain motives differs between Nigerian male and female migrants, the residence of migrants does not seem to cause any significant differences in migrants' remittance behaviour.

When it comes to the choice between official and unofficial remittance channels, especially residing in an OECD country and being highly educated affect positively the probability of using official channels: the former receives support from Uganda and Senegal, the latter from Uganda and Nigeria. The choice between international and internal migration, on the other hand, is determined by several factors that differ from country to country, and include factors such as the migrant's reason for migration, his education and potential occupation. These

results are consistent with the new model developed to depict the migration decisions made in households.

1.5. Definitions

In conjunction with its data on remittances, estimated on the basis of the International Monetary Fund's balance of payments data, the World Bank (2012a) defines workers' remittances and compensation of employees to comprise "current transfers by migrant workers and wages and salaries earned by non-resident workers". Their data is the sum of three items: workers' remittances, compensation of employees, and migrants' transfers. According to this account, remittances are defined as "current private transfers from migrant workers resident in the host country for more than a year, irrespective of their immigration status, to recipients in their country of origin". (Ibid.) This definition of workers' remittances and compensation for employees is employed in discussions on the aggregate level of remittances.

However, the above definition is not applicable for the purposes of the empirical estimations of this study, as the household survey data utilised in the estimations includes remittances also from migrants resident in the host country for less than a year. Thus, the definition given in Plaza's et al. (2011:7) preliminary documentation, which specifically regards the data this study employs, is used. According to this account, remittances include "both international (cross-border) and internal (within-country) 'person-to-person' transfers of resources (both monetary and in-kind) often sent by migrant workers. Moreover, the same document defines a migrant as "a person who used to live in a household in the country in which the interview is being conducted, but left before the interview to live abroad, or in another village or urban area within the country, for at least six months" (Ibid.).

The above definitions are those one should be aware of in advance. When it comes to definitions of other relevant concepts related to the theory, methodology or data discussed in this study, they are given when they come across.

1.6. Structure of thesis

This study is structured to progress logically from the theoretical to the empirical. In chapter 2, the microeconomic theory of remittances is introduced by presenting the models for the six key motives for remittances: altruism, exchange, investment, inheritance, insurance and

strategic selection. These models provides the theoretical framework for the empirical estimations of the probability and amount of remittances.

In chapter 3, the theoretical and the empirical background for the empirical estimations of the choice between official and unofficial remittance channels is discussed. A model for the choice between different channels is presented, and the remittance markets of the countries under study are examined. Chapter 4, in turn, presents and elaborates on the new model describing the intra-household decision making related to migration and remittances, forming the framework for the estimations of the choice between international and internal migration.

Chapter 5 presents the econometric estimation methods employed in this study. The tobit model, the Heckman selection model, the two-part model and CLAD estimation are discussed in terms of their standard models, estimation, assumptions, specification tests, and marginal effects, and their strengths and weaknesses in relation to the research question and the empirical data are discussed.

The survey data and variables used in this study are the focus of chapter 6. First, the survey methodologies employed in each of the countries under study, and their implications for the study's empirical estimations are reviewed. The chapter also presents the independent and dependent variables, and the empirical specifications used in this study, and discusses the potential problems they, and the data itself may cause to the validity of the study. Some statistical findings made from the estimation samples are also scrutinised.

In chapter 7, the results of the various empirical estimations are presented for each of the countries under study separately. First, the results for the factors affecting the probability and amount of remittances of the whole group of migrants are presented. Second, these results are contrasted across genders and destinations of migrants, and the effect of possible additional variables on remittances are reviewed. Third, the results for the factors affecting the choice between official and unofficial remittance channels, and for the factors affecting the choice between international and internal migration, are discussed. Last, the main findings from each of the countries under study are compared with one another. Chapter 8 concludes.

2 Theories of motives for remittances

On the whole, there are two main strands of literature on remittances: one focusing on the causes and uses of remittances, and the other concentrating on the macroeconomic impact of remittances. Some theories especially of the determinants of and the motives for remittances have been developed: these theories often take a microeconomic perspective, and focus mostly on the roles that families and intra-family relationships have in decisions on migration and remittances. (Chami et al. 2003:6) However, as Rapoport and Docquier (2006:1139) point out, it is a challenge to discriminate between competing theories of motives for remittances due to their similar predictions, and additional, but rarely available, variables would often be needed to compose truly discriminative tests.

Regarding its origins, the theory of remittances stems from the theoretical framework built for the motives for general intra-family transfers. For instance, the altruistic motive, where transfers are motivated by the agents' unselfish concern with the welfare of one another, was initially studied by Barro (1974) and Becker (1974), and the inheritance motive, where parents may threat to disinherit their children to extract attention and/or transfers from them, was first suggested by Bernheim et al. (1984). However, it was Lucas and Stark's (1985) study "Motivations to remit: Evidence from Botswana" that was one of the first papers to apply this theoretical discussion to remittances. In their view, there are three distinct sets of motives and aspirations underlying remittance decisions: pure altruism, pure self-interest, and tempered altruism or enlightened self-interest. These three broad groups further include more distinctive descriptions of what motivates migrants' remittance behaviour.

In this chapter, models for the motives of altruism, exchange, investment, inheritance, insurance and strategic selection are presented and discussed in sections from 2.1 to 2.6 in terms of their main determinants and their expected impact on the probability and amount of remittances. For simplicity, it is assumed in all of the subsequent sections that there is one migrant, denoted by superscript *m*, and one recipient household with one or more household members, denoted by superscript *h*. Utility is referred to with *U*, pre-transfer incomes with *I*, consumption with *C*, and *R* denotes the amount of remittances sent by the migrant *m* to the household *h*.

Section 2.7 summarises the main predictions of these theories. In section 2.8, some previous studies on remittances reflecting the theoretical framework are reviewed. On the whole, this chapter forms the theoretical foundation for the empirical estimation of the probability and

amount of remittances: the theory both motivates the choice of variables, elaborated in section 5.2.1, and enables the discussion on the empirical results in chapter 6 in terms of whether any of the motives may be singled out as predominantly underlying the remittance behaviour of Ugandan, Senegalese and Nigerian migrants.

2.1. Altruism

Altruism has been seen as an important motive to remit and it is commonly taken as given in many empirical studies (Rapoport and Docquier 2006:1145). Migrants usually feel the unselfish need to support their families, which implies that remittances are a rather stable source of capital for the migrants' families, as they are likely to remain dependent on this capital also in the future (Bouhga-Hagbe 2006:6). Even though it is commonly supposed that these kinds of nonmarket intra-family transfers decline and move to the realm of marketplace exchanges as the economy develops, Stark (1995:13-4) argues that if families receive altruistically motivated transfers, which are valued more than transfers through the marketplace, the preference for these intra-family transfers do not vanish when exchange opportunities increase.

A model for altruistically motivated intra-family transfers by Stark (1995) is presented here to discuss the altruistic motive, as the model may easily be applied to remittances, and can account for both one- and two-sided altruism. The migrant's and the household's utility U^i, $i = m,h$, is affected by the pleasure, or felicity, the agent gets from his own consumption *C*, denoted by $V^i\left(C^i\right)$, and the other agent's utility. For V^i it holds that $V^{'} > 0$ and $V^{''} < 0$. Thus, their utilities are given by

$$U^m(C^m,C^h) = \left(1-\beta^m\right)V^m\left(C^m\right)+\beta^m U^h\left(C^h,C^m\right) \text{ and} \tag{2.1}$$

$$U^h(C^h,C^m) = \left(1-\beta^h\right)V^h\left(C^h\right)+\beta^h U^m\left(C^m,C^h\right) \tag{2.2}$$

where $\beta^i - \ 0 \le \beta^i \le 1/2$ – denotes the weight that the agent places on the utility of the other relative to his own felicity, i.e. measures his degree of altruism. Solving equations (2.1) and (2.2) in terms of $V^i\left(C^i\right)$ yields

$$U^m(C^m,C^h) = \left(1-\alpha^m\right)V^m\left(C^m\right)+\alpha^m V^h\left(C^h\right) \text{ and} \tag{2.3}$$

$$U^h(C^h,C^m) = \left(1-\alpha^h\right)V^h\left(C^h\right)+\alpha^h V^m\left(C^m\right), \tag{2.4}$$

where $0 \le \alpha^m = \frac{\beta^m(1-\beta^h)}{1-\beta^m\beta^h} \le 1/2$ and $0 \le \alpha^h = \frac{\beta^h(1-\beta^m)}{1-\beta^h\beta^m} \le 1/2$. The migrant's utility may be expressed in terms of his and the household's incomes I^i and remittances *R* as

$$U^m(C^m, C^h) = (1-\alpha^m)V^m(I^m - R) + \alpha^m V^h(I^h + R). \tag{2.5}$$

Differentiating the equation with respect to *R* and supposing that $V^i(\cdot) = \ln(\cdot)$ gives the first-order condition

$$\begin{aligned} \frac{dU^m(C^m, C^h)}{dR} &= -(1-\alpha^m)\frac{\partial V^m}{\partial C^m} + \alpha^m \frac{\partial V^h}{\partial C^h} \\ &= -\frac{(1-\alpha^m)}{I^m - R} + \frac{\alpha^m}{I^h + R} \le 0, \end{aligned} \tag{2.6}$$

which is binding for $R > 0$. Assuming that there cannot be negative remittances, optimal remittances R^* are thus given by

$$R^* = Max\{\alpha^m I^m - (1-\alpha^m)I^h, 0\}. \tag{2.7}$$

For this equation it holds that $\frac{\partial R^*}{\partial I^m} > 0, \frac{\partial R^*}{\partial I^h} < 0, \frac{\partial R^*}{\partial \beta^m} > 0$ and $\frac{\partial R^*}{\partial \beta^h} < 0$.

Quite intuitively, when the migrant's income I^m increases, he is able to consume – relative to the consumption of the recipient household – more than he optimally would, and will thus prefer to increase remittances to the recipient household to arrive back to his optimal consumption. Also, if the migrant becomes more altruistic and β^m increases, his optimal relative consumption decreases, resulting in larger remittances. In turn, if the recipient household's income I^h increases, the household's relative consumption increases above the optimal level, meaning that it would prefer to transfer money to the migrant. However, as such transfers are not allowed, this merely translates into smaller remittances from the migrant to the receiving household. Moreover, if the recipient household becomes more altruistic and β^h increases, it receives less remittances, since the household will be more hurt by the decrease in the migrant's utility arising from sending remittances. Importantly, these transfers are mutually agreed to by both the migrant and the recipient household. (Stark 1995:15-20)

One specific prediction of the altruistic motive is that if both the migrant's income increases and the recipient household's income decreases by one dollar simultaneously, remittances from the migrant to the household should increase by exactly one dollar, i.e.

$$\frac{\partial R}{\partial I^m} - \frac{\partial R}{\partial I^h} = 1. \tag{2.8}$$

This result is called income pooling, or redistributive neutrality property. To understand the result, suppose that the distribution of income changes slightly such that $dI^m = -dI^h$ and $dI^m > 0$. The migrant adjusts the remittances he sends to cancel the decrease in the recipient household's income. Now, the increase in the migrant's income is also cancelled, and he does not increase his own consumption. Effectively, this means that the consumption of either of the agents is not changed, when they are linked by altruism and remittances from the migrant to the recipient household. (Laferrère and Wolff 2006:897)

Further implications arise from the altruism-based model developed by Funkhouser (1995:139), First, he suggests that, in addition to the predictions above, the importance that the migrant assigns to the recipient household's utility is dependent on the relationship the migrant has to the receiving household member, and on whether he intends to return. Second, the more migrants there are from the same household, the less the migrant remits. Third, the time-discount factors of the migrant and his earnings profile affect the amount of remittances: when the migrant's earnings increase with his experience in his new country of residence, remittances should increase, but if the migrant values his own future consumption significantly more than the utility of the recipient household in the future, remittances may decline over time. (Ibid.) However, these implications are rather general and predicted by other motives for remittances, as well.

2.2. Exchange

In contrast to being altruistically motivated, remittances may also be involved in Pareto-improving exchanges between the migrant and the household: in these cases, remittances act as compensation for services – taking care of the migrant's assets or relatives back home, for instance – that the migrant's former household members perform on behalf of the migrant. As the outcome and the division of surplus is determined by the agents' relative bargaining powers and their external options, the amount paid for the service lies somewhere between the

market price for such services and the opportunity cost of the recipient. (Rapoport and Docquier 2006:1145)

To examine the exchange motive theoretically, the model presented in the previous section is modified slightly, and the model for exchange-motivated transfers by Cox (1987) is utilised. In the latter, neither the migrant nor the recipient household is altruistic, and a fixed service $\overline{X}$ provided by the household is exchanged for remittances *R*. The migrant's and the recipient household's felicities V^i now depend on their consumption and the service, $V^i\left(C^i, \overline{X}\right)$, $i = m, h$. The increased disutility of effort arising from the service is accounted for by the partial derivatives $V_{\overline{X}}^{m'} > 0, V_{\overline{X}}^{h'} < 0, V_{\overline{X}}^{m''} < 0$ and $V_{\overline{X}}^{h''} > 0$. The recipient household will enter into the exchange arrangement and provide the service only if the compensating remittances are large enough to give the household at least the same felicity level as a situation with no exchanges:

$$V^h\left(I^h + R, \overline{X}\right) \geq V^h\left(I^h, 0\right). \tag{2.9}$$

Under the exchange motive, this non-negativity constraint is binding, and the last unit of remittances sent by the migrant to the recipient household does not equalise the agents' marginal utilities of consumption, but compensate for the services performed by the household. Solving the constraint (2.9) for equality and expressing remittances as $R = R\left(I^h, \overline{X}\right)$, the implicit function theorem yields

$$\frac{\partial R}{\partial I^h} = -\frac{\partial V^h\left(I^h + R, \overline{X}\right)/\partial C^h - \partial V^h\left(I^h, 0\right)/\partial C^h}{\partial V^h\left(I^h + R, \overline{X}\right)/\partial C^h} \neq 0 \tag{2.10}$$

$$\frac{\partial R}{\partial \overline{X}} = -\frac{\partial V^h\left(I^h + R, \overline{X}\right)/\partial \overline{X}}{\partial V^h\left(I^h + R, \overline{X}\right)/\partial C^h} > 0 \tag{2.11}$$

Expression (2.10) means that, in contrast to the altruistic case, the amount of remittances can either increase or decrease with the recipient household's income. Intuitively, when the household's income increases, the quantity of services exchanged declines, since the increase in income causes a decline in the household's marginal utility of consumption. Consequently, the household requires a higher compensation per service. Whether the sign of expression (2.10) is positive or negative depends also on the migrant's demand for the service: the harder it is for the migrant to find substitutes for the household-provided service, i.e. the more

inelastic his demand for the service is, the more likely it is that the sign is positive. (Cox 1987:512-7) When it comes to the effect of education on remittances, the model predicts that remittances decrease with the migrant's education, as educated migrants are less inclined to return home (Rapoport and Docquier 2006:1164).

In addition, it is important to consider whether the migrant decides to send remittances in the first place. Suppose there is an initial endowment point $V^m(I^m,0)$ and $V^h(I^h,0)$. In short, the migrant will send remittances, if the migrant's marginal rate of substitution (MRS) of remittances for services is greater than that of the receiving household's at the endowment point, i.e. the migrant can gain from trade with the household. Formally, and denoting the household's MRS at $\overline{X} = 0$ with $(dR/dX)_0^h = P_0^h$ and the migrant's MRS at $\overline{X} = 0$ with $(dr/ds)_0^m = P_0^m$, remittances occur when the $P_0^m > P_0^h$. If the latent variable $\bar{r} = P_0^m - P_0^h$ determining the remittance decision is positive, remittances will be sent. It can be shown that

$$\frac{\partial \bar{r}}{\partial I^h} < 0 \text{ and} \tag{2.12}$$

$$\frac{\partial \bar{r}}{\partial I^m} > 0 . \tag{2.13}$$

These expressions may be explained as follows. When the recipient household's income I^h increases, its marginal utility at the endowment point falls and he requires more consumption to be compensated for providing the first unit of service. If the price at which the household agrees to supply the service rises high enough, exchange may not take place. In turn, if the migrant's income I^m increases, his marginal utility of consumption at the endowment point falls too, and he is willing to give up more consumption to obtain the first unit of services. These results in terms of the remittance decision hold in the case of the altruistic motive, as well: thus, it is the effect of the recipient household's income on the amount of remittances that may distinguish these motives from one another. (Cox 1987:517-9)

Different kinds of contractual arrangements between the agents, reflecting their bargaining powers, may be modelled, and further differences between the altruistic and exchange motives may be found. Suppose, for instance, that remittances are repayments of loans taken by the migrant from the household, and that the recipient household receives public transfers of some sort. If public transfers to the recipient household increased so that the lifetime

wealth of the household, but not that of the migrant, increased, remittances at later periods from the migrant to the recipient household would increase: the liquidity-constrained migrant would be able to borrow more, meaning higher repayments to the household later on. In other words, the increase in the household's lifetime wealth improves the household's bargaining position, as its lowered credit constraints enable it to lend more to the migrant than previously. Under altruism, however, it is predicted that such public transfers crowd out privately sent remittances completely, and both the migrant's and the recipient household's consumptions are unchanged. (Cox and Jimenez 1992:157-8)

2.3. Investment

The previous section and the above situation described by Cox and Jimenez (1992:157-8) relates closely to the so-called investment motive, under which the migrant sends remittances to repay loans on investments made by his former household in his education and/or migration. In these kinds of exchanges, like in the previous section, there is a participation constraint that is determined by the agents' external options, and the ultimate outcome and division of the surplus depends on the agents' relative bargaining powers. First and foremost, these kinds of familial implicit contracts aim at increasing family income. (Rapoport and Docquier 2006:1145, 1156) Effectively, the investment motive and its most typical models may be seen as generalisations of the model by Cox (1987) reviewed in the previous section: under the investment regime, the migrant compensates his former household for a monetary loan rather than services, and there are two time periods instead of one. Clearly, the higher the initial investment in the migrant, the higher are the subsequent remittances compensating for this investment.

As the intuition behind the investment motive – modelled by e.g. Cox et al. (1998) and Ilahi and Jafarey (1999) – is rather similar to the one reviewed in the previous section, a model by Rapoport and Docquier (2006) is presented, as it includes the determination of the optimum amount of migrants that the household should send. The basic premise of the model is that the recipient household aims at increasing its income by sending migrants until it is no longer income-maximising. However, migration entails costs, and poorer households may not be able to send the number of migrants that would be optimal to them.

Suppose that total familial output in agriculture is depicted by the function $\varphi\left(\ell - \frac{\beta}{2}\ell^2\right)$, where ℓ is the number (or proportion) of workers employed in the domestic activity, φ is a technological parameter describing the quantity and quality of land, and $0 < \beta < 1$ captures the decreasing marginal productivity of labour. Assuming that income is equally divided within a given family and focusing distinctly on inequality between households, a two-period framework is constructed: if no-one migrates, income per household member at each period is given by

$$I_1^h = I_2^h = \varphi - \frac{\varphi\beta}{2}. \tag{2.14}$$

Migration to a high-wage destination will cost *c* per migrant, whose number (or proportion) is denoted by *m*. The migration cost is financed with first-period savings as there are no credit markets. Migration occurs in the second period, meaning that in the first period, $\ell = 1$, and in the second period, $\ell = 1 - m$. Assuming no risk-aversion and no inter-temporal discounting of income, utility is linear in income. In addition, it is assumed that there is a minimal level of subsistence, denoted by $I^{\min}$, which is kept for consumption at each period.

The number of migrants is determined by the household's wealth, captured by φ. Even though members of poor households are likely to have more incentives to migrate, as their foregone earnings are lower than those of members of rich households, poor households may not have the liquidity to finance every profitable migration. The liquidity constraint is given by

$$\varphi\left(1 - \frac{\beta}{2}\right) - mc \geq I^{\min} \Leftrightarrow m \leq \frac{\varphi}{c}\left(1 - \frac{\beta}{2}\right) - \frac{I^{\min}}{c} \equiv m^c(c, \varphi). \tag{2.15}$$

This gives the maximal, or constrained proportion of migrants m^c, which is increasing in φ, decreasing in $I^{\min}$, and a decreasing and convex function of *c*.

To find out the optimal, or unconstrained proportion of migrants m^*, total recipient household income is maximised:

$$\underset{m}{Max}\ \varphi - \frac{\varphi\beta}{2} - mc + \varphi(1-m) - \frac{\varphi\beta}{2}(1-m)^2 + mI^m, \tag{2.16}$$

which gives

$$m^* = \begin{cases} 0 & if\ -\varphi + \varphi\beta + I^{\min} - c < 0 \\ 1 & if\ -\varphi + I^m - c > 0 \\ \dfrac{I^m - c}{\varphi\beta} - \dfrac{1-\beta}{\beta} & otherwise. \end{cases} \tag{2.17}$$

The actual proportion of migrants is given by $m^{eff}\left(Min\left\{m^*; m^c\right\}\right)$, i.e. it lies between the optimal proportion given by equation (2.17) and the constrained proportion given by equation (2.15). The optimal proportion is decreasing in φ, and is a linearly decreasing function of c.

The amount of remittances received by each remaining household member is given by the difference between the average household income and the domestic income per remaining household member, distinguished by squared brackets:

$$\left[I^m m^{eff} + \varphi\left(1 - m^{eff}\right) - \frac{\varphi\beta}{2}\left(1 - m^{eff}\right)^2 \right] - \left[\varphi - \frac{\varphi\beta}{2}\left(1 - m^{eff}\right) \right]. \tag{2.18}$$

This gives remittances R, which is a concave function of the migrant proportion:

$$R = m^{eff}\left[I^m - \varphi + \frac{\varphi\beta}{2}\left(1 - m^{eff}\right) \right]. \tag{2.19}$$

Taking the total derivative of R with respect to φ gives

$$\frac{dR}{d\varphi} = \frac{\partial R}{\partial m^{eff}} \frac{dm^{eff}}{d\varphi} + \frac{\partial R}{\partial \varphi}, \tag{2.20}$$

which may be positive or negative, depending on the number of migrants and whether it is the constrained or unconstrained region in question: the model predicts that the relationship between remittances and the recipient household's income is inverse U-shaped for interior solutions. (Rapoport and Docquier 2006:1157-9) This prediction thus distinguishes the investment motive from the exchange motive, under which the amount of remittances responds positively to an increase in the recipient household's income.

The two models are further set apart by the effect that unemployment has on remittances: while unemployment at home lowers the bargaining power of the recipient household and thus decreases the amount remitted under the exchange motive, this is not the case under the investment motive. As education insures at least partly against unemployment, higher

unemployment at home increases the value of education. This, in turn, improves the contractual terms for the family, resulting into higher remittances. (Stark and Bloom 1985:174)

2.4. Inheritance

An important aspect of all contractual arrangements is their enforcement, i.e. the methods that make, for instance, a contract exchanging an educational loan for future remittances incentive compatible for both the migrant and his former household. A few such enforcement mechanisms are suggested by Poirine (1999:593): the migrant may be denied of future family solidarity, lose rights to benefit from the care of the village community for his elderly parents or children, lose prestige in the community, or lose the rights to inherit family assets. It is this last mechanism of inheritance as a form of enforcement that is now examined, as it is a rather likely way of a household to try to ensure remittances from a migrant.

The model by de la Brière et al. (2002) gives insight into what affects remittance decisions of a migrant who contributes to an investment in his parent's assets in the hope of inheriting them later on. The migrant attempts to maximise the utility of the investment portfolio, and can choose to invest either in safe assets such as a savings account, or in risky assets such as a possible inheritance, whose riskiness arises from the uncertainty of the time of the parent's death. The migrant saves a constant rate *s*. In the next period, one unit of the safe asset yields $(1+i)$, while investing in the inheritance yields only if the parent dies. The assets of the parent's increase with the law of motion

$$A_{t+1}^{p} = s^{p}\left(A_t^{p}\right)\left(A_t^{p} + I_t^{p} + R_t\right)(1+i'), \tag{2.21}$$

where A_t^p are the parent's assets at time *t*, I_t^p is the parent's autonomous income, R_t are remittances, i' is the rate of appreciation of the parent's assets, and $s^p\left(A_t^p\right)$ is the parent's saving rate, which increases, but with a decreasing rate, with wealth.

If the parent dies in the next period, the child inherits $\gamma\left(R_t, n_h\right)A_{t+1}^{p}$, where $\gamma\left(R_t, n_h\right)$ is the reward function of the parent and n_h is the number of heirs. The reward function is increasing in R_t, as the possibility of inheritance is intended to induce remittances, but the effect of the number of heirs is not as straightforward. On one hand, a larger number of heirs implies a smaller return for any one agent, but on the other hand, the threat of depriving any one

migrant of his inheritance is more credible when the parent has a large number of heirs to give his wealth to. Thus, it holds that $\delta\gamma/\partial R_t = \gamma_{R_t} \geq 0, \partial\gamma/\partial n_h \leq 0$ and $\partial^2\gamma/(\partial n_h \partial R_t) \geq 0$.

The migrant maximises the expected utility he gets from his portfolio:

$$\underset{R_t}{Max} \sum_t \delta^t \left[(1-\phi_{t+1})u\left(A^m_{NI,t+1}\right) + \phi_{t+1}u\left(A^m_{I,t+1}\right)\right], \tag{2.22}$$

where ϕ_{t+1} is the probability of inheriting at time *t+1*, $A^m_{NI,t+1} = \left(s\left(A^m_t + I^m_t\right) - R_t\right)(1+i)$ is the migrant's asset position at *t+1* with no inheritance, A^m_t is the migrant's asset position at time *t*, I^m_t is the migrant's income, and $A^m_{I,t+1} = \left(s\left(A^m_t + I^m_t\right) - R_t\right)(1+i) + \gamma s^p\left(A^p_t + I^p_t + R_t\right)(1+i')$ is the migrant's asset position with inheritance.

Deriving the first-order conditions from expression (2.22) gives

$$-(1-\phi_{t+1})u'\left(A^m_{NI,t+1}\right)(1+i) + \phi_{t+1}u'\left(A^m_{I,t+1}\right)\left[-(1+i) + \gamma_{R_t} s^p\left(A^p_t + I^p_t + R_t\right)(1+i') + \gamma s^p(1+i')\right] = 0. \tag{2.23}$$

Thus, the marginal return for the migrant from investing in the safe asset is $(1+i)$, and from investing in inheritance, his marginal return is $\phi_{t+1}\left[\gamma_{R_t} s^p\left(A^p_t + I^p_t + R_t\right) + \gamma s^p\right](1+i')$. The following condition gives the optimal allocation between the two assets:

$$\frac{u'\left(A^m_{NI,t+1}\right)}{u'\left(A^m_{I,t+1}\right)} = \frac{\phi_{t+1}}{1-\phi_{t+1}}\left\{-1 + \left[\gamma_{R_t} s^p\left(A^p_t + I^p_t + R_t\right) + \gamma s^p\right]\frac{1+i'}{1+i}\right\}. \tag{2.24}$$

The optimal amount of remittances, R^*_t, may be determined by applying the implicit function theorem to the first-order condition in equation (2.23) – in reduced form, it may be expressed as

$$R^*_t = R^*_t\left(+A^p_t, +I^p_t, +\phi_{t+1}, +A^m_t, \pm n_h, +I^m_{t+1}, -\xi_I\right), \tag{2.25}$$

where ξ_I is denotes the migrant's risk aversion at the asset level A^m_I. If the risk aversion is below a threshold level of ξ_A, the effects of A^p_t and I^p_t are positive. Moreover, a richer and wealthier, and not too risk averse a migrant will remit more. The ambiguous effect of n_h contains the two effects mentioned above: inheritance of any one migrant is decreased due to having to share it with other heirs, decreasing the return on his investment in remittances, but

competition among heirs may increase the parent's response to the remittances he receives from any one migrant. However, the migrant will remit more if the probability of inheriting is higher. (de la Brière et al. 2002:313-5) To this end, Rapoport and Docquier (2006:1161) suggest that in the case of multiple migrants, remittances per migrant may first increase and then decrease with the number of other migrants, i.e. meaning an inverse U-shaped relationship between remittances and the number of other migrants.

2.5. Insurance

Contractual arrangements, where the migrant insures his former household against drops in rural incomes, may also be arise instead of more self-interested contracts reviewed in the previous sections. Insurance contracts are made possible by the fact that the risks of the migrant's urban or foreign job are rarely associated with the risks inherent in his former household's rural activities. Like self-interested contracts, these contracts need to be self-enforcing, as well. However, as harsh enforcement mechanisms as mentioned in the previous section may not be needed: the mere loyalty and altruism of the migrant may act as sufficient enforcement in contracts aiming at insurance and consumption smoothing rather than income maximisation. (Rapoport and Docquier 2006:1151)

To depict an insurance contract between a migrant and his parent back home, a model by de la Brière et al. (2002) is presented. The model assumes that remittances are not invested, meaning that the migrant does not attempt to encourage risk-management behaviour by his family. As regards the roles of the agents, the parent is the principal and main beneficiary of the contract, and the migrant acts as an insurer and draws up an optimal contract for the insurance. The principal may be any other member of the household who is the main recipient of the insuring remittances.

The parent is risk-averse, and he receives income I^P with probability π, and an income $I^p - IS$ with probability $1-\pi$, where $IS > 0$ represents a random income shock. The parent may want to enter into a contract with his risk-averse migrant child to insure himself against these shocks, so if the parent is willing to pay a premium *p*, the migrant will send his parent remittances $R = aIS$ when the shock hits, with $0 \le a \le 1$ denoting the coverage of the contract. It is assumed that the parent chooses both the premium *p* and the coverage *a*, and simultaneously takes into account the preferences of his migrant child.

The parent maximises his utility U^P subject to the participation constraint of the migrant:

$$\begin{aligned} &\underset{a,p}{Max}\ \pi U\left(I^p - p\right) + (1-\pi)U^p\left(I^p - p - (1-a)IS\right), \\ &s.t.\ \pi U^m\left(I^m + p\right) + (1-\pi)U\left(I^m + p - aIS\right) \geq U\left(I^m\right), \end{aligned} \tag{2.26}$$

where U^m is the migrant child's utility and I^m is his income. The first-order conditions yield

$$\frac{U^{m'}\left(I^m + p - aIS\right)}{U^{m'}\left(I^m + p\right)} = \frac{U^{p'}\left(I^p - p - (1-a)IS\right)}{U^{p'}\left(I^p - p\right)}. \tag{2.27}$$

A Taylor expansion around incomes yields

$$\frac{a}{1-a} \approx \frac{\chi\left(I^p - p\right)}{\xi\left(I^m + p\right)} \tag{2.28}$$

where $\chi(\cdot)$ and $\xi(\cdot)$ represent the parent's and the migrant's absolute risk aversions at incomes $I^p - p$ and $I^m + p$, respectively. Thus, the relative risk aversion of the two agents determines the optimal risk sharing level. Optimal remittances to the parent are thus given by

$$R^* = aIS = \frac{\xi\left(I^m + p\right)}{\xi\left(I^m + p\right) + \chi\left(I^p - p\right)} IS. \tag{2.29}$$

As the premium *p* may be influenced by other variables, the risk aversions of the agents, and thus remittances, are influenced indirectly be them, as well. Solving the parent's optimisation problem for *a* by first solving a second-order Taylor expansion of the participation constraint for the premium *p*, and then substituting this expression into the parent's utility results in the following reduced form solution for *a*:

$$a = a\left(-IS, -(1-\pi), +\chi^0, -\xi^0\right), \tag{2.30}$$

where χ^0 and ξ^0 are the parent's and migrant's absolute risk aversions at incomes I^p and I^m, respectively. When coverage is costly, the parent wants less coverage if the size and/or the incidence of shocks increase, or if he is less risk-averse. The parent opts for less coverage also if the migrant is more risk-averse, since the cost of insurance is increasing in the migrant's risk aversion. As regards remittances, they may be expressed in reduced form as

$$R^* = aIS = R^*\left(+IS, -(1-\pi), +\chi^0, -\xi^0\right). \tag{2.31}$$

Remittances are increasing in the size of the shock and the parent's risk aversion, and decreasing in the migrant's risk aversion. As increasing wealth decreases absolute risk aversion, richer migrants will remit more in case a shock hits their parents, and poorer parents will receive larger remittances in case they are hit by a shock. What is notable, and in contrast to the models previewed thus far, remittances do not directly depend on either the migrant's or the recipient household's income. (de la Brière et al. 2002:311-3, 315)

In addition to these predictions, Rapoport and Docquier (2006:1153) compare the insurance motive to the altruistic motive and point out that under the insurance motive, remittances should be sent relatively irregularly and should not decrease during a given period, while under the altruistic motive, remittances should decrease over time with the dissolving feelings of altruism. Moreover, the effect of the recipient household's income on remittances may be positive under the insurance motive: wealthier households with large assets are more likely to send migrants, as migration is more worthy to them than to poorer households. Moreover, as bargaining power increases with wealth, wealthier households are able to induce higher remittances than poorer ones. In other words, the probability and amount of remittances may be increasing in the recipient households' income across households, but be decreasing for a given household. (Ibid.)

Amuedo-Dorantes and Pozo (2006) approach the possible insurance contracts between migrants and their former households slightly differently and suggest that migrants may send remittances to insure themselves, rather than their former households, in the face of income uncertainty. Remittances may either act as premia ensuring that the migrant receives support from his family in the case he need to return home, or they may be accumulated as precautionary savings – in the form of physical or financial assets, for instance – back home. The key prediction of this approach is that the higher the income risk the migrant faces, the larger are the remittances he sends in order to insure himself. (Ibid:229)

2.6. Strategic selection

While the motives for remittances discussed above may be applied to various situations involving intra-family transfers, the strategic motive for remittances was developed by Stark (1995) specifically for the context of migration. The model is based on the premise that employers in the migrants' destination country do not have sufficient information regarding the migrants' different skill levels, so the wage employers pay is based on the average product

of the whole group of migrants. High-skill workers clearly suffer from this situation, and would benefit from having a means to persuade workers with lower skills to remain home. This means is provided by remittances, sent by the high-skill workers to the low-skill workers. (Ibid:93) In this section, a two-group case of this model is reviewed in more detail.

The model starts with there being two countries, a rich country *R* and a poor country *P*¸ and with workers with two skill levels originating from country *P*. To reflect their difference, skill-determined wages *W* in country *R* are higher than in country *P* for all skill levels θ, i.e. $W_R(\theta) > W_P(\theta)$. The skills of low-skill workers, constituting a share α of workers, are denoted by θ_1, and those of high-skill workers, constituting a share $1-\alpha$ of workers, are denoted by θ_2. It is assumed that the workers have been observed in country *P*, so their skills are known there, but this is not the case in country *R*. Thus, if the true skills of workers are not revealed in country *R* over time, employers in country *R* will offer all migrants a wage reflecting their average product. Moreover, workers are assumed to prefer the lifestyle of country *P*, which is captured by a discount factor *k*, $0 < k < 1$, which is applied to wages in country *R*. Discount factor *k* includes also the costs associated with migration. Thus, workers compare $kW_R(\theta)$ with $W_P(\theta)$ when making their migration decisions, and *k* is such that $kW_R(\theta_1) < W_P(\theta_1)$ and $kW_R(\theta_2) > W_P(\theta_2)$. These last conditions are meant to capture the different migration incentives of the symmetric and asymmetric information cases.

Under symmetric information, only high-skill workers will migrate. In contrast, under asymmetric information, if the wage based on the average product of migrants with different skill levels, $k\overline{W_R}$, paid in country *R* is higher than the wage paid for high-skill workers in country *P*, i.e.

$$k\overline{W_R} = \alpha k W_R(\theta_1) + (1-\alpha) k W_R(\theta_2) > W_p(\theta_2), \tag{2.32}$$

then both high- and low-skill workers will migrate under asymmetric information. But, if employers in country *R* correctly identify the skills of high-skill workers and adjust their wage accordingly in the next period, low-skill workers will return to country *P*. As workers with different skill levels are no longer pooled, the wage of the high-skill workers will naturally rise:

$$kW_R(\theta_2) = \alpha k W_R(\theta_2) + (1-\alpha) k W_R(\theta_2) > \alpha k W_R(\theta_1) + (1-\alpha) k W_R(\theta_2). \tag{2.33}$$

Migration is thus positively selective *ex post*: even though initially workers with all skill levels migrate, in time their true skills are revealed, the informational asymmetry is removed, and low-skill migrants return home, producing a feature of positive selectivity.

Obviously, high-skill workers would prefer not to be pooled with low-skill workers even in the beginning. Hence, they are likely to be willing to make a transfer to the low-skill workers to persuade them to stay home. This transfer *T*, or remittances, must be smaller than the difference between the wage of high-skill workers in country *R* if they were to migrate there alone, and their wage in country *R* if they were to migrate there with low-skill workers:

$$T < W_R(\theta_2) - [\alpha W_R(\theta_1) + (1-\alpha) W_R(\theta_2)], \tag{2.34}$$

where

$$\frac{1-\alpha}{\alpha} T = \alpha k W_R(\theta_1) + (1-\alpha) k W_R(\theta_2) - W_p(\theta_1) + \varepsilon, \tag{2.35}$$

where $\varepsilon > 0$ is a sufficiently small constant. From expressions (2.34) and (2.35) it is derived that

$$\frac{\alpha}{1-\alpha}[\alpha k W_R(\theta_1) + (1-\alpha) k W_R(\theta_2) - W_P(\theta_1)] < T < W_R(\theta_2) - [\alpha W_R(\theta_1) + (1-\alpha) W_R(\theta_2)] = \alpha [W_R(\theta_2) - W_R(\theta_1)] \tag{2.36}$$

For *T* that fulfils expression (2.36), high-skill workers are able to induce low-skill workers to stay home by offering them $\frac{1-\alpha}{\alpha} T$ each. Transfers larger than *T* cannot be extracted by low-skill workers even if they threaten to migrate, as this threat is not credible: if they migrated, they would receive the wage $k\overline{W_R}$, but if they stay home, they receive $W_p(\theta_1) + \frac{1-\alpha}{\alpha} T$ each, which is larger than $k\overline{W_R}$ by *ε*. Also the high-skill workers are better off under this arrangement, as they are left with $W_R(\theta_2) - T$ – worth $k[W_R(\theta_2) - T]$ to them – which is more than $k\overline{W_R}$.

What this model implies is that if this joint action by migrants is successful, they form action groups based on their skills, migration is selective *ex ante,* and only high-skill workers will migrate. In a sense, then, remittances act in advance of informational asymmetry and thus enhance allocative efficiency. Therefore, there is a positive relationship between selectivity

and remittances, and a negative relationship between return migration and remittances. It should be noted that the formation of groups is more likely when the difference between the wage of high-skill workers in country *R* and the wage of low-skill workers in country *P* is large, and when the workers' individual skill levels are only slowly identified in the destination country. Moreover, the larger the group of migrants is, the smaller are strategic remittances per migrant: the larger and less cohesive the group of high-skill workers is, the more likely will the free riding problem associated with bribing low-skill workers arise.

Under the strategic motive, high-skill workers act purely out of their self-interest and send remittances to protect their wage from being lowered by the presence of low-skill workers. Remittances are thus sent to those at home who can credibly threaten the migrant with engaging in migration themselves, i.e. those with some earning power. Even more interestingly, some migrants might send remittances to non-migrant workers toward whom there prevails no altruism. The strategic motive also gives an explanation to why remittances stop at some point: as soon as the skills of high-skill workers are identified, their wage can no longer be affected by the migration of low-skill workers. Thus, remittances are no longer needed to bribe the latter. (Stark 1995:91-103)

Despite its clear predictions, the model is criticised by Rapoport and Docquier (2006:1149) who point out that each migrant may free ride on others' efforts to achieve positive selection, and that the gains of selection are not that large if the migrants' skills are revealed in a short period of time. Moreover, they note that while any one ethnic community of migrants is clearly able to distinguish itself from other migrant communities, employers may not be able to do this as well, and may assimilate them to a wider group of foreigners. Thus, the selection that communities undertake within them will benefit the whole group that it is identified with. This would, in turn, reduce the occurrence of strategically motivated remittances within any ethnic community, as remittances would not anymore serve the purpose of promoting wealth among this community. (Docquier and Rapoport 1998:580-1) Moreover, the predictions of the model are not easily distinguished from those of the altruistic model (Rapoport and Docquier 2006:1150).

2.7. Predictions of theories

To be able to compare the theories more efficiently, a table by Rapoport and Docquier (2006:1163), which concisely summarizes all the predictions discussed in the previous

sections, is adapted and presented here as table 1. It clearly explicates the independent variables of interest and their relationship to remittances predicted by the models discussed above. It is especially useful when reviewing the empirical results for the estimations of the probability and amount of remittances in chapter 7.

Table 1. Predictions of models for motives for remittances

	Motives					
Independent variable	Altruism	Exchange	Investment	Inheritance	Insurance	Strategic selection
Migrant's income	>0	>0	>0	>0	nde*	>0
Migrant's education	nde	<0*	>0*	nde	nde	>0
Time since arrival	≤0	nde	nde	nde	nde	≤0
Number of migrants or heirs	<0	nde	nde	Inverse U-shaped effect	nde	nde
Recipient's long-run income	<0	≠0	≠0	nde*	nde*	<0
Adverse short-run shocks to the recipient's income	>0	≠0*	>0	nde	>0	>0
Recipient's assets	nde	nde	nde	>0*	nde	nde
Specific predictions	$\frac{\partial R}{\partial I^m} - \frac{\partial R}{\partial I^h} = 1$	$\frac{\partial R}{\partial I^h} > 0$ *possible*	Inverse U-shaped effect of I^h		Irregular basis	$\frac{\partial R}{\partial I^m} - \frac{\partial R}{\partial I^h} > 1$ $\frac{\partial R}{\partial I^h} = -1$

nde = no direct effect

* specific prediction

2.8. Empirical evidence

In this section, some empirical studies on motives for remittances and their results are scrutinised. Quite often these studies consider only two motives, present models for them, and then attempt to determine econometrically which of these motives dominates migrants' remittance behaviour in the context under study. There are exceptions, however, such as the pioneering empirical paper by Lucas and Stark (1985) mentioned in the beginning of the chapter. The study presents theoretical frameworks for three different sets of motives, and in its subsequent empirical analysis on Batswana migrants, the presence of all of the motives reviewed above, except for the strategic motive, is tested as well. For this reason, this paper is examined in detail first. The other studies chosen under review are closely linked in their approach to the theoretical framework discussed in the previous sections, give insight into the methods most generally used in this field of study, utilise data from a variety of developing countries, and thus are a good representation of the empirical literature on the motives for remittances.

Lucas and Stark (1985) consider remittances to be motivated by three different motives: pure altruism, pure self-interest, and tempered altruism or enlightened self-interest. While the first two motives correspond closely to the altruistic motive and the exchange and inheritance motive modelled in sections 2.1, 2.2 and 2.4, respectively, the third motive sees remittances as a part of an intertemporal, mutually beneficial contractual arrangement between the migrant and the recipient household. This motive reflects the investment and insurance motives described in sections 2.3 and 2.5. The authors test for all of these motives empirically by carrying out standard OLS estimations which, as will be discussed in chapter 4, does not properly take into account the sample selection problem pertaining remittance data.

Lucas and Stark (1985) discover that in Botswana, remittances rise with both the migrant's income and the recipient household's income: while the first result is consistent with various motives, the second result implies that the exchange or investment motive may underlie migrants' remittance decisions. They test for the investment motive by studying the effect of the migrant's years of schooling and find that remittances increase with years of schooling, but they increase even more among such migrants who are children, grandchildren, nieces or nephews of the household head, i.e. closely related to the household head. What this suggests is that migrants may send remittances at least partly as a repayment of investments made in their education.

The authors also investigate whether any inheritance considerations affect the amount the migrant remits to the recipient household by inspecting whether the recipient household's assets – in this case, cattle – has an effect on remittances. Lucas and Stark's (1985) results show that sons tend to remit more to households that have more cattle, which implies that migrants attempt to ensure the receipt of inheritance with remittances. This finding is also consistent with the authors' notion that in Botswana, sons are more likely to inherit than other household members. However, the sons also tend to keep their cattle with the recipient household who takes care of the cattle – behaviour that is in accordance with the exchange motive – so it is not entirely clear-cut whether it is the possible inheritance or the maintenance of cattle that is motivating remittances.

Also the insurance motive is tested for by Lucas and Stark (1985), when they examine the effect of drought – both independently and interacted with the number of cattle and acres of land owned – on remittances. Alone, the variable depicting the village-specific severity of drought is positive and significant, implying that remittances rise with the scale of the income

shock hitting the recipient household. However, adding the interaction terms to the specification makes the drought per se insignificant: what this means is that those who receive more remittances in times of hardship are those whose sustenance is more reliant on cattle or crops. Thus, remittances seem also to provide insurance against income risks for migrants' households back home.

All in all, the study by Lucas and Stark (1985) – despite its outdated methodology – is a prime exemplar of empirical studies on remittances: it finds that there is no single motive driving the remittance behaviour of migrants collectively, but that there may be differences in motivations between migrants, and any one migrant may be motivated by several different considerations. In addition, it demonstrates well how these kinds of analyses can be enriched and supported by non-econometric investigation of the anthropological, cultural and climatic context where the migrants and their families make their migration and remittance decisions.

The study by Cox et al. (1998) represents the more common type of studies, which test for one or two motives for remittances. They take the altruistic and the exchange motive under consideration in the context of Peru, and examine transfers flowing from parents to children and from children to parents with probit and tobit estimations. The type of exchange they are scrutinising is that of repaying loans on investments in education, which falls under the investment motive described in section 2.3. Before discussing the motives for transfers, however, they investigate whether transfers respond to capital market imperfections and liquidity constraints, and find that timing does significantly affect transfers from children to parents: transfers are more likely when the earnings of the recipient household are low, i.e. when households are very young or old. At these phases, the desired consumption of the household exceeds its current earnings and remittances provide the needed consumption smoothing, which can be interpreted as a sign of capital market imperfections.

Focusing on Cox's et al. (1998) results obtained from the estimation of the specification for child-to-parent transfers, which mostly comprise remittances, the authors find that while the probability of remittances is negatively associated with the recipient household's income – consistent with both the altruistic and the exchange motive – the amount sent is positively associated with the recipient household's income, which is possible only under the exchange motive. This result suggests that the purely altruistic framework is not sufficient for describing the data the authors are investigating, and a bargaining-cum-altruism framework should be employed instead.

Cox et al. (1998) make some other interesting findings, as well. For instance, if the recipient household receives social security income, the probability of remittances decreases, but their amount increases. The effect of social security on the incidence of remittances coincides with both the altruistic and the exchange motive: on one hand, social security benefits, as noted by Cox and Jimenez (1992), crowd out altruistically motivated private transfers, but on the other hand, households who expect to receive social security pensions are less inclined to make intergenerational contracts with their children to ensure the receipt of old-age support. Moreover, the observation that the probability of remittances is increased if the recipient is unemployed or ill cannot discriminate between the altruistic and the exchange motive, as these results may indicate that there are some informal insurance schemes at place that fall under Lucas and Stark's (1985) framework of tempered altruism or enlightened self-interest.

In the study by de la Brière et al. (2002), the inheritance motive is tested against the insurance motive in the context of Dominican Sierra – the models for these motives suggested by these authors are presented in sections 2.4 and 2.5, respectively. The authors employ standard and random-effects OLS, tobit, and censored least absolute deviation (CLAD) estimations, and restrict their analysis on remittances sent by children of household heads. Based on the descriptive statistics they hypothesise that remittances are involved in both asset accumulation and in insurance schemes. To test this they estimate their remittance specification for all migrants, as well as for different groups of migrants, e.g. for male and female migrants, and for migrants residing in the US and in Dominican Sierra.

In terms of all migrants, de la Brière et al. (2002) conclude that the inheritance motive, supported by two findings, affects migrants' remittance decisions more strongly than the insurance motive. First, inheritable land as such increases remittances. Second, the interaction between the number of heirs and parents' land assets is negative, meaning that inheritance becomes a less attractive investment as the number of siblings grows, which in turn reduces the incentives to remit. The insurance motive is only weakly supported, as the variable indicating the number of working days the migrant's parents lost due to illness affects remittances significantly and positively only in the CLAD estimation.

When it comes to the heterogeneity among migrants possibly affecting the above results, de la Brière et al. (2002) find that in terms of the insurance motive, female migrants respond strongly to the number of lost working days by parents, but male migrants are unaffected. Also migrants residing in the US respond more strongly to this variable than migrants residing

in Dominican Sierra. Moreover, male migrants with siblings are not motivated by insurance, but male migrants without siblings need to take the role of the sole insurer of the family and correspondingly their remittances respond to their parents' lost working days. In contrast, female migrants' insurance behaviour is not affected by the existence of other migrants in the household. In terms of the inheritance motive, de la Brière et al. (2002) find no difference between the remittance behaviour of male and female migrants, as remittances sent by both groups respond positively to their parents' land assets. However, the residence of migrants does play a role: only migrants residing in the US respond significantly to their parents' land assets, and their remittances decline as the number of heirs increases.

The insurance motive has been investigated by several other authors, as well, and it has received support from e.g. Gubert (2002) in the context of Western Mali, and from Amuedo-Dorantes and Pozo (2006) in the context of Mexico – these studies are briefly reviewed next. In contrast, the study by Agarwal and Horowitz (2002) on Guyanese migrants comes to the opposite conclusion: they test the insurance motive against the altruistic motive and find that per migrant remittances decline with the number of migrants, which is consistent with the altruistic motive but in contrast to the insurance motive.

In his study, Gubert (2002) studies the effect of two shock variables: the number of household members who did not cultivate because of illness in 1996, and the number of funerals held in 1996. In addition to these observable shocks, he constructs three crop income shock variables from income data. What Gubert (2002) finds is that in general, remittances act as insurance as they increase when bad shocks hit the recipient household. More importantly, he finds that different kinds of shocks are insured. Gubert (2002) also notes that moral hazard problems may arise because of imperfect monitoring of the insurance contract, as recipient households have the incentive to under-report income or cut down their labour effort in order to be eligible for financial assistance or to not be obliged to support others.

As mentioned in section 2.5, Amuedo-Dorantes and Pozo (2006) take a different approach and hypothesise that migrants who face a greater income risk in the country they are currently residing in remit more than those facing a lower risk. Consistent with their hypothesis, the results of the study imply that as the income risk of migrants – captured by their legal status, existence of social networks and work experience in the US – increases, migrants insure themselves either by remitting more to their parents or by accumulating more savings in their home country. The authors find that family-provided insurance is acquired mostly by

migrants who are male, younger, less educated, have larger households back home, have less work experience in the US, work as wage and salary workers, and do not have social networks in the US. In contrast, self-insuring migrants are older, work in specific tasks, have social networks in the US, and receive fringe benefits in their jobs in the US.

Judging by the empirical remittance literature reviewed above, the overall consensus seems to be that remittances are not motivated solely by the altruism of migrants, as is often assumed, but by different contractual arrangements – regarding either services performed by households, repayments of educational loans, or insurance – between migrants and their former households. This is also the conclusion reached by Rapoport and Docquier (2006:1171), but they point out that altruism should not disregarded altogether, as it still serves as a driver of these contracts.

To conclude, the above studies provide a relevant framework for the estimations of the probability and amount of remittances, as they, among other studies, inspire both the theoretical and empirical approach taken in the analyses of motives for remittances that follow. Not only they provide some theoretical background and models whose predictions are to be tested empirically, but they also guide the choice of estimation methods and variables to be employed. In addition, they provide plenty of suggestions for dealing with different theoretical and empirical challenges and point out problematic issues that need to be taken into account when making particular choices and drawing conclusions. However, despite their undeniable value as a source of information and inspiration, the lack of comprehensiveness of these studies draws attention to the work that still needs to be done both theoretically and empirically to improve the understanding of remittances, and thus acts as a motivation for this study, as well.

3 Remittance channels

This chapter elaborates on the theoretical framework and context of the research question examining the use of different remittance channels. First, a theoretical model for the choice of remittance channel is presented, and some empirical findings regarding the use of remittance channels is examined. In addition, remittance trends and markets of Uganda, Senegal and Nigeria are each discussed in turn, with an emphasis on the remittance channels used in these countries. These descriptions form the background for the estimations of the choice between official and unofficial remittance channels examined in sections 7.1.5, 7.2.6 and 7.3.6.

3.1. Theory of choice of remittance channel

On the whole, the theoretical literature on remittance channels is much scarcer than on the motives of remittances. However, some models depicting the choice between official and unofficial remittance channels have been developed in the recent years. In a sense, these models are similar to the ones for motives for remitting that they both tend to start with migrants deriving utility from certain choices they make regarding remittances. In this section, a model by Amuedo-Dorantes and Pozo (2005) is presented, as it is a representative example of the theoretical framework that has emerged around remittance channels.

In the model for choosing a certain remittance channel, each migrant, denoted by subscript *i*, $i = 1,2,...,n$ gets utility U_{ij} from using any of the possible remittance channels, denoted by subscript *j*, $j = 1,2,...,n$. Naturally, after considering his alternatives, the migrant chooses the channel that gives him the highest utility. The level of utility that the migrant can get from using a certain channel depends on several personal and payment characteristics, as well as on demographic and employment characteristics. Thus, the utility derived from choosing a certain remittance channel may be expressed as

$$U_{ij} = V_{ij} + \varepsilon_{ij} = x_{ij}^{'}\beta_j + \varepsilon_{ij}, \tag{3.1}$$

where V_{ij} and ε_{ij} represent the deterministic and stochastic components of the utility function, respectively. The probability that migrant *i* chooses the remittance channel *j* is equal to the probability of U_{ij} being the largest of $U_{i11}, U_{i12}, ..., U_{in}$, i.e.

$$P_{ij} = P\{Y_i = j\} = P\{U_{ij} > U_{ik}\} = P\{\varepsilon_{ij} - \varepsilon_{ik} \le x_{ij}^{'}\beta_j - x_{ik}^{'}\beta_k\}, \tag{3.2}$$

where $k = 1,2,...,n$, and $k \neq j$. Given the deterministic components, this probability depends on what is assumed about the distribution of the stochastic error terms $\varepsilon_{i1}, \varepsilon_{i2}, ..., \varepsilon_{in}$. If all ε_{ij} are mutually independent with a log Weibull distribution, then the multinomial logit model may be derived from utility maximisation (McFadden 1974). It can then be shown that the choosing a certain remittance channel may be expressed by the probability

$$P\{Y_i = j\} = \frac{\exp\left(x_{ij}^{'}\beta_j\right)}{1 + \sum_{k=1}^{n}\exp\left(x_{ik}^{'}\beta_k\right)}. \tag{3.3}$$

The probability of the most commonly used remittance channel may be set as the base category in the estimation, and the relative risk ratios for a one-unit change in the corresponding independent variables x_{ij} may be obtained:

$$\frac{P_{ij}}{P_{ik}} = \exp\left(x_{ij}^{'}\beta_j\right), \tag{3.4}$$

where the category of reference is remittance method *j*. When there are only two alternatives, the model reduces to the standard binary logit model. (Amuedo-Dorantes and Pozo 2005:565-6; Verbeek 2008:221-2) This is indeed the case in this study, where the several remittance channels are grouped into two alternative categories based on whether they are regarded as official ($j = 1$) or unofficial ($j = 0$). In this setting, the probability of using official channels, may be expressed as

$$P\{Y_i = 1\} = P\left\{x_{i1}^{'}\beta_1 + \varepsilon_{i1} > 0\right\} = P\left\{-\varepsilon_{i1} \le x_{i1}^{'}\beta_1\right\}. \tag{3.5}$$

Again, the distribution of the error term ε_{ij} determines the form of this probability: if a standard normal distribution is assumed, as is the case in this study, the probit model is obtained. (Verbeek 2008:203)

Amuedo-Dorantes and Pozo (2005:559, 565) suggest a number of independent variables x_{ij} that may determine the choice of remittance channel, such as the amount of remittances, the migrant's documentation status, his age, his gender, his education level, his occupational sector, the time he has spent in his country of residence, the extent of his networks of family and friends in his country of residence, the degree of rurality of the remittance-receiving household, and the intended use of remittances. These variables are rather similar to the determinants of the motives for remitting appearing in table 1 and discussed in sections 2.1 through 2.6.

In terms of hypotheses, Amuedo-Dorantes and Pozo (2005:559-60) distinguish between three remittance channels – banks, money transfer firms (MTFs) and unofficial channels – and expect the above-mentioned variables to affect the use of these channels differently. First, they expect that the higher the amount of remittances, the more likely will migrants use banks, as the transaction costs on a personal check do not depend on the check amount. Also more educated migrants, migrants with more work experience and with wider networks of family

and friends in their country of residence are more likely to use banks, as they are likely to understand the banking system and to hold a bank account. In contrast, the authors expect banks to be less likely used when migrants are undocumented or older. In addition, using unofficial channels and MTFs is more likely when migrants remit to more rural areas where banks may not be available. Lastly, the authors expect that banks are more likely used when remittances are sent for savings or investment purposes. (Ibid.)

The authors make an important note that including the amount of remittances as an independent variable may result in endogeneity, as it is likely that the migrants choice of remittance channel may depend on the cost associated with remitting a certain amount of money, whereas it is also possible that the amount of remittances may be affected by the remittance channel used by the migrant. They account for this possibility by first estimating a tobit model for the amount of remittances, from which they obtain unconditional predicted values for the amount remitted. They then use this to instrument the amount of remittances in their multinomial logit model for the choice of remittance channel. (Ibid:556-7)

3.2. Empirical evidence

Most of the empirical studies on remittance channels has focused on the characteristics of the channels when attempting to determine why some remittance channels are used more often than others. These studies have concluded that – inter alia – the cost of using a certain channel, its convenience, security, speed, trustworthiness, familiarity and the access of both the migrant and the recipient household to the channel are the main determinants of the migrant's decision on which remittance channel to use (see e.g. Buencamino and Gorbunov 2002; El Qorchi et al. 2003; Freund and Spatafora 2005; Hernandez-Coss 2005; Pieke et al. 2005). While these factors obviously are important in the choice, also the characteristics of the remitting migrants may also have a significant impact on the choice of using a certain remittance channel. Thus, two empirical studies considering the influence of these characteristics are reviewed in this section.

Continuing with the study by Amuedo-Dorantes and Pozo (2005) on Mexican immigrants in the United States, the authors examine through a multinomial logit model the different migrant characteristics affecting the choice between using banks, money transfer firms (MTFs), unofficial remittance channels and other remittance channels. MTFs form the estimation's base category, as they are the most commonly used remittance channel. The

authors find that relative to MTFs, banks are less likely used by undocumented migrants, while more educated migrants, migrants employed in industry, and migrants with social networks in their country of residence are more likely to use banks relative MTFs. Meanwhile, migrants that are self-employed or work a specific-task job, and migrants remitting to rural areas are more likely to use unofficial remittance channels relative to MTFs. However, MTFs are preferred over unofficial channels as the time the migrant has spent in the United States lengthens. (Ibid:569) While these findings support the authors' hypotheses mentioned in the previous section, the estimation results regarding the effects of the age of the migrant, the amount of remittances he sends, and the intended use of remittances go against what they initially assume.

In their study on Moldovan migrants, Siegel and Lücke (2009) incorporate both migrant- and channel-related independent variables into their multinomial logit model for the choice between official services (banks, money transfer operators and post offices), unofficial services (third parties such as minibus operators) and personal transfers (migrants themselves, relatives and friends). The authors find that unofficial services and personal transfers are more likely used relative to official ones, when migrants and the recipient households are primarily concerned about the cost of the service as opposed to its speed, convenience, security, or trust.

In terms of the migrant-related characteristics, more educated migrants are less likely to use unofficial services and personal transfers, while migrants residing in EU countries are much more likely to use unofficial services relative to official ones than migrants residing in CIS countries, reflecting the illegal residence status of many Moldovan migrants in the EU. As could be expected, then, being a legal resident in the destination country reduces quite significantly the probability of using unofficial services relative to official ones. Also the duration of migration has an effect on the choice of remittance channel: while short-term migrants are less likely to use unofficial services relative to official ones, they are more likely to use personal transfers relative to official ones. In addition, recipient households with a bank account are much less likely to use unofficial services relative to official ones. However, the bank account may have been opened for the household to be able to use these services. (Ibid:9, 17-9)

Similarly to the empirical studies on the motives for remittances, these studies provide a relevant framework for the estimations of the choice between official and unofficial remittance channels: among other studies, they provide the theoretical underpinnings for the

empirical estimations, as well as guide the choice of variables to be included in the specifications. Importantly, they give insight into the multitude of factors affecting the choice of remittance channel: when it comes to the estimations of this study, they would greatly benefit from the possibility of including several variables that have been used in the studies reviewed above. This matter is discussed in more depth in section 6.4.1.

3.3. Remittance trends and channels in Uganda

With their rather staggering growth in recent years, remittances to Uganda are becoming a substantial source of development finance. Recorded workers' remittances to Uganda totalled $914.5 million in 2010, with a growth of 17.5 percent from the previous year. Remittances have already outpaced foreign direct investments made into the country, and represent the second largest inflow into the country after official development aid, which amounted to $1.786 billion in 2009. (The World Bank 2012a) In 2010, there were 757.5 thousand Ugandan emigrants, and among their top destinations were Kenya, the United Kingdom, Tanzania, the United States and Rwanda. Moreover, in 2000 as much as 35.6 % of tertiary-educated population emigrated. (The World Bank 2011b:248) As remittance senders to Uganda, the United Kingdom, the United States and Australia are at the top, while within sub-Saharan Africa, Kenya, the Democratic Republic of Congo and South Africa represent the major remittance-sending countries (Ngugi and Sennoga 2011:245-6). The significant growth of remittances is mainly the consequence of the increasing number of Ugandans working abroad, of the loosening foreign exchange regulatory regime, and new remittance technologies that have increased competition in the remittance markets and decreased transfer costs (Ibid:245).

In terms of the channels used for remitting, the Bank of Uganda (2010:11) defines commercial banks and international and local money transfer operators – all of which are regulated by the Bank of Uganda – as official, or formal, channels, while the unofficial, or informal, channels comprise all unlicensed service providers as well as friends and relatives. The results of a survey on remittances conducted in 2009 by the Bank of Uganda show that the most frequently used channels to remit are international money transfer operators such as Western Union and Money Gram (32.6 percent), followed by commercial banks (23.5 percent) and friends and relatives in Uganda (21.8 percent). There was also a decrease in the percentage of households using unofficial remittance channels from 41.6 percent in 2008 to 37.4 percent in 2009.

The choice between official and unofficial remittance channels is determined mainly by the remitter's preferences, but also by the ease of access to the channel, and by its transaction costs. (Ibid:11-3) Moreover, those migrants who manage to find work at the formal sector tend to use official remittance service providers, such as banks, credit institutions and microfinance-related institutions, while those employed in the informal sector tend to resort to unofficial means of transfer, e.g. to bus companies, family members and friends. Furthermore, official service providers are more frequently used when the remitter resides in an urban centre, as these centres are where the financial institutions of Uganda are mainly concentrated. Also international remittances are often sent through official channels. In contrast, unofficial channels are most used by customers whose areas are underserviced by financial institutions. Also, domestic remittances find their way to their recipients mainly through semi-official and unofficial channels. (Ngugi and Sennoga 2011:247-50)

While there is an abundance of different remittance service providers in Uganda, they all differ in their scope of services, products, and transfer costs. To overcome the problems of high transaction costs, slow speed of transfers and limited access to banking services, a large number of new entries to the market have been made in recent years: for instance, mobile money transfer services and informal services such as community-based firms and transport firms have gained entry. (Ibid:247, 251)

3.4. Remittance trends and channels in Senegal

In 2010, Senegal received $1.346 billion in recorded workers' remittances, which represents as much as 10.4 percent of Senegal's GDP. With this amount, Senegal is in the 4th place among remittance-receiving countries in Sub-Saharan Africa in the total volume of remittances (The World Bank 2012a; The World Bank 2011b:34). In the early 2000s, remittances to Senegal grew quite rapidly, but in 2009 and 2010, remittances fell: there was a 7.5 percent decline between 2008 and 2009, and a 1.4 percent decline between 2009 and 2010. Both foreign direct investment flows ($237.2 million in 2010) and official development aid ($1.018 billion in 2009) have been surpassed by remittances, further emphasising the significance of the latter. In 2010, most of the 636.2 thousand Senegalese emigrants were destined for the Gambia, France, Italy, Mauritania and Spain. In 2000, nearly 18 percent of the tertiary-educated population emigrated. (The World Bank 2012a; The World Bank 2011b:217)

The Senegalese official remittance market consists of banks, money transfer operators, the post office, and microfinance institutions. According to the African Development Bank (2007:26), 10 percent of remittance flows go through banks, 36 percent through money transfer operators, and 8 percent through postal orders – the rest 46 percent of remittances go through various unofficial channels. While the high costs of using money transfer operators limits the growth of the industry, the use of banks as remittance channels is restricted due to the long distances to banks in remittance-receiving areas, long delays and waiting times in the delivery of services, and the sometimes unexpected commission charges. Moreover, the bankarisation rate of Senegal is estimated to as low as around 5 percent on average. (Ibid:29-30) Microfinance institutions, on the other hand, act as intermediaries between money transfer operators and beneficiaries, and intensify the competition for money transfer services in the unofficial sector by making the distribution network denser (Ibid:30). In turn, the post office is highly competitive due to its presence in areas with low bankarisation (Cisse 2011:231).

The unofficial remittance market consists of carriers, "fax", in-kind transfers through traders, goods sent by migrants, and remittances sent by mail. The carrier system, where a community's remittances are assigned to one carrier is the most commonly used, but suffers from a bad reputation. In the second most popular system, i.e. in "fax" system, remittances are gathered at one collection point and redistributed to their recipients very rapidly through a trader in the recipient's country after identification by telephone. This mode of transfer is both quick and less expensive than money transfer operators, but more risky as well. (The African Development Bank 2007:35-6)

Surprisingly, cost is not the principal factor that determines whether a official or unofficial mode of transfer is used, as many migrants and recipients are unaware of them. Migrants decide to use unofficial channels due to the downsides of the official market, such as exchange rate fluctuations, waiting times at agencies, high costs and limited reach of banking services. Also the large number of unauthorised Senegalese workers abroad tends to resort to unofficial channels rather than official ones. (Ibid:32-4) Moreover, there are entry barriers to the remittance service business and regulations that impede remittance operations, such as ceilings on the amount on remittances and minimum capital requirements, which further encourage remitters to use the unofficial sector. In addition, despite their speed and reliability, official remittance services are expensive and bureaucratic. (Cisse 2011:237)

In sum, the Senegalese remittance markets are becoming more formalised primarily due to the growth of money transfer operators, but the limited reach of banking services poses a problem. Yet, remittances have improved this situation, and the reach is better among the recipients of remittances than among the population generally. (The African Development Bank 2007:39-40)

3.5. Remittance trends and channels in Nigeria

Nigeria receives the largest absolute amount of remittances of all Sub-Saharan African countries, with a total of $10.045 billion in recorded workers' remittances received in 2010 (The World Bank 2012a; The World Bank 2011b:34). Remittance flows to Nigeria have grown steadily in the last few years, but declined somewhat in 2009, but already in 2010 they returned to a higher level than in 2008. As in Senegal, foreign direct investment and official development aid have been exceeded in scale by remittances: Remittances are nearly 1.7 times as large as foreign direct investment flows, and over 6 times as large as official development aid flows to Nigeria. In 2010, the stock of Nigerian emigrants totalled 1.0 million, and their main destinations were the United States, the United Kingdom, Chad, Cameroon and Italy. Of the tertiary-educated population, 10.7 percent emigrated in 2000. (The World Bank 2011b:195) Most of the remittances to Nigeria come from the United States (CBN 2007; cited in Agu 2011:188).

As in Uganda and Senegal, there are both official and unofficial remittance service providers. The official sector is predominantly formed by global money transfer operators with Nigerian banks as their agents, and the national postal carrier NIPOST. An important feature of the official sector is that a substantial fraction of remittance service providers have formed some kind of a partnership with money transfer operators, banks, or mobile phone companies. Telecommunications operators provide remittance services as well, but they still lack in reach and depth. In the unofficial sector, on the other hand, both monetary and in-kind remittances are carried by friends or private merchants. (Agu 2011:190-1, 195)

Currently, remittances to Nigeria are not encouraged by any policies or incentives, but hampered by, inter alia, registration, licensing and capital requirements for the remittance-providing firms. Also corruption in the government, anti-money-laundering requirements and exchange controls are considered as barriers to entry to the market. In effect, remittance markets in Nigeria is an oligopoly, where banks need to get together among themselves and

with money transfer operators in order to operate remittance services. Despite their collaboration, banks are in competition with each other, as well. Thus, the unofficial sector, with a totally different customer base that is not even recognised by banks, is not perceived as a threatening competitor by the official sector. (Ibid:199-205)

In terms of remittance fees, their payment is almost solely the responsibility of the sender, and depend on the money transfer operator used and on where the remittances are sent from. However, both senders and recipients may be charged when remittances are domestic and sent through local couriers and transportation firms. The highest proportional fees accrue to those remitting small amounts. In addition, many banks have strict identification requirements to secure the integrity of remittance services, and they exclude some parts of the Nigerian population from receiving remittances through official remittance services: these people are often self-employed, employed in the informal sector, or casually employed and thus do not have official identity cards. (Ibid:206-10)

Thus, a lot remains to be improved in the remittance markets of Nigeria. For instance, competition should be increased to bring down the costs of remittance services; access to remittance services should be improved by empowering NIPOST, whose country-wide infrastructure could be much more effectively utilised; and the use of remittance proceeds should be enhanced. Only then there is a chance for the greatest possible benefits for both remittance senders and receivers to come about. (Ibid:212-5)

4 Model for intra-household decisions on migration

Judging by the models for the motives for remitting reviewed in sections 2.1 through 2.6 it may be concluded that even though most of these models incorporate the considerations of both the migrant and the household to some extent, they rarely explicitly model the household and how it is actually affected by one or more of its members migrating outside the household to work. There are exceptions, however: for instance, the model for the investment motive by Rapoport and Docquier (2006) presented in section 2.3 goes quite a long way in modelling the household, and how its income and its liquidity constraints affect its decisions regarding migration. What the authors attempt to determine with their model is the optimum number of migrants the household should send in order for it to maximise its income, but disregard, for instance, the characteristics of the migrant and those of his destination country, and the effects they may have on the optimum number of migrants.

However, it would be of great interest and importance to bring these kinds of issues under consideration in a microeconomic model for migration decisions, as they will have an effect on a variety of decisions made in households as well as on the subsequent remittances. For instance, the characteristics of the potential migrant and his potential destinations, and the characteristics of the sending household itself are very likely to have an effect on the decisions on which of the household members should migrate, where should he migrate to, as well as on the amount of remittances the household may expect from the migrant it decides to send. The questions of who to send as a migrant and where to send him are precisely those the model developed in this section attempts to answer. To the author's knowledge, similar models with the same premises and framework do not exist.

Existing research is not ignored, however, in the development of the model: the model incorporates some features of the models described in the previous chapter, such as those of the model for the strategic motive by Stark (1995), and also some empirically validated hypotheses made by Lauby and Stark (1988) in their investigation of Filipino migrants. Most profoundly, however, the model builds on the theory of comparative advantage, and how it can be factored into the migration-related decision making of the household. The model developed has an empirical counterpart in this study, as well: a probit model for the probability of sending a migrant abroad is estimated for Ugandan, Senegalese and Nigerian migrants in sections 7.1.6, 7.2.7 and 7.3.7, respectively.

4.1. Standard model

The model starts with a household that has decided to send one of its members to work outside the household to earn extra income. It should be noted that even though the expression "send a migrant" is used, the household is not necessarily the sole entity making the migration decision: as Stark and Bloom (1985:174) note, migration decisions are often jointly made by the migrant and some group of non-migrants, costs and benefits are shared, and remittances are seen as a contractual arrangement between the migrant and his former household.

Nonetheless, what the household aims at with sending a migrant is to reach a minimum income $I^{\min}$, which it needs to escape from destitution. The household has two workers, one with low skills and one with high skills, and attempts to determine which of them to send outside the household to earn extra income. In terms of the destination country of the worker, there are also two choices, a rich country and a poor country, and the worker that does not get

sent outside the household remains at home. More concretely, the rich country may be considered to represent international, and the poor country to represent internal migration. As in the strategic motive model by Stark (1995) reviewed in section 2.6, the skills, or productivities, of low- and high-skill workers are denoted by θ_1 and θ_2, respectively, and the rich and poor countries by subscripts *R* and *P*, respectively. Staying at home is denoted by subscript *H*.

The workers are paid an hourly wage $W(\theta)$ according to their skills in both country *R* and country *P*. As the workers' education is one indicator of the their skills, these wages also partly reflect the possibly disparate returns to the workers' education. In contrast to the assumption made by Stark (1995), it is assumed that their skills are accurately recognised and compensated for in both countries. In terms production at home *H*, the workers' hourly output is also translated into wages, so the workers' wages fulfil the following conditions:

$$\begin{aligned} &W_R(\theta_1) > W_P(\theta_1) > W_H(\theta_1), \\ &W_R(\theta_2) > W_P(\theta_2) > W_H(\theta_2), \end{aligned} \tag{4.1}$$

$$W(\theta_2) > W(\theta_1), \tag{4.2}$$

$$\frac{W_H(\theta_1)}{W_P(\theta_1)} < \frac{W_H(\theta_2)}{W_P(\theta_2)}, \text{ and} \tag{4.3}$$

$$\frac{W_H(\theta_1)}{W_R(\theta_1)} < \frac{W_H(\theta_2)}{W_R(\theta_2)} \tag{4.4}$$

First, the wage is better in country *R* than in country *P* for both the low- and high-skill worker, and these wages are better than that paid at home *H*. Second, the high-skill worker is paid better than the low-skill worker in country *R*, country *P* and at home, so he has an absolute advantage in all locations. According to conditions (4.3) and (4.4), the high-skill worker has a comparative advantage at home *H* over working outside the household, meaning that he is relatively more productive at home than the low-skill worker. Conversely, these conditions also mean that the low-skill worker has a comparative advantage of working outside the household over staying at home.

In terms of the labour markets the migrant will be entering outside the household, it could be reasonably assumed that there is a chance that the migrant will not find work immediately, or that he finds only temporary work or work with reduced hours. To capture this possibility in country *R* and country *P*, let there be a good state *G* where the migrant finds full-time work

with *h* hours of work per day immediately, and a bad state *B* where he is assumed to work *αh* hours per day, with $0 < \alpha < 1$. Thus, in a good state, the low-skill worker will earn either the income

$$I_R^G(\theta_1) = W_R(\theta_1) \times h \text{ or} \tag{4.5}$$

$$I_P^G(\theta_1) = W_P(\theta_1) \times h \tag{4.6}$$

in country *R* or in country *P*, respectively, and in a bad state, he will earn the either the income

$$I_R^B(\theta_1) = W_R(\theta_1) \times \alpha h \text{ or} \tag{4.7}$$

$$I_P^B(\theta_1) = W_P(\theta_1) \times \alpha h. \tag{4.8}$$

The earnings of the high-skill worker may be presented similarly. At home, the working hours of both migrants are known and do not depend on good or bad states – for simplicity, they are normalised to 1, so the income earned at home, $I_H(\theta)$, equals $W_H(\theta)$.

Assuming that the actual occurrence of good and bad states is not known ex ante, the income of the migrant at the destination country can only be expressed in expected terms. The likelihood of the good state is π, and the likelihood of the bad state is $1 - \pi$. Thus, the low- and high-skill workers may be expected to earn the following incomes in country *R* and in country *P*, respectively:

$$\begin{aligned} E[I_R(\theta_1)] &= \pi I_R^G(\theta_1) + (1-\pi) I_R^B(\theta_1) \\ &= \pi[W_R(\theta_1) \times h] + (1-\pi)[W_R(\theta_1) \times \alpha h] = (\pi + \alpha - \pi\alpha) W_R(\theta_1) \times h \end{aligned} \tag{4.9}$$

$$\begin{aligned} E[I_P(\theta_1)] &= \pi I_P^G(\theta_1) + (1-\pi) I_P^B(\theta_1) \\ &= \pi[W_P(\theta_1) \times h] + (1-\pi)[W_P(\theta_1) \times \alpha h] = (\pi + \alpha - \pi\alpha) W_P(\theta_1) \times h \end{aligned} \tag{4.10}$$

$$\begin{aligned} E[I_R(\theta_2)] &= \pi I_R^G(\theta_2) + (1-\pi) I_R^B(\theta_2) \\ &= \pi[W_R(\theta_2) \times h] + (1-\pi)[W_R(\theta_2) \times \alpha h] = (\pi + \alpha - \pi\alpha) W_R(\theta_2) \times h \end{aligned} \tag{4.11}$$

$$\begin{aligned} E[I_P(\theta_2)] &= \pi I_P^G(\theta_2) + (1-\pi) I_P^B(\theta_2) \\ &= \pi[W_P(\theta_2) \times h] + (1-\pi)[W_P(\theta_2) \times \alpha h] = (\pi + \alpha - \pi\alpha) W_p(\theta_2) \times h. \end{aligned} \tag{4.12}$$

For the expected incomes above, obviously the same conditions hold as for the workers' wages described in expressions (4.1) through (4.4). Further, for migration of either of the workers to be beneficial, it is assumed that these expected incomes for all reasonable working hours are larger than the income the same worker earns at home. However, migration is

costly, which also needs to be taken into account. Assuming that country *P* is much closer than country *R*, migration to country *P* is considered to be costless and migration to country *R* costs *c*. Migration cost *c* is small enough for the migration of either of the workers to remain beneficial.

As mentioned earlier, the household's primary concern is to escape from destitution, for which it needs a minimum income of $I^{\min}$. To be precise, this income corresponds to the size of the household after one of the workers has migrated. Assuming that the migrant worker remits all of his expected income to the household, and that there is no other work effort expended at home except for that of the remaining worker, the household has four ways of achieving this minimum income through the work effort of the remaining worker and the migrant's remittances: either the high-skill worker remains home, and the low-skill worker is sent either to country *R* or to country *P*, or the low-skill worker remains home, and the high-skill worker is sent either to country *R* or to country *P*. Thus, the household compares four possible incomes – taking into account also the cost of migration – in its decision-making. If the high-skill worker remains home, the household income amounts to either

$$I_H(\theta_2) + E[I_R(\theta_1)] - c = W_H(\theta_2) + (\pi + \alpha - \pi\alpha)W_R(\theta_1) \times h - c \text{ or} \tag{4.13}$$

$$I_H(\theta_2) + E[I_P(\theta_1)] = W_H(\theta_2) + (\pi + \alpha - \pi\alpha)W_P(\theta_1) \times h, \tag{4.14}$$

and if the low-skill worker remains home, the household income equals either

$$I_H(\theta_1) + E[I_R(\theta_2)] - c = W_H(\theta_1) + (\pi + \alpha - \pi\alpha)W_R(\theta_2) \times h - c \text{ or} \tag{4.15}$$

$$I_H(\theta_1) + E[I_P(\theta_2)] = W_H(\theta_1) + (\pi + \alpha - \pi\alpha)W_P(\theta_2) \times h, \tag{4.16}$$

depending on the destination country. Unlike under the investment motive, the household does not attempt to maximise its income, but first and foremost it aims at avoiding the situation where its income falls under the minimum income $I^{\min}$. Hence, from these formulations it can be seen that the expected working hours *h* and the cost of migration *c* determine, which of the workers is sent outside the household. For it to be irrelevant which one of the workers is sent outside the household, i.e. for the household to receive its needed income $I^{\min}$ in all possible cases, the working hours *h* must fulfil the severest condition of the following:

$$h \geq \frac{I^{\min} - W_H(\theta_2) + c}{(\pi + \alpha - \pi\alpha) W_R(\theta_1)}, \qquad h \geq \frac{I^{\min} - W_H(\theta_2)}{(\pi + \alpha - \pi\alpha) W_P(\theta_1)}$$

$$h \geq \frac{I^{\min} - W_H(\theta_1) + c}{(\pi + \alpha - \pi\alpha) W_R(\theta_2)}, \text{ and } h \geq \frac{I^{\min} - W_H(\theta_1)}{(\pi + \alpha - \pi\alpha) W_P(\theta_2)}. \tag{4.17}$$

Clearly, the higher the needed income $I^{\min}$, and the higher the migration cost *c*, the higher are also the migrant's working hours *h* needed to fulfil the household's requirements. However, the higher is the wage of the worker remaining at home relative to the wage of the migrating worker, the lower are the required working hours of the migrant. The effects of the chance of finding full-time employment π and the fraction of full hours worked α is not as straightforward, however, since they appear in the denominator with both a positive and a negative sign. Yet, as both π and α are between zero and one, the negative effect of their product is always outweighed by their individual, positive effects. Thus, the better are the chances of the worker finding full-time employment, and the higher fraction of full hours he can work when underemployed, the fewer working hours *h* are needed to attain the minimum income $I^{\min}$ required by the household.

An important note is made by Lauby and Stark (1988:478), who point out that the number of children in the household is likely to affect the household's decisions on migration. Firstly, the more children there are in the household, the larger is the household's need for additional income, which naturally increases $I^{\min}$. Secondly, if there are a large number of children, the household is ensured that there will also be someone left at home to work. Thus, the probability of a household member's migration is likely to increase with the size of the household, or more precisely, with the number of children in the household. In addition, the need for additional income may be affected by the education levels and occupations of the members of the household remaining at home. (Ibid.) Moreover, it could be possible that the size of the household affects the decision of sending a migrant abroad negatively: as international migration is likely to involve higher costs than internal migration, a large household with large consumption needs may not be able to finance it.

4.2. Extensions

The model derived in the previous section can easily be augmented from its basic form. For instance, the likelihood of finding full-time employment π may differ between the destination countries, in which case π would get different values in country *R* and in country *P*. The

chance of finding full-time employment may also be different for the different skill groups of migrants, and π may thus depend on θ, as well. The same may apply to the fraction of hours worked α when the migrant is underemployed.

Also, the model could be easily extended to include the possibly differing loyalties, or degrees of altruism, of the two workers by assuming that the migrants remit only a fixed proportion γ of their expected income to the household. It could be expected that the larger the degree of altruism, the larger is this remitted proportion. A related suggestion is made by Lauby and Stark (1988:485) in their study on Filipino migrants, who hypothesise that when compared to migrating sons, migrating daughters may be more reliable in terms of providing support to her parents and to the education of their siblings.

Similarly to model for the strategic motive developed by Stark (1995), the migrants and/or the household may apply a discount factor *k*, $0 < k < 1$, either to the wage of country *P* or to the wage of country *R*, depending on which location they prefer more. While Stark (1995:94) argued that migrants may prefer the lifestyle in country *P*, in which case the discount factor would be applied to the wage in country *R*, there may be other reasons for its application, and reasons for applying it to the wage of country *P*. For instance, the migrant and/or the household may prefer a location where another household member has already migrated to, or where there is a community of migrants from the same source country.

In addition, as suggested by Stark (1995:93), it is possible that the individual skills of the migrant workers are not recognised by employers in country *R*, and that the high-skill worker may face statistical discrimination there. When considering his wage, employers may pool him with the already existing group of migrants in country *R*, and may pay him a lower wage than the migrant's personal skill level or productivity would suggest. If the migrants at country *R* are paid according to their average product or skill level, this wage $\overline{W_R}$ may be expressed as $\overline{W_R} = \beta W_R(\theta_1) + (1-\beta) W_R(\theta_2) > W_p(\theta_2)$ – β representing the share of low-skill workers in country *R* – and incorporated into the model above. When it comes to country *P*, especially in the case of this model, it is a rather reasonable assumption that in country *P*, the recognition of individual skills and paying according to them is more likely, as country *P* represents the migrant's home country.

Also another alternative assumption could be made in terms of the treatment of high-skill migrant workers in country *R*. It could be reasonably assumed that in country *R*, the skills of

the high-skill worker would not be recognised in the beginning, and thus he would not be allocated to the high-skill jobs he would be suitable for. Instead, in the beginning he would have to work in the same jobs as the low-skill migrant workers – who have been correctly allocated to low-skill jobs – and get paid the wage $W_R(\theta_2) = W_R(\theta_1) = W_R$. However, it could be assumed that in time, the skills of the high-skill worker will be recognised and he will have the opportunity to progress to jobs requiring better skills and offering a higher wage that is more in accordance with the migrant's actual skills. This kind of an extension could be made by developing a two-period variation of the above model: in the first period, all workers regardless of their skills would get paid a wage $W_R(\theta_2) = W_R(\theta_1) = W_R$ in country *R*. In the second period, the low-skill worker would remain in his low-skill jobs, the high-skill worker would switch to a high-skill job, and they would be paid their skill-determined wages $W_R(\theta_1)$ and $W_R(\theta_2)$, respectively, with $W_R(\theta_2) > W_R(\theta_1)$.

Naturally, in the case sketched above the decision making of the household would become slightly more complicated, and it would have to consider, inter alia, how probable it is for the high-skill migrant to find and get a high-skill job at the second period. In addition, as pointed out by Lauby and Stark (1988:481-2), the household may have preferences in terms of the pattern of earnings and the kind of job the migrant takes. For instance, in terms of the scenario above, if the household only cares about the short-run satisfaction of its income need $I^{\min}$, it may not care at all about the possible progress of the high-skill migrant at country *R*, and thus may disregard the second period altogether, and the positive effect the high-skill migrant's increased earnings would have on the household's income in the second period.

This section introduced only a few possible extensions to the basic model developed in the previous section. As the basic model is sufficient for the purposes of this study, the formal modelling of the above suggestions is not embarked on here but possibly in future research.

5 Empirical methods

In the literature studying the determinants of remittances, two estimation methods – the tobit model and the Heckman selection model – are most prevalently used. Though some earlier papers, such as the one by Lucas and Stark (1985), use OLS to model the remittance behaviour of migrants, it is now widely understood that OLS estimates may be biased and inconsistent in the context of estimating the determinants of remittances: there is a significant number of migrants who do not remit at all, and those who do, can be considered to self-select

themselves non-randomly into the "state" of remitting. Remittances are thus observed only for a non-random sample of migrants, which is likely to introduce sample selection bias into the estimations.

Thus, models such as the tobit model and the Heckman selection model, which take this restricted nature of the dependent variable and the sample selection bias linked to it into account, are preferred in more recent papers studying the determinants of remittances. In addition to these estimation methods, the two-part model consisting of separate probit and OLS estimations, and the censored least absolute deviations (CLAD) estimation are employed to model the determinants of remittances. Since none of the used methods is a perfect fit for the research question or the underlying data, it is useful to compare the estimation results obtained with each of them. To model the choice between official and unofficial remittance channels, and between international and internal migration, a probit model is used.

In this chapter, each of these methods is introduced and their strengths and weaknesses relative to the research question and data at hand are discussed. Throughout the following sections it should be kept in mind that the continuous dependent variable y_i - the amount of remittances – appearing in the tobit, Heckman selection and two-part model, as well as in the CLAD estimation, is on logarithmic scale. All of the estimations were carried out using Stata 11.

5.1. Tobit model

The original Tobit model is named after James Tobin, and since its introduction in 1958 the model has been generalized in a variety of ways. Tobin (1958) proposed the use of maximum likelihood in the estimation of the model, and the applicability of the usual ML theory was later proved formally by Amemiya (1973). The tobit model is designed for applications, where the dependent variable is continuous but censored, i.e. its range is restricted from below or above. Often the range is restricted from below so that all negative values are mapped to zero. When this is the case, the model depicts two things simultaneously: it describes both the probability that the dependent variable equals zero, and the distribution of the dependent variable given that it gets a positive value. (Verbeek 2008:232)

In terms of this study, modelling the determinants of remittances with the tobit model regards the remittance process as a one-stage decision: the decision to remit and the amount of remittances are made together, and they are both affected the same way by the independent

variables. In the empirical remittance literature, the tobit model has been employed by, for instance, Cox et al. (1998), Gubert (2002) and Amuedo-Dorantes and Pozo (2006).

5.1.1. Standard and its estimation

The standard tobit model is one with censoring from below at zero – stated formally, the so-called threshold parameter L equals zero. The latent variable y_i^* is linear in the independent variables, with an additive error that is normally distributed and homoskedastic. Formally, it may be presented as follows:

$$y_i^* = x_i'\beta + \varepsilon_i, \quad i = 1, 2, \ldots, N, \tag{5.1}$$

where the error term

$$\varepsilon_i \sim \mathrm{N}[0, \sigma^2] \tag{5.2}$$

and where the observed y_i is defined as, with $L = 0$,

$$\begin{aligned} y_i &= y_i^* \quad if \quad y_i^* > 0 \quad and \\ y_i &= - \quad if \quad y_i^* \leq 0. \end{aligned} \tag{5.3}$$

The error term ε_i has a constant variance σ^2 across observations and is independent of x_i. The $-$ sign means that y_i is observed to be missing, but often it is recorded at zero. (Cameron and Trivedi 2005: 536; Verbeek 2008: 231-232) In the tobit estimations of this study, there are no negative remittances, and when y_i is observed to be missing, i.e. when the household receiving remittances has reported that it has not received any remittances during the previous 12 months, y_i is recorded at zero. As there is no censoring in its true meaning, these zero observations are called corner solutions.

As mentioned, the tobit model first depicts the probability that $y_i = 0$, given vector x_i:

$$\begin{aligned} P\{y_i = 0\} &= P\{y_i^* \leq 0\} = P\{\varepsilon_i \leq -x_i'\beta\} \\ &= P\left\{\frac{\varepsilon_i}{\sigma} \leq -\frac{x_i'\beta}{\sigma}\right\} = \Phi\left(-\frac{x_i'\beta}{\sigma}\right) = 1 - \left(\frac{x_i'\beta}{\sigma}\right), \end{aligned} \tag{5.4}$$

where σ is the standard deviation of the tobit model error term. Second, the model describes the distribution of y_i, conditional on it being positive. For this left-truncation at zero, y_i is only observed if $y_i^* > 0$, and the left-truncated mean, given vector x_i, is given by

$$\begin{aligned} E\left[y_i \,|\, y_i > 0\right] &= E\left[x_i'\beta + \varepsilon_i \,|\, x_i'\beta + \varepsilon_i > 0\right] \\ &= x_i'\beta + E\left[\varepsilon_i \,|\, \varepsilon_i > -x_i'\beta\right] \\ &= x_i'\beta + \sigma \frac{\phi\left(x_i'\beta/\sigma\right)}{\Phi\left(x_i'\beta/\sigma\right)}. \end{aligned} \tag{5.5}$$

The last term in equation (5.5), $\frac{\phi\left(x_i'\beta/\sigma\right)}{\Phi\left(x_i'\beta/\sigma\right)}$, is called the inverse Mill's ratio and denotes the conditional expectation of a mean-zero normal variable given that it is larger than $-x_i'\beta$. This expectation is evidently larger than zero. The last term in the equation also makes it clear why it is not suitable to restrict attention only to the positive observations and estimate a linear model from the subsample – the conditional expectation of y_i does not merely equal $x_i'\beta$, but depends also nonlinearly on x_i.[1] (Cameron and Trivedi 2005:539-41; Verbeek 2008:232)

The tobit model is usually estimated through maximum likelihood. The contribution that an observation makes to the likelihood function either is the probability mass at the observed point $y_i = 0$, or the conditional density of y_i, given that it is positive, times the probability mass of observing $y_i > 0$. Maximising the loglikelihood function with respect to β and σ^2 gives consistent and asymptotically efficient estimators for both β and σ^2, given that the model is correctly specified. (Verbeek 2008:234) In terms of the tobit model estimations of this study, the estimation is by maximum likelihood, but the subsequent inferences do not assume that the density is correctly specified, which is referred to as pseudo-maximum likelihood estimation.

The most significant weakness of the tobit maximum likelihood estimation is that it relies heavily on its distributional assumptions of the error term ε_i: the maximum likelihood

[1] Also the left-censored (at zero) mean may be obtained, taking the form

$$E[y_i] = P\{y_i > 0\} \times E\left[y_i \,|\, y_i > 0\right] = P\{\varepsilon > -x_i'\beta\}\left[x_i'\beta + E\left[\varepsilon_i \,|\, \varepsilon_i > -x_i'\beta\right]\right] = \Phi\left(\frac{x_i'\beta}{\sigma}\right) x_i'\beta + \sigma\phi\left(\frac{x_i'\beta}{\sigma}\right)$$

(Cameron and Trivedi 2005:539).

estimators of β and σ^2 are rendered inconsistent when non-normality or heteroskedasticity in the error terms is detected (Verbeek 2008:238). Non-normality of the error terms means that the errors are not jointly normally distributed, which in turn means that also y_i is not normally distributed, and exact statistical inferences from a given sample cannot be made. Heteroskedasticity of the error terms, on the other hand, means that the variance of the error terms is not constant over observations, even though the error terms are mutually uncorrelated (Ibid:20, 88).

In terms of how well the model approximates the observed data, the goodness-of-fit measure for the maximum likelihood estimator is $pseudo-R^2$, defined as $1-\ln L_1 / \ln L_0$, where $\ln L_1$ is the log likelihood of the fitted model, and $\ln L_0$ is the log likelihood of an intercept-only model. As the tobit model has a continuous dependent variable, and the log likelihood is the log of a density, it is possible that $pseudo-R^2 < 0$ or $pseudo-R^2 > 1$. Moreover, the measure does not increase as independent variables are added, unlike the standard R^2 measuring the goodness-of-fit of the standard regression model. (Cameron and Trivedi 2009:345-6) Thus, for the tobit model, the $pseudo-R^2$ has no real meaning. Thus, along with the tobit estimations of this study, the model F-statistic, which tests the significance of all of the independent variables, is reported in addition to the $pseudo-R^2$ to give a better indication of the model's fit.

5.1.2. Specification tests

Both non-normality and heteroskedasticity of the error terms should be tested after tobit estimations. For this purpose, Lagrange multiplier tests are of great appeal, as they only require estimation of the models under the hypothesis of normality and heteroskedasticity. Also conditional moment tests, which have been developed with generalised residuals, may be performed. (Cameron and Trivedi 2009:535) In this study, this latter approach was adopted, and a test for non-normality based on the framework of Pagan and Vella (1989) and described by Verbeek (2008:238-40) was employed. The test for heteroskedasticity employed in this study follows similar lines and is also described by Verbeek (2008:239). These tests are not further detailed here, but in practice, both of them are manually constructed from Stata 11 output by following instructions given by Cameron and Trivedi (2009:535-7).

In the tobit estimations of this study, the above tests detected both non-normality and heteroskedasticity. To address heteroskedasticity, heteroskedasticity-robust clustered standard errors are employed in the estimations. However, Wooldridge (2009:594) notes that the tobit model may provide reasonably good estimates of the partial effects on the conditional means, if departures from the assumptions are moderate.

5.1.3. Marginal effects

The interpretation of the coefficients of the independent variables obtained by estimating a tobit model is not exactly straightforward, as these parameters in β have a double interpretation: they include the impact of changes in independent variables on the probability of nonzero remittances, and the impact of a changes in independent variables on the amount of remittances (Verbeek 2008:234). In other words, the parameters in β measure the partial effects of the independent variables on $E(y_i^*)$, y_i^* being the latent variable. Thus, more informative marginal effects of the independent variables on the probability of observing a positive y_i, and on the conditional expected y_i, $E[y_i|y_i>0]$, should be examined. (Wooldridge 2009:589) Both of these marginal effects are studied in conjunction with the estimation results in chapter 7.

To obtain the effect of changes in the independent variables on the conditional mean of the dependent variable, the dependent variable is differentiated with respect to x_{ik}. Depending on whether one is interested in the latent variable mean, or the truncated mean given in equation (5.5), the marginal effects, are given by

latent variable: $$\partial E[y_i^*]/\partial x_{ik} = \beta_k \quad (5.6)$$

left-truncated at zero: $$\partial E[y_i|y_i>0]/\partial x_{ik} = [1-\omega\lambda(\omega)-\lambda(\omega)^2]\beta_k \quad (5.7)$$

where $\omega = x_i'\beta/\sigma$, $\lambda(\omega)=\phi(\omega)/\Phi(\omega)$, and the equalities $\partial\phi(z)/\partial z = -z\phi(z)$ and $\partial\Phi(z)/\partial z = \phi(z)$ are used.[2] To note, the dependence of expectations on vector x_i is suppressed. (Cameron and Trivedi 2005:541-2; Verbeek 2008:233)

[2] Also the left-censored (at zero) marginal effect may be obtained, taking the form $\partial E[y_i]/\partial x_{ik} = \Phi(\omega)\beta_k$ (Cameron and Trivedi 2005:542).

The use of the tobit model in modelling the remittance behaviour of migrants may not be appropriate, as it does not allow the independent variables to have a different impact on the decision on whether to remit and on how much to remit – it assumes that those migrants who are more likely to remit are also those who, on average, send more remittances. In other words, the marginal effects of the independent variables on the probability of remitting and on the amount remitted are bound to have the same sign. The appropriateness of the tobit model in this respect may be informally assessed by estimating a separate probit model for the probability of remitting and comparing its estimates with the tobit estimates: the probit coefficient estimate γ_j for an independent variable x_j should be "close" to the ratio of β_j / σ, where β_j is the tobit coefficient estimate for the independent variable, and σ the standard deviation of the tobit model error term (Wooldridge 2009:595). This test is carried out for the three countries under study and discussed in appendix 2.

5.2. Heckman selection model

The Heckman selection model, which is a standard model for describing sample selection problems, was developed by James Heckman (1976). The model divides the one-stage process of the standard tobit model into two stages: at the first stage, the individual decides whether to participate in an activity, and at the second stage, the level of participation in this activity is observed for the participants. Thus, in contrast to the tobit model, an independent variable may affect the probability of a nonzero observation, and the level of a positive observation of the dependent variable differently (Verbeek 2008:241).

The Heckman selection model is well suited for the study of remittance behaviour of migrants: a sample selection problem arises, as only those migrants who decide to send remittances at the first stage are self-selected into the sample of the second stage, at which they decide on the amount of remittances – for those who do not remit, the amount of remittances is not observed. This selection may bias standard OLS estimates, in which case a correction through the Heckman selection model is needed. The Heckman selection model – either as an alternative or as a complement to the tobit model – has been employed widely in the remittance literature, for example in studies by Hoddinott (1992), Funkhouser (1995) and Agarwal and Horowitz (2002).

5.2.1. Standard model and its estimation

In essence, the selection model consists of a participation equation where

$$\begin{aligned} h_i &= 1 \;\; if \;\; h_i^* > 0 \\ h_i &= 0 \;\; if \;\; h_i^* \leq 0 \end{aligned} \tag{5.8}$$

and a resultant outcome equation where

$$\begin{aligned} y_i &= y_i^* \;\; if \;\; h_i^* > 0 \\ y_i &= - \;\; if \;\; h_i^* \leq 0. \end{aligned} \tag{5.9}$$

This model introduces a latent variable h_i^*, and the outcome of interest y_i is observed if $h_i^* > 0$. In terms of this study, remittances, y_i, are recorded as missing if the migrant chooses not to remit, i.e. $h_i = 0$. The model specifies a linear model with additive errors for the latent variables:

$$\begin{aligned} h_i^* &= x_{2i}^{'}\beta_2 + \varepsilon_{2i} \\ y_i^* &= x_{1i}^{'}\beta_1 + \varepsilon_{1i}. \end{aligned} \tag{5.10}$$

Variables in x_{1i} are all included in x_{2i}, plus at least one identification variable not contained in x_{1i}, discussed in section 5.2. As y_i^* is not observed for those not participating, the latter equation in the equation pair (5.10) describes the potential outcome, not the actual one. The conditional expected y_i, given that $h_i = 1$, is given by

$$\begin{aligned} E\left[y_i \middle| h_i = 1\right] &= x_{1i}^{'}\beta_1 + E\left[\varepsilon_{1i} \middle| \varepsilon_{2i} > -x_{2i}^{'}\beta_2\right] \\ &= x_{1i}^{'}\beta_1 + \frac{\sigma_{12}}{\sigma_2^2} E\left[\varepsilon_{1i} \middle| \varepsilon_{2i} > -x_{2i}^{'}\beta_2\right] \\ &= x_{1i}^{'}\beta_1 + \sigma_{12} \frac{\phi\left(x_{2i}^{'}\beta_2\right)}{\Phi\left(x_{2i}^{'}\beta_2\right)}, \end{aligned} \tag{5.11}$$

where the dependence of expectations on *x*, which is the union of vectors x_{1i} and x_{2i}, is suppressed. If the error terms ε_1 and ε_2 are independent of one another, i.e. the covariance $\sigma_{12} = 0$, the equation for y_i^* may be estimated consistently by OLS. However, if the two error terms are correlated, i.e. $\sigma_{12} \neq 0$, sample selection bias in the OLS estimator arises: the

covariance gives rise to the inverse Mill's ratio $\frac{\phi(x_{2i}'\beta_2)}{\Phi(x_{2i}'\beta_2)}$ – also termed as Heckman's lambda – biasing $E[y_i|h_i=1]$.[3] (Cameron and Trivedi 2005:547-9; Verbeek, 2008:241-2)

However, Verbeek (2008:245) points out that the inclusion of the Heckman's lambda into the Heckman selection model does not eliminate all the problems of sample selection, as the non-random selection implies a fundamental identification problem. Therefore, the validity of any solution will depend upon the validity of the assumptions that are made, which can only be partly tested (Ibid.).

Like the tobit model, the Heckman selection model is estimated by maximum likelihood. The participation equation of the model describes the binary choice problem of whether to remit or not, so the likelihood contribution is the probability of observing $h_i=1$ or $h_i=0$. The outcome equation gives the distribution of the amount remitted for those who remit, so the contribution to the likelihood function is the density $f(y_i|h_i=1)$. Maximisation of the loglikelihood function with respect to the unknown parameters leads to consistent and asymptotically efficient estimators that have an asymptotic normal distribution. (Ibid:243-4) In terms of the Heckman selection model estimations of this study, the estimation is by maximum likelihood, but the subsequent inferences do not assume that the density is correctly specified, which is referred to as pseudo-maximum likelihood estimation.

Due to its estimation through maximum likelihood, the Heckman selection model suffers from the same weaknesses as the standard tobit model, discussed in section 5.1.1, when it comes to its distributional assumptions of homoskedasticity and normality of the error terms. The validity of these assumptions could not be tested in this study, but heteroskedasticity-robust clustered standard errors are still used in the estimations.

Similarly to the tobit model, the goodness-of-fit measure for the Heckman selection model's maximum likelihood estimator is $pseudo-R^2$. For the Heckman selection model, the $pseudo-R^2$ has no real meaning and is not even reported in the estimation output produced

[3] Also the censored mean may be obtained, taking the form $E[y_i]=E_{h_i^*}\left[E\left[y_i|h_i^*\right]\right]$

$$=P\{h_i^*\le 0\}\times 0+P\{h_i^*>0\}\times E[y_i^*|h_i^*>0]=0+\Phi(x_{2i}'\beta_2)\left\{x_{1i}'\beta_1+\sigma_{12}\frac{\phi(x_{2i}'\beta_2)}{\Phi(x_{2i}'\beta_2)}\right\}=\Phi(x_{2i}'\beta_2)x_{1i}'\beta_1+\sigma_{12}\phi(x_{2i}'\beta_2)$$

(Cameron and Trivedi 2005:550).

by Stata 11, as the model includes both a continuous and a discrete dependent variable. Thus, after the Heckman selection model estimations of this study, the model chi-squared –statistic is reported to give an indication of how well the model approximates the observed data.

5.2.2. Identification

To identify the model, the participation equation must contain all the independent variables that the outcome equation does, but also at least one independent variable that does not appear in the outcome equation (Baum 2006:268). If exactly the same independent variables are used, the model with normally distributed errors are close to unidentified, and multicollinearity problems arise. The independent variable that is excluded from the outcome equation should be chosen so that it affects the choice of whether to remit or not, but not the amount remitted. (Cameron and Trivedi 2005:551) However, such exclusion restrictions, that are also defensible, are quite difficult to make (Ibid.; Verbeek 2008:244).

Also Amuedo-Dorantes and Pozo (2006) point out that sample selection models such as the one by Heckman (1976) may lead to identification problems, as it is difficult to theoretically justify and find variables that affect the decision on whether to remit, but do not have an impact on the amount remitted. Still, the results of the Heckman estimation provide a good comparison to those obtained with the tobit model and to those obtained with the two-part model. The variables tested for identification purposes in the Heckman selection model are discussed in section 6.2.1.3.

5.2.3. Marginal effects

Again, the marginal effects are different depending on whether the latent variable mean or the truncated mean is considered. Denoting the union of x_{1i} and x_{2i} with x, $x_{1i}^{'}\beta_1$ may be rewritten as $x^{'}\gamma_1$ and $x_{2i}^{'}\beta_2$ as $x^{'}\gamma_2$. If x_{1i} is not equal to x_{2i}, γ_1 and γ_2 will have some zero entries. Differentiation with respect to x gives the marginal effects (given x)

uncensored: $\partial E\left[y_i^*\right]/\partial x = \gamma_1$ (5.12)

truncated at zero: $\partial E\left[y_i \middle| h_i = 1\right]/\partial x = \gamma_1 - \sigma_{12}\lambda\left(x^{'}\gamma_2\right)\left(x^{'}\gamma_2 + \lambda\left(x^{'}\gamma_2\right)\right)$, (5.13)

where $\lambda(z) = \phi(z)/\Phi(z)$, and the equalities $\partial\lambda(z)/\partial z = -z\phi(z)/\Phi(z) - \phi(z)^2/\Phi(z)^2$ $= -\lambda(z)(z + \lambda(z))$ and $\partial\phi(z)/\partial z = -z\phi(z)$ are used.[4] (Cameron and Trivedi 2005:552) The interpretation of these marginal effects is similar to that discussed in section 5.1.3.

5.3. Two-part model

The third model used in this study is a two-part model like the Heckman selection model, but the two parts of the model are not correlated as in the Heckman selection model. The two-part model was presented by Cragg (1971:831-2) as a generalisation of the tobit model: in the first part of the model, a decision is made about whether to participate in some activity or not. In the second part, a decision on the level of participation is made. Quite obviously, in terms of this study the first decision is about whether to remit or not, and the second decision is made, given that the first decision is to send remittances, on how much to remit.

Comparing the two-part model to the Heckman selection model, Manning et al. (1987:60) conclude in their Monte Carlo experiments that if one is not certain about the true equation specification for a research question, but uses the data at hand to find an acceptable specification – as is the case in this study – the overall selection bias in the predictions of the two-part model is close to insignificant. Effectively, choosing a fitting specification for the observed data eliminates the bias from ignoring the selection effect, for the most part at least (Ibid.). In this study, there is also an empirically proven argument for estimating the two-part model without sample correction: when the Heckman selection model is applied to the Nigerian data, the correlation coefficient between the error terms is found to be insignificant, meaning that the standard OLS estimation of the equation for positive remittances is likely to yield consistent estimators.

5.3.1. Standard model and its estimation

One form of Cragg's (1971:831) two-part model assumes particularly that y_i follows a logarithmic distribution, which is a relevant consideration in terms of this study: the continuous dependent variable, i.e. the amount of remittances, is used in its logarithmic form to obtain a more symmetric distribution for it. A specification for this case is given by Manning et al. (1987:62-3): slightly altering their specification, the first equation of the two-

[4] Also the censored (at zero) marginal effect may be obtained, taking the form $\partial E[y_i]/\partial x = \gamma_2\phi(x'\gamma_2)x'\gamma_1 + \Phi(x'\gamma_2)\gamma_1 - \sigma_{12}x'\gamma_2\phi(x'\gamma_2)\gamma_1$ (Cameron and Trivedi 2005:552).

part model is for the latent variable h_i^* for the dichotomous event of zero versus positive outcomes $y_i > 0$:

$$h_i^* = x_{2i}^{'}\beta_2 + \varepsilon_{2i}, \tag{5.14}$$

where, h_i gets the value of one if $h_i^* > 0$ and zero otherwise, and $\varepsilon_{2i} \sim N(0,1)$. The outcome y_i is positive if $h_i^* > 0$ and zero otherwise, so the second equation is a linear model, on the logarithmic scale, for positive outcomes, on the condition that positive outcomes are observed (given vector x_{1i}):

$$\left(y_i \middle| h_i^* > 0\right) = x_{1i}^{'}\beta_1 + \varepsilon_{1i}, \tag{5.15}$$

where $E\left(\varepsilon_{1i} \middle| h_i^* > 0\right) = 0$, and ε_{1i} is independently and identically distributed for $h_i^* > 0$. In equation (5.15), normality of the error distribution is not assumed. However, a zero correlation between the error terms ε_{1i} and ε_{2i} is assumed, which makes this model different from the Heckman selection model. Another difference of equation (5.15) from the second equation in the equation pair (5.10) for the Heckman selection model is that equation (5.15) refers to observed rather than potential outcomes. (Ibid.)

The first equation of the two-part model may be represented by a probit model, and the second by a standard regression model (Cragg 1971:831). In terms of the probit model, the probability of observing $h_i = 1$, given vector x_{2i}, is given by

$$P\{h_i = 1\} = P\{h_i^* > 0\} = P\{x_{2i}^{'}\beta_2 + \varepsilon_{2i} > 0\} = P\{-\varepsilon_{2i} \le x_{2i}^{'}\beta_2\} = F\left(x_{2i}^{'}\beta_2\right), \tag{5.16}$$

where *F* denotes the distribution function of $-\varepsilon_{2i}$. For the probit model, *F* is the standard normal distribution function $\int_{-\infty}^{x_{2i}^{'}\beta_2} \frac{1}{\sqrt{2\pi}} \exp\left\{-\frac{1}{2}t^2\right\} dt$. Like the tobit model and the Heckman selection model, the probit model is estimated through maximum likelihood. The likelihood contribution of observation *i* with $h_i = 1$ is given by the probability $P\{h_i = 1 | x_i\}$ as a function of the unknown parameter vector β, and similarly for $h_i = 0$. Maximising the loglikelihood function with respect to β gives the likelihood estimator $\hat{\beta}$. (Verbeek 2008:203) In terms of the probit model estimations of this study, the estimation is by maximum likelihood, but the

subsequent inferences do not assume that the density is correctly specified, which referred to as pseudo-maximum likelihood estimation. The second equation of the two-part model, given by the standard regression model, is estimated through ordinary least squares.

Similarly to the tobit and Heckman selection model, due to its estimation through maximum likelihood, the probit model suffers from its heavy reliance on the distributional assumptions regarding the error terms: if the assumptions of normality or homoskedasticity of the error terms are violated, the maximum likelihood estimator is inconsistent. In turn, for the OLS estimator to be unbiased in the second equation of the two-part model, the well-known Gauss-Markov conditions must be satisfied. In terms of consistency, one of the benefits of the standard regression model – compared to the above-discussed models employing the sensitive maximum likelihood estimation – is that the consistency of the OLS estimator does not assume normality of the error term distribution, and any distributional results for the OLS estimator, and the t- and F-statistics, are approximately valid even if the errors are non-normally distributed, provided that the Gauss-Markov conditions are satisfied. However, the consistency of the least squares estimator s^2 for the error variance σ^2 still relies on the homoskedasticity of the error terms. (Verbeek 2008:18, 33-6)

Similarly to the tobit model and the Heckman selection model, the goodness-of-fit measure for the probit model's maximum likelihood estimator is $pseudo-R^2$. As the probit model has a discrete dependent variable and the log likelihood is the log of a probability, $0 \leq pseudo-R^2 \leq 1$, and the measure increases as independent variables are added into the specification. (Cameron and Trivedi 2009:345-6) Thus, for the probit model, the $pseudo-R^2$ gives a measure of how much better the specified model performs than a model that contains only a constant as an independent variable. For the standard regression model, the goodness-of-fit is measured by R^2 – $0 \leq R^2 \leq 1$ – which gives the proportion of sample variance of y_i that is explained by the specified model (Verbeek 2008:21).

5.3.2. Specification tests

Regarding the probit estimations, the assumption of homoskedasticity of the error terms may be tested by comparing two alternative models, one with a variance normalised to one and another with a heteroskedastic error term with a non-constant variance, by using a Wald test as described by Cameron and Trivedi (2009:455). As this test detected heteroskedasticity in all of the probit estimations of this study – for the probability of remittances, for the choice

between official and unofficial remittance channels and for the choice between international and internal migration – heteroskedasticity-robust, clustered standard errors are used. In turn, the assumption of normality of the error terms may be tested with a Lagrange multiplier test as described in detail by Verbeek (2008:211-2). In this test, first an alternative distribution that is more general than the normal is specified, and then the restrictions implied by the normal distribution are tested against the alternative. In all of the probit estimations of this study, non-normality was detected by this test.

In terms of the OLS estimations, to test for heteroskedasticity of the error terms, the Breusch-Pagan test, proposed by Breusch and Pagan (1980), is employed. Even though heteroskedasticity was not detected in any of the OLS estimations of this study, heteroskedasticity-robust clustered standard errors are used in the estimations – the resulting test statistics are asymptotically appropriate, whether the errors have constant variance or not (Verbeek 2008:94). In addition, two features of the survey data, explained in more detail in section 6.1.4, justify the use of heteroskedasticity-robust standard errors: first, the survey data of this study has a cluster design, so clustered standard errors should be, and are, used, since they allow for intragroup correlation between the error terms. Second, the observations of data are weighted using probability weights. Specifying these two features in estimations automatically imply the use of heteroskedasticity-robust standard errors (Baum 2006:138; StataCorp 2009:309).

5.3.3. Marginal effects

The coefficients of the probit model can not be interpreted in a straightforward manner. Thus, for a continuous independent variable x_{2ik}, the marginal effect is the partial derivative of the probability that $y_i = 1$. The marginal effect at some specific point, given vector x_{2i}, is given by

$$\partial P\{h_i = 1\} / \partial x_{2ik} = F'\left(x_{2i}'\beta_2\right)\beta_{2k}, \tag{5.17}$$

where $F'(z) = \partial F(z)/\partial z$. Thus, the effect of a change in x_{2ik} depends on the values of x_{2i}. Often marginal effects are computed for the 'average' observation, in which case x_{2i} is replaced with sample averages in previous estimations. However, it is possible also to compute average marginal effects, which are given for continuous independent variables by

$$\frac{1}{N}\sum_i F'\left(x_{2i}'\hat{\beta}_2\right)\hat{\beta}_{2k}\,, \tag{5.18}$$

and for discrete independent variables by the average of the discrete differences in the predicted probabilities. (Cameron and Trivedi 2005:467) While a marginal effect at a point gives an estimate of the marginal effect at chosen covariate values, an average marginal effect gives an estimate of a population-averaged marginal effect.

In the standard regression model, i.e. in the second equation of the two-part model, the estimation coefficients themselves give the marginal effects of independent variables on the dependent variable. In this study the dependent variable is on the logarithmic scale, so a coefficient β_{1i} of a discrete or any other non-logarithmic independent variable gives the relative change in y_i owing to an absolute change of one unit in x_{1ik}, referred to as semi-elasticity. If the independent variable is on logarithmic scale as well, then the coefficient β_{1i} of this kind of variable gives an elasticity, i.e. the relative change in the dependent variable owing to a relative change in the independent variable. (Verbeek 2008:55)

It is important to note that in nonlinear models such as the probit, tobit and Heckman selection model, the interpretation of marginal effects of interaction variables is not as unambiguous as in linear models such as OLS. In terms of the probit (and logit) model, this issue is discussed by Ai and Norton (2003:125), who point out that the true interaction effect is not found by looking at the coefficient of the interaction variable in a probit estimation, but by computing cross derivatives. Not following the notation used thus far, this has four implications: first, the interaction effect could be different from zero, even if the coefficient β_{12} of an interaction between variables x_1 and x_2 is zero. Second, the simple t-test on the coefficient β_{12} cannot tests the statistical significance of the interaction effect. Third, the interaction effect depends on the independent variables. Fourth and last, the interaction effect can have different signs for different values of covariates. Thus, the sign of β_{12} may not give the true sign of the interaction effect. (Ibid:124)

Stated formally, the interaction effect of x_1 and x_2 on the dependent variable y_i is

$$\mu_{12} = \frac{\Delta^2 F(x,\beta)}{\Delta x_1 \Delta x_2}, \tag{5.19}$$

which is estimated by

$$\hat{\mu}_{12} = \frac{\Delta^2 F\left(x, \hat{\beta}\right)}{\Delta x_1 \Delta x_2}, \tag{5.20}$$

where the function $F(\cdot)$ is known up to β and twice continuously differentiable, and $\hat{\beta}$ is a consistent estimator of β. These features ensure that also μ_{12} and $\hat{\mu}_{12}$ are consistent.

The asymptotic variance is consistently estimated by

$$\hat{\sigma}_{12}^2 = \frac{\partial}{\partial \beta'}\left[\frac{\Delta^2 F\left(x, \hat{\beta}\right)}{\Delta x_1 \Delta x_2}\right] \hat{\Omega}_\beta \frac{\partial}{\partial \beta}\left[\frac{\Delta^2 F\left(x, \hat{\beta}\right)}{\Delta x_1 \Delta x_2}\right], \tag{5.21}$$

where $\hat{\Omega}_\beta$ is a consistent covariance estimator of $\hat{\beta}$. The t-statistic is given by $t = \hat{\mu}_{12}/\hat{\sigma}_{12}$, which under some regularity conditions has an asymptotic standard normal distribution. (Ibid:125)

In terms of this study, interaction effects and their true marginal effects of interaction variables in a probit model are estimated, when the results obtained with the two-part model for the probability and amount of remittances for the whole group of migrants are contrasted across genders and destinations of migrants. The results obtained with the tobit and the Heckman selection model are not similarly contrasted, as at the moment, true marginal effects of interaction variables in nonlinear models may be estimated in Stata 11 only after probit estimations.

5.4. Semiparametric estimation for censored models: CLAD estimator

The censored least absolute deviations (CLAD) estimation to a regression model where the dependent variable is constrained to be non-negative was first developed by James L. Powell (1984) as a generalisation of the least absolute deviations estimator (LAD). The CLAD estimator is semiparametric, as it is only partly parameterised: the uncensored mean $x_i'\beta$ is parameterised, but the error distribution is not (Cameron and Trivedi 2005:564). As the CLAD estimator starts with a similar problem of a left-censored-at-zero linear model for the latent variable as the tobit model, which is appropriate for modelling the data on the amount of sent remittances, the CLAD estimator is suitable for this purpose, as well.

5.4.1. Standard model and its estimation

In the semiparametric literature, the linear model for the latent variable $y_i^* = x_i'\beta + \varepsilon_i$, which is left-censored at zero, is usually written as

$$y_i = \max\{0, x_i'\beta_0 + \varepsilon_i\}, \tag{5.22}$$

where the dependent variable y_i and the independent variable vector x_i are observed for each *I*, while the parameter vector β_0 and the error term ε_i are not observed. The definition of the LAD estimator starts with the notion that for any scalar random variable *Z*, the function $E[|Z-b|-|Z|]$ is minimised by choosing *b* to be a median of the distribution of *Z*. It is further assumed that the error term ε_i is continuously distributed and has a median zero, and that the density function is positive at zero. What this means is that the median function for y_i takes the form $m(x_i, \beta_0) = \max\{0, x_i'\beta_0\}$. Thus, the probability that $y_i = 0$ when $x_i'\beta_0 > 0$, is less than one-half, and the median of y_i is $x_i'\beta_0$. Conversely, if $x_i'\beta_0 \le 0$, the probability that $y_i = 0$ is more than one-half, and the median of y_i is zero. (Powell 1984:305)

The CLAD estimator $\hat{\beta}_N$ minimizes the sum of absolute deviations of y_i from $\max\{0, x_i'\beta_0\}$ over all β in parameter space *B*, or

$$S_N(\beta) = \frac{1}{N}\sum_{i=1}^{N}\left|y_i - \max\{0, x_i'\beta\}\right|. \tag{5.23}$$

The existence of the minimum is ensured by the parameter space *B* being compact. However, the behaviour of the regression function $x_i'\beta_0$ must be restricted to ensure that the LAD estimator $\hat{\beta}_N$ is unique for large samples: the censored sample median provides a consistent estimate of the population median, if less than a half of the sample is censored. Moreover, the independent variables x_i are required not to be collinear for the uncensored observations. (Powell 1984:305-6; Cameron and Trivedi 2005:564)

5.4.2. Assumptions

To sum up the assumptions made that ensure the consistency of the CLAD estimator $\hat{\beta}_N$, first the parameter vector β_0 must be an element of a compact parameter space *B*. Second, the

error terms ε_i must be independently and identically distributed, independent of the independent variables x_i, and have a median zero. Moreover, the distribution function of ε_i must be continuously differentiable with density f that is positive at zero and bounded above, i.e.

$$f\left(\lambda \middle| x_i\right) > k > 0, \tag{5.24}$$

whenever $|\lambda| < k$, some $k > 0$, all *i*.

Third, the independent variables x_i must be independently distributed random variables with $E\|x_i\|^3 < K_0$ for all *I* and some positive K_0. Moreover, the smallest characteristic root v_i of the matrix

$$E\left[\frac{1}{N}\sum_i 1\left(x_i'\beta_0 \geq \varepsilon_0\right)x_i x_i'\right] \tag{5.25}$$

has $v_i > v_0$ whenever $N > N_0$, some positive ε_0, v_0 and N_0.

Clearly, the assumptions on the distribution of the error term ε_i are much weaker than those required for consistency of the maximum likelihood or least squares estimators for the censored regression model. Moreover, some of the assumptions made above may even be relaxed. It is sufficient that the conditional distribution of ε_i given x_i has median zero for all *I*, and the corresponding distribution functions for ε_i only need to be continuously differentiable in a uniform neighbourhood of zero, with density functions as shown in equation (5.25). Importantly, even the assumption of homoskedasticity is not needed for the consistency of $\hat{\beta}_N$, as the conditional median of the dependent variable will still be of the form $\max\{0, x_i'\beta_0\}$. Under some further assumptions, $\hat{\beta}_N$ is also asymptotically normal, which holds even if the error terms ε_i are heteroskedastic. (Powell 1984:307-12).

The facts that the consistency of the CLAD estimator does not depend on the functional form of the error terms, and that it is robust to heteroskedasticity of the error terms ε_i makes the estimator for the censored regression model an attractive alternative to the sensitive maximum likelihood estimator – employed by both the tobit model and the Heckman selection model –

which is rendered inconsistent when either non-normality or heteroskedasticity are detected. As both of these were indeed detected in this study after the estimation of the tobit model, CLAD estimations were carried out. However, the practical estimation proved troublesome due to non-convergence, and the estimation could be carried out properly only with the Senegalese data. Moreover, the censored sample median would not even have provided a consistent estimate of the population median in the case of Uganda, where more than a half of the sample is censored. The CLAD estimation of the probability and amount of remittances for Senegal are presented in appendix 4 and may be considered as a robustness check to the tobit, Heckman selection and two-part model estimates for Senegal discussed in sections 7.2.1, 7.2.2 and 7.2.3.

6 Data

The data used in the empirical estimations comes from Migration and Remittances Household surveys conducted as a part of the Africa Migration Project, which was jointly implemented by the World Bank and the African Development Bank in 2009 and 2010. The intention of the project was to increase the information on, and to increase the development impact of migration and remittances in Sub-Saharan Africa. (The World Bank 2011a) Surveys were conducted in Burkina Faso, Kenya, Nigeria, Senegal, South Africa, and Uganda. and covered recent migration and remittance trends, housing conditions, household assets and expenditures, use of financial services, internal and international migration and remittances from former household (and non-household) members, and return migration. A single-round, cross-sectional survey was implemented in the above-mentioned six countries, but different sampling designs were employed in each of them so as to obtain representative samples of households. (Plaza et al. 2011:6-9) The Ugandan, Senegalese and Nigerian survey data may be obtained from the World Bank Microdata Catalog (DECDG 2011).

Uganda, Senegal and Nigeria were chosen for this study, as their samples were the only ones that were nationally representative. In section 6.1, the coverage, methodology and sampling procedure of the Ugandan, Senegalese and Nigerian surveys are briefly presented. It is also discussed how the sampling designs affect the subsequent estimations, and what limitations the empirical data used in the estimation has. In section 6.2, the independent and dependent variables used in the empirical estimations of this study – the probability and amount of remittances, the choice between official and unofficial remittance channels and the choice between international and internal migration – are described. Section 6.3 presents some

statistical findings made from the estimation samples, and section 6.4 discusses the possible threats to the internal validity of the study.

6.1. Sampling designs of Migration and Remittances Household Surveys

6.1.1. Ugandan Migration and Remittances Household Survey

In 2010, Makerere Statistical Consult Limited conducted the Migration and Remittances Household Survey in Uganda. Only its main features discussed here, but for a more detailed description of the survey methodology, one may refer to the methodological report by Makerere Statistical Consult Ltd (2011). The survey data collected in Uganda is representative of the whole nation, and as a frame for sample selection, the 2002 Population and Housing Census was used – 1,940 households were ultimately selected.

The sampling frame was subsequently divided into two strata, rural and urban, and a two-stage stratified sampling was carried out. At the first stage, 200 enumeration areas, i.e. the primary sampling units were selected from each stratum, and at the second stage, 10 households per enumeration area were selected from three strata of households – households without migrants, households with internal migrants and households with international migrants. Because the enumeration areas were selected proportionally and because stratification was employed at both sampling stages, the sample is not self-weighting, so the probabilities of households being selected are not equal. To make the sample representative of the whole nation, weights were attached to the sampled units at each of the two sampling stages, and these weights were multiplied with each other to yield the final household weights. (Makerere Statistical Consult Limited 2011:3-7).

6.1.2. Senegalese Migration and Remittances Household Survey

The Senegalese Migration and Remittances Household Survey was conducted by Consortium pour la Recherche Economique et Social (CRES) in 2009 – for the full methodology report, one may refer to the manual composed by the World Bank and CRES (2009). The survey data collected from Senegal is nationally representative, and the sampling frame used for the survey was the 2002 General Population Census – altogether, 2,100 households were interviewed.

A two-stage stratified sampling design was adopted: at the first stage, 100 census districts, i.e. primary sampling units, were selected and they were categorised into six strata, defined by whether they had high or low migration, and by whether the region was urban Dakar, other

urban or rural. At the second stage, 21 households per census district were selected from three strata of households: 7 households without migrants, 7 households with internal migrants and 7 households with international migrants. The census districts were chosen proportionally, and combined with the stratification at both levels of the sampling design, the data needed to be weighted to make it nationally representative. (The World Bank and CRES 2009:3-4)

6.1.3. Nigerian Migration and Remittances Household Survey

The Nigerian Migration and Remittances and Household Survey was conducted by Zibah Consults Ltd in 2009. Due to the sampling procedure of the Nigerian migration and remittances household survey being highly complex, only a coarse outline of it is given here – for a detailed description of the survey design, one may refer to the methodology report by Zibah Consults Ltd (2011). The survey data collected in Nigeria is representative of the whole nation, and the sampling frame used in the survey was the 2006 National Population Census – 2,251 households were successfully interviewed.

All in all, the sample selection had four stages. At the first stage, 17 states, i.e. primary sampling units, were selected from two strata of states with high and low migration rates. For the high migration rate stratum, 12 states were randomly selected at the first stage, with one state falling into the sample twice; at the second stage, two local government areas were randomly selected from each sample state; at the third stage, two enumeration areas were randomly selected from each sample local government area. For the low migration rate stratum, six states were randomly selected at the first stage; at the second stage, one local government area from each sample state were selected; at the third stage, two enumeration areas were randomly selected from each sample local government area. At the final stage of the sampling, irrespective of the state-level strata, households were selected from three strata of households – households without migrants, households with internal migrants and households with international migrants – through three different procedures, resulting in 20-25 or 34 households per enumeration area being selected.

Both stratification and disproportionate random sampling were employed to ensure that households with international migrants were adequately represented in the sample. Thus, the sample is not self-weighting, so weights were attached to the sampled units at each sampling stage. These four weights were then multiplied with each other to obtain the final sampling weight for each sample household and to make the sample nationally representative. The final

sampling weight is the inverse of the probability of a household being selected in the sample arising from the sampling design. (Zibah Consultants Ltd 2011:5-7, 15-17, 23-27)

6.1.4. Effects of sampling designs of Migration and Remittances Household Surveys

Due to the sampling designs adopted in each of the countries under study, the survey data are influenced by stratification, cluster sampling, and sampling weights. Each of these features affect the way the data should be used in the estimations, and ignoring them may result in bias in the estimates and/or their standard errors.

First, taking stratification into account in estimations can reduce sampling variability compared to simple random sampling, whenever the means differ across strata. This is due to the strata being statistically independent of one another, making the variance dependant only on within-stratum variance, but not on between-stratum variance. It will have the most significant effect in making standard errors of estimations smaller when the stratum means are different from one another, and when the data is rather homogenous within the strata. (Deaton 1997:13-4, 49) Despite detecting rather significant differences in means between the different strata defined at the first stages of all three sampling designs, due to practical difficulties stratification had to be ignored in the estimations of this study, leading possibly to higher standard errors, and consequently to more conservative estimates.

Second, survey data from each of the countries is clustered, meaning that households and individuals are not sampled independently. For instance, in the four-stage sample design employed in Nigeria, the data is first clustered by states, then by so-called local government areas, and then by so-called enumeration areas. It is typical that clustering – in comparison to simple random sampling – increases the variance of estimated means and the standard errors of the least squares regression, since households within clusters tend to be similar to each other in their relevant features. In consequence, standard errors are scaled upwards and t-values downwards, producing more conservative estimates compared to an estimation ignoring the cluster design. (Deaton 1997:52, 74-5) Thus, the clustering by different administrative areas at the first stages of the three sampling designs – in Uganda by enumeration areas, in Senegal by districts, and in Nigeria by states – is taken into account in the estimations by using clustered standard errors that relax the assumption of independence of observations within the clusters. The usage of these standard errors entails also the usage of heteroskedasticity-robust standard errors (Baum 2006:138).

Finally, due to disproportionate sampling, each surveyed household in each of the countries under study represents a different number of households in the population, i.e. has a different sampling weight attached to it. By weighting the sample data, the sample design is "undone": each group of households is properly represented, and unbiased estimates of means matching the population are obtained. Also the standard errors are affected by weighting. (Deaton 1997:15, 48) However, there are different opinions about whether these sampling weights should be taken into account in estimations. Even though the case can be made that weighting should be ignored in regressions due to the weighted estimator often being inconsistent, sampling weights are taken into account in the estimations of this study: Referring to Kish and Frankel (1974), Deaton (1997:66-73) states that if the regression function itself is the main object of interest, and if it mainly attempts to study the relationships between variables by looking at some variable mean conditional on others, then weights should be used. This is indeed the case in this study.

6.1.5. Limitations of data

Due to the wide sample coverage of the surveys, and the careful sampling procedures, the data may be expected to be of rather high quality and to represent the Ugandan, the Senegalese and the Nigerian population well. However, Plaza et al. (2011:14) point out that sampling error may be of an issue, and there might be biases in the samples achieved, which occur if a section of the population is under-represented, or if some questions are not answered by a large proportion of people. Moreover, in terms of the Nigerian survey, Zibah Consultants Ltd (2011:27) note that there are both sampling and non-sampling errors present, arising from incorrect information given by the respondents, interviewer errors and data entry errors. In Uganda, some of the households selected could not be visited, and some households provided only incomplete information (Makere Statistical Consult Limited 2011:12). Lastly, the amount of detail about some topics may not be that high, as the surveys were not intended to provide "economic" statistics (Plaza et al. 2011:14).

In terms of this study, this last issue is particularly evident: for instance, there is no data on the income of migrants or households, which are often the key determinants of remittances. It should also be noted that migrants themselves were not interviewed, but their former household members. Further, the occurrence of missing values for some variables is rather frequent, and the possibility of imprecise information undermine the representativeness and quality of the underlying data, as well as the internal validity of the estimations. The internal

validity may be weakened by several other factors, as well, which are discussed in more detail in section 6.4.

6.2. Variables used in estimations

As regards the data used in estimations, data on only household member migrants is utilised – the Migration and Remittances Household Surveys contain data on non-household member migrants and their remittances, as well – as the intention of this study's estimations is to examine the determinants of remittances in a familial context. Many of the variables used in the estimations were not readily available in the data but needed to be constructed from other variables by the author, for instance by transforming variables with several discrete alternatives into a group of binary variables.

In section 6.2.1, the estimation of the probability and amount of remittances is discussed: the dependent and the independent variables, as well as the identification variable of the Heckman selection model are elaborated on and justified, and the specifications of different models are presented. In section 6.2.2 and 6.2.3, the same is done for the estimations of the choice between official and unofficial remittance channels, and of the choice between international and internal migration, respectively.

The variables used in the empirical analyses of this study are defined, and their non-weighted sample summary statistics are presented in appendix 1. It should be noted that from some of the households in each of the countries under study, data on more than one migrant was collected. Thus, some households appear in the data more than once.

6.2.1. Estimation of probability and amount of remittances

6.2.1.1. Dependent variables

In the models for the probability and amount of remittances, the continuous dependent variable in the tobit model, in the Heckman selection model's outcome equation and in the two-part model's second equation is the logarithm of the amount of monetary remittances sent to the household during the preceding 12 months (named *log amount remitted*) – measured in each country's local currency – and it does not include the value of in-kind remittances. As the linear non-zero amount of remittances has a highly skewed distribution, the logarithmic scale produces a more symmetric distribution and is more likely to have a normal error distribution. This is ultimately not the case, however. In the Heckman selection model's participation equation and in the two-part model's first equation, a binary dependent variable

indicating whether the migrant has sent any remittances during the preceding 12 months is used (named *sends money*).

Estimations in which the continuous dependent variable included the value of in-kind remittances were also carried out: the results were rather similar to the estimates obtained with only monetary remittances, both in terms of the sign and the magnitude of the estimates as well as their significance levels, giving robustness to the estimations. Still, the value of in-kind remittances was left out from the final estimations, as estimating this value over the course of 12 months is likely to be rather imprecise. In general, however, the information obtained with household surveys give a better picture of the true amount of remittances than official statistics, which record remittances sent only through official channels.

6.2.1.2. Independent variables

Migrant-related variables

The independent variables appearing in the estimations may be divided into migrant- and recipient household-related variables. The migrant-related independent variables appearing in all estimations, with their names in parentheses, indicate the migrant's age (*age*), whether he is male (*sex*), whether he is married (*married*), whether he lives alone (*lives alone*), whether he is the son or daughter of the household head at home (*son*), whether he is employed (*employed*), how long his migration has lasted (*duration*), whether he migrated for work (*reason*), and where he originated from (*origin state/region*). There are 17 origin states for Nigerian migrants, and 11 and 5 origin regions for Senegalese and Ugandan migrants, respectively. In addition, there are three migrant-related characteristics that are each described with four indicator variables, of which one acts as the reference group and is left out of the specifications to avoid exact multicollinearity. These variables indicate the level of schooling the migrant has completed (*primary, secondary* and *tertiary* – reference group has no education), the level of his occupation (*professional, service* and *agriculture & crafts* – reference group works in elementary occupations) and where he is currently residing (*OECD, Africa* and *urban Uganda/Senegal/Nigeria* – reference group resides in rural Uganda/Senegal/Nigeria).

As mentioned in section 6.1.5, the data contains no information on the income level of the migrant, which is crucial in determining the probability and amount of remittances. Hence, some of the abovementioned independent variables need to act as proxies for this income.

Referring to the standard human capital model, in Agarwal and Horowitz's (2002) study the migrant's income is proxied with several variables indicating his education, the duration of his migration, his country of residence, and his gender. Also de la Brière et al. (2002:319) use a similar approach by referring to Mincer's (1974) earnings function, and proxy the migrant's income and asset position with the migrant's gender, his age, his age squared, his education, the time he has spent in the migration location, the time he has spent in the migration location squared, a dummy variable indicating whether he is residing in the US, and a dummy variable for whether he has dependent children in his current country of residence. The usage of the last variable is explained by the fact that if the migrant has children in his current country of residence, the migrant is likely to divide his income between providing for his children and sending remittances back home (de la Brière et al. 2002:319).

Following these lines, variables *age, sex, lives alone, duration, primary, secondary, tertiary, OECD, Africa* and *urban Uganda/Senegal/Nigeria* are used as proxies for the migrant's income, which is expected to increase from the effect of these proxies. In addition, as it could be expected that income depends positively on employment and occupation, variables *employed* and *professional, service, and agriculture & crafts* are used as additional proxies for the migrant's income. The effects of all of these variables may thus be interpreted as an indicator of the effect that the migrant's income has on remittances. To note, specifications in which the migrant's age and the duration of his migration were in their level and squared forms were also tested, but the coefficients of the squared terms were insignificant and mostly of the incorrect sign, and were thus left out of the final specification. The addition of the squared terms would have described how the migrant's work experience in his migration location might have been related to his income in an inverse U-shaped manner. This, in turn, could have produced a similar relationship between these variables and the remittances he sends – however, this was not the case.

In addition to their effects through the migrant's income, the individual effects of some of the above-mentioned proxies should also be examined, as they are important indicators of some of the motives for remitting. Such are the variable *duration*, and those relating to the education level of the migrant: with the former, the presence of the altruistic and the insurance motive may be detected and distinguished from one another, while the latter group of variables is an important indicator of, and may distinguish between, the exchange and the investment motive.

Moreover, in the spirit of Amuedo-Dorantes and Pozo (2006), the variable *employed* could also be seen as a proxy for the income risk the migrant is facing, and indicate whether the migrant attempts to insure himself with remittances. The authors predict that a migrant facing a lower income risk remits less than one facing a higher income risk, as the latter tries to ensure that he will receive support from his family back home in case he needs to return. Alternatively, remittances motivated by self-insurance may be accumulated as savings in the migrant's home country that they can tap on in times of income insecurity.

Recipient household-related variables

The recipient household-related variables present in the estimations indicate the number of household members in the recipient household (*size of HH*), whether the recipient household owns any land or buildings (*assets*) and the recipient household's expenditure during the last six months (*expenditure*). This expenditure is expressed in logarithms of local currency, includes expenditure on clothing and footwear, household appliances, mobile phone/internet bills, utilities, education, health, rent and loan/mortgage repayment, and excludes all more irregular purchases such as computers, luxury goods, weddings, land, housing and home improvement. While the size of the household acts mainly as a control variable, the recipient household's assets are an important indicator of the inheritance motive. As there is no data on the long-run income of the recipient household, a proxy for it is the recipient household's expenditure during the past six months. The recipient household's income is a particularly important indicator of the exchange and investment motives. Whether the latter explains remittance behaviour of migrants is tested with separate estimations where the expenditure appears in its level and squared form in order to capture its U-shaped relationship to the dependent variable predicted by the investment motive (Rapoport and Docquier 2006:1159).

Moreover, with the Senegalese data, variables indicating the number of international migrants from the same household (*international migrants*), the number of international migrants from the same household squared (*international migrants^2*) and whether the migrant received funding for his migration from his parents (*parental funding*) are included in an additional specification for the probability and amount of remittances. While the number of other migrants tests for the presence of the inheritance motive, the effect of parental funding on remittances gives insight into whether migrants are motivated by investment considerations and repaying the costs of their migration. Estimations testing the effect of the number of

internal migrants from the same household were also carried out, but it did not have a statistically significant impact on the probability or amount of remittances.

With the Nigerian data, variables that indicate the level of the recipient household member's occupation (*professional HH member, service HH member* and *agriculture & crafts HH member*), the level of schooling he has completed (*primary HH member, secondary HH member* and *tertiary HH member*) and whether he is employed (*employed HH member*) are included in an additional specification for the probability and amount of remittances. Each of these variables act as further proxies for the recipient household's income. Even if this interviewed household member is not the primary recipient of the migrant's remittances, it is likely that the presence of professionals or highly educated household members in the household, and their presumably higher income, affect the whole household's income, and thus is likely to be accounted for by the migrant when he makes his remittance decision.

Moreover, there is no data on any adverse short-run shocks on parental income, or variables that could acts as proxies of these shocks. Thus, their effect on remittances cannot be tested, which would be of value especially considering the hypotheses arising from the insurance motive. However, variable *employed HH member* found in the Nigerian data can be used as an indicator of the recipient household's income risk, and its effect on remittances may signal whether the migrant and the recipient household have an insurance contract between them: if a household member is employed, i.e. the household does not face a severe income risk, under the insurance motive the household should receive less remittances.

Interaction variables

After the estimations of the probability and amount of remittances for all migrants, the two-part model estimations are contrasted across genders and destinations of migrants, as it is reasonable to expect that migrants are heterogeneous, and different groups of migrants differ in their motives for remittances. To compare male and female migrants' remittance behaviour, a dummy variable characterising male migrants, named *male* instead of *sex* for clarity, is interacted with variables *OECD, tertiary, employed, assets of HH* and *expenditure of HH*. The resulting interaction variables, named *male*OECD, male*tertiary, male*employed, male*assets of HH* and *male*expenditure of HH*, are then added to the "base specification" of the two-part model reviewed in section 6.2.1.4. Similarly, the possible difference in motives for remitting of between migrants residing in OECD countries and those residing in other

countries was separately examined with interaction variables named *OECD*male*, *OECD*tertiary*, *OECD*employed*, *OECD*assets of HH* and *OECD*expenditure of HH*.

The variables *tertiary, employed, assets of HH* and *expenditure of HH* are chosen to be interacted because they are important signals of the various motives for remitting, as explained in chapter 2. It should be noted, however, that the specific prediction of the investment motive, i.e. the inverse U-shaped relationship between the recipient household's expenditure (income) and remittances, cannot be meaningfully tested for in the specifications including the interaction variables.

As elaborated on in section 5.3.3, in nonlinear models such as the probit, tobit, and Heckman selection model, the interpretation of interaction variables is not exactly straightforward, since the marginal effect of changing just the interaction variable does not equal the marginal effect of a change in both interacted variables. There is a way of handling this issue with probit models in Stata 11, enabling the inspection of the true interaction effects through the two-part model consisting of a separate probit and OLS estimation. (Norton et al. 2004:154-5) However, this is not the case, yet, with the tobit model and the Heckman selection model. To note, estimations were also performed by splitting the sample according to the gender and to the destination of the migrant, but this approach has the drawback of unreliable estimates due to the smaller sample size, and does not test properly the behavioural models behind different groups of migrants.

6.2.1.3. Identification variable of Heckman selection model

The identification variable of the Heckman selection model warrants some discussion. As mentioned in section 5.2.2, the model needs to be identified by having at least one variable in the participation equation that does not enter the outcome equation. This variable should affect significantly only the decision on whether to remit, and not the decision on the amount remitted. While such a variable is difficult to determine using theory, several alternatives were tested based on suggestions made in previous studies employing the Heckman selection model.

The identifying variable chosen for this study is a binary variable indicating whether the migration has lasted for more than one year (*duration > 1 year*). This variable is used by Hoddinott (1992) and Agarwal and Horowitz (2002), who propose that it may take time for the migrant to settle in the new host country, resulting in a lag in the remittance flow

initiation. While this non-theoretical justification seems plausible in itself, the variable enters the participation equation significantly in the case of Senegal and Nigeria, and nearly significantly in the case of Uganda. Moreover, it did not affect the amount remitted statistically significantly, when included in an OLS estimation of the positive amount of remittances.

Other identifying variables tested were binary variables for migrant living alone and for being the household head (see e.g. Amuedo-Dorantes and Pozo 2006), and the origin state/region of the migrant (see e.g. Amuedo-Dorantes and Pozo 2006; Gubert 2002; Hoddinott 1992). A theoretical justification for the latter would be that the origin region of the migrant indirectly captures the transactions costs of remitting funds, as money transfer fees or travelling expenses associated with officially and unofficially sent remittances, respectively, vary with the geographic location of the recipient household (Gubert 2002:277, 286) While these identification variables entered some of the participation equations significantly, according to the Bayesian information criterion, having the duration variable as the identifying variable gives the best fit of the model for the Senegalese and Nigerian data.

6.2.1.4. Empirical specifications

The form of the specifications that follow conforms with, where possible, the list of variables in table 1, which summarises the predictions of models for motives for remitting. Starting with the specification of the tobit model, the "base specification" estimated in sections 7.1.1, 7.2.1 and 7.3.1 for Uganda, Senegal and Nigeria, respectively, may be written as

$$\begin{aligned} &\textit{log amount remitted} = \alpha + \beta_1 \textit{*migrant's income} + \beta_2 \textit{*migrant's education} \\ &+ \beta_3 \textit{*time since arrival} + \beta_4 \textit{*migrant's income risk} + \beta_5 \textit{*control variables} \\ &+ \beta_6 \textit{*recipient household's income} + \beta_7 \textit{*recipient household's assets} + \varepsilon, \end{aligned}$$

The dependent variable of the specification is continuous and indicates the logarithmic amount of remittances. The independent variables included in the specification, and their interpretation as proxies, are elaborated on in section 6.2.1.2.

In terms of the Heckman selection model, the specification for the probability of remitting, i.e. for the participation equation is the following:

$$sends\ money = \alpha + \beta_1 * migrant's\ income + \beta_2 * migrant's\ education + \beta_3 * time\ since\ arrival + \beta_4 * migrant's\ income\ risk + \beta_5 * control\ variables + \beta_6 * recipient\ household's\ income + \beta_7 * recipient\ household's\ assets + \theta * duration > 1\ year + \varepsilon,$$

where the identification variable *duration > 1 year* is utilised, and the dependent variable is binary indicating whether or not the migrant sends remittances. The outcome equation is specified similarly as the one for the tobit model:

$$log\ amount\ remitted = \alpha + \beta_1 * migrant's\ income + \beta_2 * migrant's\ education + \beta_3 * time\ since\ arrival + \beta_4 * migrant's\ income\ risk + \beta_5 * control\ variables + \beta_6 * recipient\ household's\ income + \beta_7 * recipient\ household's\ assets + \varepsilon.$$

The equation specifications of the two-part model are the same as those of the Heckman selection model, but in the two-part model the variable *duration > 1 year* is not included in the first equation. As mentioned in section 6.2.1.2, additional specifications were estimated with the Senegalese and Nigerian data, but as they only add a few variables to the base specifications described above, it is not necessary to present these specifications here.

6.2.2. Estimation of choice between official and unofficial remittance channels

6.2.2.1. Dependent variable

In the probit model for the choice between official and unofficial remittance channels, the binary dependent variable indicates whether or not the migrant used official channels for remitting (named *channel*). The channels regarded as official include the following: Western Union, Moneygram, other money transfer operators, postal money orders, direct transfers to bank account, banks, Forex, credit unions, and travel agencies. If the migrant sent remittances through informal individual agents, through friends or relatives, through couriers, brought remittances back home himself, or used a mobile phone, a pre-paid card, the internet or some other means for remitting, the channel was regarded as unofficial.

Studies on the use of remittance channels reviewed in section 3.2 use a multinomial logit model, in which the dependent variable contains several discrete alternatives of remittance channels. This approach is not employed in this study for two reasons. First, the 17 different remittance channels recorded by the household surveys could not be plausibly grouped into three or more groups: either some channels would have had to be dropped altogether from the estimations, or a group of "other channels" would have become disproportionately large. The most reasonable grouping, and the grouping used in this study is therefore based on whether

the channels are considered to be official or not. Second, as there is no data on the characteristics of the different remittance channels, it is possible to examine only the effects of different migrant- and recipient household-related characteristics on the choice between these channels in the estimations. Thus, as there are no other known factors that could distinguish between the different remittance channels, the distinction between official and unofficial remittance channels must suffice in terms of examining the effects of migrant- and recipient household-related independent variables.

6.2.2.2. Independent variables

It is likely that similar independent variables as used in the estimation of the probability and amount of remittances determine the choice between official and unofficial remittance channels. The variables chosen also reflect the theoretical framework for remittance channels described in chapter 3.

The independent variables in the estimation of the choice between official and unofficial remittance channels are precisely the same as those used in the estimation of the probability and amount of remittances, elaborated on in section 6.2.1.2. It is expected that the choice is affected by both migrant- and recipient household-related characteristics – especially by both the migrant's and the recipient household's incomes. As using official remittance channels usually entails costs or other requirements set by different remittance service providers, either the migrant or the recipient household may be excluded from using these channels in case their incomes are low (see e.g. Ngugi and Sennoga 2011:260; Agu 2011:209-10).

Thus, attention should be paid to the effects of variables that act as proxies for the migrant's and the recipient household's incomes, discussed in section 6.2.1.2. In addition to the proxies of the recipient household's income, variable *assets of HH* may also be considered as one, as it is likely to be positively correlated with the recipient household's income. Moreover, at least in the context of Uganda it has been found that international remittances are usually sent through official channels: thus, the individual effects of variables *OECD* and *Africa* – not just the effects they have through their relationship with the migrant's income – are of special interest, as well (Ngugi and Sennoga 2011:250). Also the hypotheses of Amuedo-Dorantes and Pozo (2005:559-60) regarding the individual effects of different migrant- and recipient-household characteristics mentioned in section 3.1 should be kept in mind when examining the estimation results.

In these estimations, differences between male and female migrants, or between international and internal migrants, are not inspected as is done in the estimations of the probability and amount of remittances. First, it is not clear which independent variables should have been chosen to be interacted in the way explained in section 6.2.1.2. Second, splitting the estimation sample into two according to the gender or the destination of the migrant would have resulted in unreliable estimates due to small sample size.

6.2.2.3. Empirical specification

Referring to the discussion in the previous section, the following specification is meant to highlight the effects to which specific attention should be paid when examining the estimation results in chapter 7. Thus, the probit model specification for the choice between remitting through official and unofficial channels may be expressed as

$$channel = \alpha + \beta_1 * migrant's\ income + \beta_2 * migrant's\ destination + \beta_3 * control\ variables + \beta_4 * recipient\ household's\ income + \varepsilon.$$

To sum up, the dependent variable is binary and indicates whether the migrant resorts to official or unofficial remittance channels. The independent variables in the specification should be interpreted as described in the previous section.

6.2.3. Estimation of choice between international and internal migration

6.2.3.1. Dependent variable

In the probit model for the choice between international and internal migration, the binary dependent variable indicates whether the migrant is sent abroad, i.e. to OECD or African countries, or to urban or rural parts of his home country (*destination*). Estimations in which the dependent variable indicated whether the migrant is sent to an OECD country or to an African country, including his home country, were also carried out, but their results were rather similar to the ones presented, and are not thus reported. Estimating a multinomial probit model, with which a choice between more than two alternative destinations could have een examined, could have also been possible, but the estimations could not be carried out due to non-convergence.

6.2.3.2. Independent variables

Regarding the estimation of the choice between international and internal migration, the variables are almost the same as those used in the estimation of the probability and amount of remittances, but the interpretation of some of them differs slightly from what has been stated

earlier. These interpretations, and the choice of the variables altogether, is guided by the model of migration decisions developed in chapter 4.

Quite naturally, the independent variables in the specification do not contain the variables indicating the migrant's current residence, as they form the dependent variable. Thus, variables *age, sex, lives alone, duration, primary, secondary, tertiary, employed, professional, service* and *agriculture & crafts* act as proxies for the migrant's expected, in contrast to his actual, income. Especially the variable *duration* and those depicting the migrant's occupation need to considered as potential, or intended states of the migrant, since the duration of migration nor the occupation of the migrant may not be known ex ante.

As mentioned in chapter 4, the variables indicating the migrant's education may reflect the possibly disparate chances of finding work, and the possibly disparate returns to education between different skill groups of migrants. These may be different depending on the migrant's country of residence, as well. Also variables *employed* and *reason* should be interpreted in the light of the household's perception of the migrant's chances of finding work in his destination country. In terms of variable *reason,* if the migrant intends to work or search for work in the destination country, it is likely that he is sent to a location where the household perceives this to be most likely. In addition, the variable gives an indication of whether the migration of a household member is even considered as a way for the household to earn supplementary income in the form of remittances: this is likely to be the case when the migrant is sent outside the household to work.

In turn, the recipient household's expenditure still is a proxy for its income, but more specifically it reflects the household's need for supplementary income in the form of remittances. The same goes for the variable *size of HH,* which is also related to the likelihood of sending a migrant outside the household in the first place, as discussed in section 4.2. Also the variable *assets of HH* is likely to demonstrate its effect, if any, through its presumably positive correlation with the recipient household's income.

In the specifications for Senegal and Nigeria, a couple of additional variables are included in the specifications. In the case of Senegal, variables *international migrants* and *internal migrants* indicate the number of other migrants residing abroad and in Senegal, respectively. It could be expected that the migrant is more likely sent abroad, if there already are migrants from the same household residing abroad. This may especially be the case if the household

intends to send the migrant to the same location as the previous one(s), as he would then have an existing social network to help him adjust to the new environment.

In the case of Nigeria, variables *primary in HH, secondary in HH, tertiary in HH, professional in HH, service in HH* and *agriculture & crafts in HH* indicate the household's education and occupation level. As mentioned in section 4.2, these variables are likely to affect the likelihood of the household sending a migrant in the first place, but they also reflect household's need for supplementary income, i.e. remittances: as the levels of education and occupation tend to correlate positively with earnings, it could be expected that households with highly educated members, or members in professional level occupations are more able to sustain themselves and escape from destitution than households with less qualified members.

In these estimations, differences between male and female migrants are not inspected as is done in the estimations of the probability and amount of remittances. First, it is not clear which independent variables should have been chosen to be interacted in the way explained in section 6.2.1.2. Second, splitting the estimation sample into two according to the gender of the migrant would have resulted in unreliable estimates due to small sample size.

6.2.3.3. Empirical specification

The probit model specification for the choice between international and internal migration may be expressed as

$$destination = \alpha + \beta_1 * migrant's\ expected\ income + \beta_2 * migrant's\ potential\ occupation + \beta_3 * potential\ duration\ of\ migration + \beta_4 * likelihood\ of\ employment + \beta_5 * control\ variables + \beta_6 * recipient\ household's\ income + \varepsilon.$$

In sum, the dependent variable is binary indicating whether the migrant is sent abroad or to another location within his home country. The independent variables and their interpretation are as described in the previous section, and those with a special interpretation have been brought to the fore in the specification. As mentioned, the specifications for Senegal and Nigeria include a few additional variables, but it is not necessary to present them separately.

6.3. Characteristics of migrants and recipient households

Table 2 summarises some of the main characteristics of migrants and recipient households in Uganda, Senegal and Nigeria, broken down by the destination country of migrants. The calculations are made by the author and are based on the Migration and Remittances

Household Survey data on Uganda, Senegal and Nigeria, and more particularly, on the samples used in the empirical estimations. In appendix 1, definitions and general summary statistics – means, standard deviations, maxima, minima and number of observations – are given for all variables used in the empirical estimations, except for the variables indicating the migrant's origin state/region. The averages and proportions are unweighted, so they cannot be interpreted as statistics representing the entire population of the respective countries.

Regarding table 2, it should first be noted that migration from Uganda, Senegal and Nigeria is primarily internal, and only from Senegal, more than a half migrate abroad. Interestingly, migration from Senegal and Nigeria to other African countries is less popular than migration to OECD countries. However, it should be remembered that the household surveys oversampled households with international migrants. In terms of migrant characteristics, migrants from all countries residing in OECD countries are slightly older on average than migrants residing in Africa, and especially Senegalese and Nigerian migrants are predominantly male. Regarding the migrants' education level, most Ugandan and Nigerian migrants residing in OECD countries have completed either tertiary or secondary level education, while over a half of Senegalese migrants residing in OECD countries have not completed either of these.

These differences in education levels are likely to be reflected also in the employment patterns of migrants residing in OECD countries: while about 77 percent of Ugandan and Nigerian migrants are employed, and 36 and 68 percent of them work in professional level occupations, respectively, 70 percent of Senegalese migrants are employed, and only 12 percent of them work in professional level occupations. What is slightly peculiar, however, is that even though Nigerian migrants seem to fare really well employment- and occupation-wise, only 45-63 percent of them migrated for work or search for one.

When it comes to the characteristics of the recipient household, the large households in Senegal first catches the eye – these are mainly due to polygamy. However, the household size does not seem to vary much according to the destinations of migrants. There are no significant differences in the asset holdings of households with migrants in different destinations, but there are, however, quite distinct differences in the long-run expenditure of households: especially, households with migrants residing in an OECD country spend almost three times as much as households with migrants remaining in Uganda or Nigeria, and about two times as much as households with migrants who remain in Senegal. As the household's

expenditure is a proxy for household's income, this latter finding indicates that wealthier households are more likely to send migrants abroad than poorer ones, as the former have the liquidity required to fund long-distance migration.

In terms of recipient household data available only for Nigeria or Senegal, interestingly, if a Nigerian migrant resides in an OECD country, it is more likely that at least one of his household members is highly educated or works in a professional occupation than if the migrant is residing in an African country, or in urban regions of Nigeria. Thus, the education and occupation levels of the household seem to affect international migration positively. In Senegal, about 70 percent of households have more than one migrant, regardless of the destination of the migrant under study. Not surprisingly, parents fund migrations to OECD countries more often than to closer destinations within Africa, as the costs of migration tend to rise with distance from home.

Regarding the channels used for remitting, the data clearly indicates that the proportion of migrants using unofficial channels depends on where the remittances are sent from: while only 8-20 percent of all migrants residing in OECD countries use unofficial channels such as friends or couriers for remitting, as much as 80 percent of Senegalese migrants remaining in Senegal remit informally. This result is quite natural: visits back home by migrants or their friends are likely to be much cheaper and thus more frequent when the distance is shorter. Combined with the fact that migrants residing in OECD countries send larger remittances, also the relatively better security of official channels may be more important to these migrants than for migrants sending smaller remittances domestically.

There are some differences between countries of origin and between destination countries of migrants in terms of the proportion of migrants sending remittances, and the amounts they send. Firstly, migrants from all countries residing in OECD countries are more likely to remit than migrants residing within Africa. However, only about half of Ugandan migrants residing in OECD countries remit, while the proportion is around 70 and 80 percent in Nigeria and Senegal, respectively. Secondly, migrants from all countries residing in OECD countries remit more – conditional on that they remit at all – than migrants residing within Africa. Nigerian migrants in OECD countries stand out as the ones remitting the most on average, around $2,600 in the previous 12 months, while Ugandan migrants within Uganda send only approximately $161 on average. These differences are likely to reflect the different wages paid to migrants in different destination countries.

Table 2. Characteristics of migrants and recipient households by migration destination

Characteristics/destination	Uganda	Senegal	Nigeria
Destination (%)			
OECD	7	30	17
Africa	11	18	6
Internal	81	47	75
Age (average)			
OECD	31	38	33
Africa	30	36	28
Internal	28	33	27
Gender (% male)			
OECD	56	79	71
Africa	66	86	75
Internal	53	75	61
Education (% tertiary)			
OECD	58	16	58
Africa	24	5	28
Internal	17	14	28
Education (% secondary)			
OECD	28	30	39
Africa	26	14	47
Internal	22	19	45
Employed (%)			
OECD	77	70	77
Africa	69	82	73
Internal	51	67	59
Profession (% professional)			
OECD	36	12	68
Africa	20	5	46
Internal	14	15	45
Reason (% work)			
OECD	85	76	54
Africa	80	84	63
Internal	62	65	45
Number of HH members			
OECD	5	12	6
Africa	5	12	5
Internal	6	11	6

Table 2. continued

Characteristics/destination	Uganda	Senegal	Nigeria
HH owns assets (% yes)			
OECD	83	95	88
Africa	80	97	82
Internal	90	96	85
HH long-run expenditure ($US)			
OECD	1433	1020	724
Africa	458	502	588
Internal	495	501	264
Education in HH (% tertiary)			
OECD			36
Africa			22
Internal			19
Profession in HH (% professional)			
OECD			46
Africa			33
Internal			29
More than one migrant from HH (%)			
OECD		70	
Africa		68	
Internal		69	
Migration funded by parents (%)			
OECD		59	
Africa		39	
Internal		43	
Channel (% unofficial)			
OECD	8	11	20
Africa	41	36	33
Internal	79	80	54
Migrant remitted (% yes)			
OECD	49	78	72
Africa	32	64	45
Internal	25	56	44
Amount remitted ($US)			
OECD	1730	1749	2590
Africa	557	834	1083
Internal	161	549	431

6.4. Threats to internal validity

When estimated coefficients of variables in a regression are unbiased and consistent and their standard errors yield confidence intervals with the desired confidence level, a study based on the analysis of this regression is said to be internally valid. What might render a study internally invalid are omitted variable bias, misspecification of the functional form of the regression function, sample selection, simultaneous causality, and errors in variables (Stock and Watson 2007:316). Some of these points have arisen in the above sections, but here, first four of them are elaborated on from the point of view of the validity of the estimations. The errors in variables and where they arise from is explained in section 6.1.5.

6.4.1. Omitted variables

Omitted variables bias arises when the regression does not include a variable that is both the determinant of the dependent variable, and is correlated with one or more of the included independent variables. When it comes to determinants of the probability and amount of remittances, such variables are, most importantly, the migrant's and the recipient household's income: both of them are likely to correlate with their proxies mentioned in section 6.2.1.2, and are highly likely to affect remittances. Other omitted variables are those depicting shocks to the recipient household's income, such as community-level information on droughts or floods, which could affect remittances through the insurance motive, and be correlated with the recipient household's expenditure.

Also variables related to the migrant's community back home, or to his status and community in his current country of residence would be of interest. Examples of the home-community characteristics could be the migrant's community membership (Massey and Basem 1992) or the social prestige of the migrant's clan (Azam and Gubert 2005): these could both determine remittances and be correlated with the migrant's state or region of origin. In turn, Amuedo-Dorantes and Pozo (2006) study the effects on remittances of a variety of variables related to the migrant's status and community in his country of residence, such as his legal status, fringe benefits on his job, duration of his work experience and the extent of his social networks – these are likely to correlate with the overall duration of the migration and with the migrant's occupation, for instance.

Not only could the inclusion of the above-mentioned omitted variables improve the internal validity of the analysis, but they would also extend its scope and provide valuable insight into

several aspects of the context remittances occur in. However, due to lack of specific enough data, these kinds of variables, or instruments for them, could not be constructed. In terms of the migrant's and the recipient household's incomes, proxies have to be relied upon, as discussed in section 5.2.1.2.

Also the model for the choice of between official and unofficial remittance channels may suffer from omitted variable bias arising from the lack of variables describing the relative prices and other characteristics of the different remittance channels, such as their speed, reliability and convenience: studies mentioned in section 3.2 have found that these factors clearly affect the choice between different channels, and they are also likely to be associated with the migrant's country of residence. Even though an effort has been made by the World Bank (2012b) to measure and record the prices of using different official channels in distinct remittance corridors, in terms of the countries under study, data is still lacking: for remittances from Nigeria and Uganda, no price data exists, and for remittances from Senegal, price data has been recorded only for the corridor Senegal-Mali. In addition, there is no variable nor data describing the recipient household's access to different remittance channels, such as data on the relative rurality of the household: as mentioned in section 3.2, several studies have found this to be an important determinant of the choice between remittance channels, and it is likely to be correlated with the origin state or region of the migrant.

Similarly, from the specification for the choice between international and internal migration variables might be omitted. Such variables are a measure of the relative costs of migrating to different countries, and a measure of the relative chance of getting employed in different countries. While both of the variables may determine the choice of the migration destination, the cost of remitting may be associated with the origin state or region of the migrant, and the chance of getting employed with the migrant's education and the level of occupation he is aiming to work at. However, these kinds of measures, or plausible instruments for them, could not be found or obtained, or could only be crudely estimated, which is why they are absent from the estimations.

6.4.2. Misspecification of functional form of regression function

It could be possible that the functional form of the estimated regression function is different from the true functional form of the population regression function, in which case the estimator of the partial effect of change in one of the independent variables will often be

biased. In terms of this study, in the models for the probability and amount of remittances, this situation could arise from two sources.

Firstly, as mentioned in section 6.2.1.2, wage theory implies that the effects of the migrant's age and the duration of his migration may have an inverse U-shaped relationship to the probability and amount of remittances, in which case also the squared terms of these independent variables should be included in the estimated specification. In addition, related to the investment motive, a similar relationship may exist between the recipient household's long-run income, proxied by its long-run expenditure, and remittances.

To address these possibilities, the data on the migrant's age, on the duration of his migration, and on the recipient household's expenditure were each plotted in turn against the amount of remittances. In addition, specifications including the squared terms of these variables were estimated. However, neither of these efforts provided support for the inclusion of the squared terms to the "base specifications" described in section 6.2.1.4, and the relationship of these variables to remittances is more likely to be linear.

Secondly, misspecification could arise from the wrong logarithmic transformation of the continuous dependent variable, i.e. the amount of remittances. As mentioned in section 6.2.1.1, the amount of remittances is expressed in its logarithmic form due to the linear non-zero amount of remittances having a highly skewed distribution – the logarithmic scale produces a more symmetric distribution and is more likely to have a normal error distribution. The same applies to the independent variable indicating the recipient household's long-run expenditure, which is also transformed to its logarithm.

6.4.3. Sample selection

Sample selection bias becomes a problem when data availability is influenced by a selection process that is related to the values of the dependent variable. The selection process may cause correlation between the error term and the independent variables, leading to biased estimators. This is a relevant concern especially when it comes to the models for the probability and amount of remittances.

Firstly, this bias may arise from the fact that migrants self-select themselves to the group of remitters in a non-random way, and consequently, remittances can only be observed for migrants actually remitting. This issue may be addressed with the estimation methods discussed in chapter 4, but they may not do away with the sample selection bias altogether:

for instance, in the case of the Heckman selection model, the non-random selection entails a fundamental identification problem, so the validity of any solution will depend on the validity of the assumptions that are made. Yet, these assumptions can only be partly tested. (Verbeek 2008:245)

Secondly, the sampling methods employed in each of the countries under study should be investigated more closely to see whether they are related to the value of the dependent variable. In Nigeria, households with migrants were systematically oversampled from the beginning of the four-stage sampling procedure: more states with a high migration rate than those with a low migration rate were selected to the sample at the first stage, and more local government areas from the states with a high migration rate than those from the states with a low migration rate were selected to the sample at the second stage. At the fourth and last stage of sampling it was found that the original listing and sampling procedure of households would not yield a sufficient number of households with international migrants, so new procedures to oversample households with international migrants relative to others, and households with internal migrants relative to those with no migrants, were developed. (Zibah Consults Ltd 2011:6-7, 15-7) Also in Uganda, households with migrants were oversampled relative to those with no migrants, with a goal of selecting 4 households with international, 3 households with internal, and 3 household with no migrants from the 200 enumeration areas. If this goal could not be satisfied, for instance due to the lack of households with international migrants, priority was given to households with migrants, either international or internal. (Makerere Statistical Consult Limited 2011:6) In Senegal, census districts with a high migration rate were favoured over those with a low migration rate in the selection process, and households with migrants were oversampled relative to those with no migrants (The World Bank and CRES 2009:3-4)

The oversampling of households with migrants may certainly introduce bias: the factors that determine whether the household sends a migrant – migrant characteristics and household income and assets, for instance – may be similar to the factors determining whether or how much the migrant remits when having migrated, meaning that whether someone is migrant is in part determined by the omitted variables in the error term in the remittance equations. Hence, the fact that someone is a migrant and thus appears in the data set suggests that, all else equal, the error terms in the remittance equations are positive (on average) and could be correlated with the independent variables. In addition, the statistical findings discussed in section 6.3 imply that in each of the countries under study, international migrants, both in

OECD and other African countries, are more likely to remit, and remit more than internal migrants. Thus, also the oversampling of households with international migrants relative to others, may cause further sample selection bias.

6.4.4. Simultaneous causality

Endogeneity means that the independent variables are correlated with the error term of the equations, and leads to estimators being biased and inconsistent. Particularly, the problem of simultaneous causality, which is a form of endogeneity, may arise: the independent variables have an impact on the dependent variable, but simultaneously, the dependent variable may affect some of the independent variables. (Verbeek 2008:138-9)

It is not likely that any of the migrant-related variables are endogenous, but some of the recipient household-related variables may suffer from this problem. In particular, it is possible that remittances sent by the migrant affect the expenditure and thus the income of the recipient household, and if the remittances are significant in size, they may affect the land and other asset holdings of the recipient household, as well. Moreover, remittances may be used for funding the education and/or migration of other household members, thus affecting variables indicating the recipient household's expenditure, education level, and the number of migrants it sends.

These hypotheses receive some support from findings from the data made by Plaza et al. (2011:22). For instance in Nigeria, 22.1 percent of international and 19.6 percent of intra-African remittances were spent on education, which may render the variables depicting both the recipient household's expenditure and its education level endogenous. Moreover, especially in Nigeria, a large proportion of remittances is used to purchase land (24.8 percent of international and 16.6. percent of intra-African remittances), and in Senegal, 7.0 percent of international remittances are spent on the construction of new buildings, meaning that also the variable indicating the recipient household's assets may be endogenous. (Ibid.)

The relative endogeneity of the recipient household's expenditure and land and other assets was tested crudely in the base specification for each country by adding these variables separately to such tobit, Heckman and two-part model specifications that included only the presumably exogenous independent variables. If the coefficient values of the exogenous variables had been altered significantly by this addition, it would have been likely that the added variables would have been endogenous, or at least more endogenous than the already

included variables. As the coefficients of the exogenous variables did not change that drastically, the possible endogeneity of the variables indicating the recipient household's expenditure and assets does not pose a significant problem.

Regarding the additional specifications for Nigeria and Senegal, the same test was carried out for the variables describing the recipient household's education level and the number of other international migrants from the same household. In the case of Nigeria, adding the education level to specifications with only exogenous variables did cause relatively large changes in the coefficients of the exogenous variables, while in the Senegalese case, adding the number of other international migrants did not change the coefficients of the exogenous variables practically at all. Thus, it is likely that the variable indicating the recipient household's education level is relatively endogenous. This could have be corrected for only by finding an instrument variable that is correlated with the endogenous variable but not with the dependent variable: such variables, however, could not be found, so the results of the additional specification for Nigeria should be interpreted with caution.

Endogeneity is also a problem when considering the dependent variables of the estimations. It is probable that the decision on whether to remit and on how much to remit, whether to use official or unofficial remittance channels, and whether to migrate internationally or internally are determined by similar independent variables. These dependent variables are also likely to determine one another, i.e. they are endogenous: if, for instance, the channel used for remitting were included as a determinant of the probability and amount of remittances, the latter would most likely also affect the former at the same time, and the resulting coefficient estimates would most likely be biased and inconsistent (see also Amuedo-Dorantes and Pozo 2005). For this reason, the reduced form of the model is estimated, i.e. the endogenous variables of the channel used for sending remittances and the amount of remittances are modelled separately and expressed as functions of the same or similar exogenous variables and unobservable error terms, as shown in sections 6.2.1.4 and 6.2.2.3.

7 Empirical Results

This chapter discusses the results of the different empirical estimations carried out for this study and how they reflect their respective theoretical frameworks outlined in chapters 2, 3 and 4. The results obtained with the three models for the probability and amount of remittances – the tobit model, the Heckman selection model and the two-part model – are

examined and compared with one another, and the results obtained with the two-part model for each country are contrasted across genders and destinations of migrants. Also, the results obtained with the probit model for the choice between official and unofficial remittance channels, and for the choice between international and internal migration, are analysed.

These results are reviewed for each country separately in sections 7.1 through 7.3, starting with Uganda. Section 7.4 summarises and compares these findings. In appendix 2, the tobit and probit coefficient estimates of the country-wise estimations of the probability and amount of remittances are compared, as it implies whether the tobit model is appropriate for the estimation. Appendix 4 gives the estimation results for Senegal obtained with the CLAD estimation of the probability and amount of remittances.

To facilitate the interpretation of the tables containing the estimation results, all of the tables presented in the following sections have a similar structure. The coefficient estimates and standard errors of the independent variables are presented first, and the statistical significance of the coefficients are indicated with ***, ** or * for the 1 percent, 5 percent and 10 percent significance levels, respectively. As heteroskedasticity and non-normality were detected with the specification tests discussed in chapter 4, heteroskedasticity-robust, clustered standard errors are reported – the clustering has been done according to the primary sampling units of the samples of each country. To save space, the effects of the origin region or state of the migrant are not individually displayed. In most of the tables, also the joint significance of dummy variables indicating the migrant's education, occupation, residence and origin region are given below the estimates for the individual independent variables. In addition, the goodness-of-fit measure, and some other model statistics, for the respective model are reported at the bottom of these tables.

In the estimations for the probability and amount of remittances, the average marginal effects of the independent variables on the probability of remitting and on the conditional expected logarithmic amount remitted, i.e. $\partial E\left[y_i \middle| y_i > 0\right] / \partial x_{ik}$, are reported. In the probit estimations of the choice of remittance channel and the choice of migration destination, the average marginal effects of the independent variables on the probability of using official channels and on the probability of migrating internationally are reported, respectively. Anything appearing in the tables but not accounted for here will be explained in the context of the table in question.

7.1. Estimation results for Uganda

In sections 7.1.1, 7.1.2 and 7.1.3, the tobit, Heckman selection and two-part model results for the determinants of the probability and amount of remittances in Uganda are presented and discussed, respectively. In section 7.1.4, these results are contrasted across genders and destinations of migrants. In section 7.1.5, the probit model results for the determinants of the choice between official and unofficial remittance channels are investigated, and in section 7.1.6, the probit model results for the determinants of the choice between international and internal migration are examined.

7.1.1. Tobit model for probability and amount of remittances

The estimation results of the tobit model are presented in table 3. The coefficients of the independent variables indicating whether the migrant is married, whether he has completed secondary or tertiary education, whether he currently resides in an OECD country or in the urban regions of Uganda, whether he is employed in the service sector, whether he migrated for work, whether he is employed, and whether he is living alone are statistically significantly different from zero. Moreover, the variables indicating the migrant's education, his current residence and his origin area are jointly statistically significant.

Looking at the partial effects, the probability of remitting and on the amount remitted are most strongly, and positively, affected by whether the migrant is currently residing in an OECD country, whether he has completed tertiary education, and whether he is employed. Migrants residing in an OECD country have a 26.3 percent higher probability of remitting, and they remit on average 394 percent more than migrants living in rural regions of Uganda. In turn, migrants having completed tertiary education have a 17.0 percent higher probability of remitting, and remit about 215 percent more than those with no education, and employed migrants have a 20.7 percent higher probability of remitting, and remit about 217 percent more than unemployed ones.

In terms of the motives for remitting, an increase in the migrant's income seems to increase both the probability and amount of remittances, as the proxies for the income – residing in OECD countries, having a higher education, and living alone – are all positively associated with remittances. However, this result does not discriminate that well between the different motives for remitting, and it only rules out the insurance motive, which predicts that the migrant's income should not have a direct effect on remittances. In turn, the fact that the migrant's education affects remittances positively may be an indication of either the strategic

or the investment motive. Under the strategic motive, the highly-educated migrant may be bribing less-educated family members with remittances to persuade them to stay home (Stark 1995). Under the investment motive, remittances act as repayments of loans on investments made in the migrant's education (Rapoport and Docquier 2006:1156).

Table 3. Tobit model for probability and amount of remittances in Uganda

Independent Variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Partial effect on the conditional expected log amount remitted
Sex	0.8650	1.2440	0.0204	0.2447
Married	2.7487*	1.5872	0.0652	0.7810
Son	0.5743	1.5415	0.0134	0.1625
Age	0.1224	0.0790	0.0029	0.0348
Primary	2.0674	1.6214	0.0487	0.6041
Secondary	4.8995***	1.5233	0.1176	1.4961
Tertiary	6.7967***	1.7647	0.1695	2.1483
Duration	-0.0779	0.1046	-0.0018	-0.0221
OECD	10.7303***	2.8266	0.2634	3.9354
Africa	2.5089	2.3606	0.0600	0.7554
Urban Uganda	5.9273***	1.8519	0.1382	1.6134
Professional	1.8115	2.6913	0.0434	0.5314
Service	4.5916*	2.3802	0.1127	1.3736
Agriculture & Crafts	3.4601	2.5175	0.0819	1.0520
Reason	6.9863***	1.8022	0.1655	1.7746
Employed	8.4466***	2.6646	0.2065	2.1734
Alone	3.8235***	1.2152	0.0916	1.1281
Size of HH	-0.1701	0.2574	-0.0040	-0.0484
Assets of HH	3.5558	2.5481	0.0802	0.9282
Expenditure of HH	-0.2057	0.2707	-0.0048	-0.0585
Constant	-34.3434***	5.6887		

Joint significance

	F	Prob > F
Education	5.59	0.0008
Residence	6.81	0.0002
Occupation	1.73	0.1586
Origin region	5.21	0.0004

Model statistics

N	1092
Uncensored	340
Sigma	10.8982
Log pseudolikelihood	-4708228.5
Pseudo-R^2	0.1237
F	13.51
Prob > F	0.0000

The results suggest that Ugandan migrants are not motivated by a possible inheritance, as the recipient household's assets do not affect remittances significantly. Moreover, the prediction by Amuedo-Dorantes and Pozo (2006:229) that migrants facing a larger income risk remit

more in order to insure themselves is not supported by the results: in contrast, migrants who face a smaller risk, i.e. are employed, are more likely to remit and remit more than unemployed ones. However, as the employment status of the migrant is also a proxy for his income, the positive effect of being employed on remittances is, in this respect, in line with most of the motives for remitting. This view is backed up by the finding that also the intention of migrants to work in their destination country affects remittances positively.

7.1.2. Heckman selection model for probability and amount of remittances

In table 4, the Heckman selection model results for the likelihood of remitting and for the amount remitted are presented. In terms of the overall purposefulness of the Heckman selection model, the correlation coefficient *rho* between the error terms of the participation and the outcome equation is significant as indicated by the chi-squared –statistic for *rho* at the bottom of the table. Thus, the null hypothesis of independent equations can be rejected, and the participation equation should be taken into account when estimating the outcome equation. However, this conclusion should not be regarded as definite, as the model is based on a bivariate normality assumption whose validity may be questioned, as discussed in section 5.2.1. Moreover, it should be noted that the identification variable indicating whether the migration has lasted for more than a year is statistically insignificant, suggesting that it may not be the best choice for an identification variable.

Comparing the Heckman selection model estimates to those of the tobit model, the same variable coefficients that were statistically significant in the tobit model are also significant in the participation equation of the Heckman selection model, and have the same signs as those in the tobit model. The outcome equation of the Heckman selection model, on the other hand, displays a rather different pattern in terms of the statistical significance of the variable coefficients than the participation equation, or the tobit model: the coefficients of variables indicating whether the migrant is the son or daughter of the household head at home, his age, whether he is residing in an OECD or an African country, whether he lives alone, and what the recipient household's long-run expenditure is prove to be significant.

Thus, there are only two independent variables whose coefficients are statistically significant in both the participation and the outcome equation, indicating whether the migrant is residing in an OECD country, and whether he is living alone. Interestingly, the latter affects the probability of remittances positively, but the amount remitted negatively. The variables

indicating the migrant's education and his current residence are jointly statistically significant in both equations.

Table 4. Heckman selection model for probability and amount of remittances in Uganda

	Likelihood of remitting			Amount remitted		
Independent Variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Coefficient	Robust std. err.	Partial effect on the conditional expected log amount remitted
Sex	0.0978	0.1269	0.0235	-0.2555	0.2011	-0.1883
Married	0.2831*	0.1615	0.0687	0.0172	0.2163	0.2116
Son	0.0567	0.1628	0.0136	-0.6765***	0.2328	-0.6375
Age	0.0094	0.0077	0.0023	0.0312**	0.0124	0.0376
Primary	0.1776	0.1547	0.0429	-0.0630	0.2854	0.0576
Secondary	0.4721***	0.1534	0.1168	-0.0393	0.2955	0.2753
Tertiary	0.7595***	0.1679	0.1982	0.5584	0.4095	1.0536
Duration	-0.0078	0.0108	-0.0019	-0.0322	0.0273	-0.0375
OECD	0.8332***	0.3131	0.2145	1.5156**	0.6307	2.0373
Africa	0.2181	0.2398	0.0536	1.0149*	0.6084	1.1615
Urban Uganda	0.5343***	0.1792	0.1270	0.0773	0.3576	0.4494
Professional	0.1232	0.2869	0.0301	0.0338	0.4049	0.1176
Service	0.5079*	0.2794	0.1287	-0.5825	0.4480	-0.2420
Agriculture & Crafts	0.3312	0.2753	0.0806	-0.3216	0.3784	-0.1004
Reason	0.5903***	0.1745	0.1395	0.3734	0.4973	0.7928
Employed	0.8375***	0.2663	0.2028	-0.4185	0.3706	0.1771
Alone	0.3969***	0.1304	0.0975	-0.4744**	0.2318	-0.2064
Size of HH	-0.0112	0.0279	-0.0027	-0.0317	0.0450	-0.0394
Assets of HH	0.3780	0.2657	0.0855	-0.1657	0.3852	0.1023
Expenditure of HH	-0.0349	0.0271	-0.0084	0.1187**	0.0499	0.0947
Duration > 1 year	0.2814	0.1721	0.0661			
Constant	-3.4901***	0.5629		11.8932***	1.2579	
	Joint significance			Joint significance		
		Chi^2	Prob > Chi^2		Chi^2	Prob > Chi^2
	Education	23.58	0.0000	Education	3.07	0.3803
	Residence	12.78	0.0051	Residence	14.22	0.0026
	Occupation	4.72	0.1933	Occupation	2.73	0.4359
	Origin region	20.13	0.0005	Origin region	31.67	0.0000
	Model statistics					
	N	1092				
	Uncensored	339				
	Log pseudolikelihood	-3111285.0				
	Chi^2	159.82				
	Prob > Chi^2	0.0000				
	Rho	-0.6365				
	Rho = 0: Chi^2	5.18				
	Rho = 0: Prob > Chi^2	0.0228				

Comparing the partial effects of the independent variables on the probability of remitting in the Heckman selection model to those in the tobit model, the magnitudes and signs of the effects prove to be rather similar to one another. For instance, according to the Heckman

selection model, employed migrants are 20.3 percent more likely to remit than unemployed ones, and migrants having completed tertiary education are about 19.8 percent more likely to remit than migrants with no education. The corresponding effects estimated by the tobit model are 20.7 percent and 17.0 percent, respectively.

The partial effects of the independent variables on the conditional expected logarithmic amount remitted differ somewhat in the two models. In the Heckman selection model, the effects of whether the migrant is residing in an OECD country or in an African country, and whether he is the son of the household head are the largest ones of the statistically significant variables. Migrants residing in an OECD country remit about 204 percent more than migrants residing in rural areas of Uganda, which is a significantly smaller effect than the 394 percent suggested by the tobit model. In turn, migrants residing in African countries remit about 116 percent more than migrants residing in rural areas of Uganda, while the sons and daughters of household heads remit about 64.6 percent less than migrants with some other relationship to the household head.

In terms of the motives for remitting, the statistically significant variable coefficients in the participation equation have the same implications as the results obtained with the tobit model, and suggest that a variety of motives may be driving remittance behaviour of Ugandan migrants through the effects that the migrant's income and education have on remittances. An interesting finding in the outcome equation, however, is the positive effect that the recipient household's long-run expenditure has on the amount remitted. This variable proxies the recipient household's long-run income and its partial effect on remittances suggests that a one percent increase in the recipient household's income is associated with about a 9.5 percent increase in remittances.

This result implies that Ugandan migrants may be motivated by exchange or investment considerations. Under the exchange motive, the likelihood of remitting may be affected negatively and the amount remitted positively by the recipient household's income: here, however, the former effect is statistically insignificant (Cox 1987:519). Under the investment motive, a positive relationship between remittances and the recipient's long-run income appears when migration is constrained, but should become negative when migration is unconstrained (Rapoport and Docquier 2006:1159). This inverse U-shaped relationship between the variables, however, does not receive support from additional estimations. Yet, the investment motive cannot be disregarded altogether because of the positive effect that the

migrant's secondary and tertiary education have on the probability of remitting – under the exchange motive, education should affect remittances negatively, as educated migrants are less inclined to return home than uneducated ones (Ibid:1164).

7.1.3. Two-part model for probability and amount of remittances

The two-part model's probit estimation of the likelihood of remitting and the OLS estimation of the conditional logarithmic amount remitted are presented table 5. However, as the correlation coefficient *rho* in the Heckman selection model reviewed in the previous section is significant, the participation and the outcome equation are not independent of one another, and the OLS estimation of the conditional logarithmic amount remitted is likely to be inconsistent. Nonetheless, the two-part model estimation results provide a good robustness check for the Heckman selection model estimation results, which is why they are presented and briefly compared to those discussed in the previous section.

Not surprisingly, the probit coefficient estimates and the related partial effects display a similar pattern in their signs and magnitudes as the coefficient estimates and partial effects in the Heckman selection model's participation equation. The OLS estimates, however, differ somewhat in their signs and magnitudes from the estimates in the Heckman selection model's outcome equation, arising most likely from the different estimation methods and assumptions of the two models. Yet, the semi-elasticities, or the partial effects on the conditional expected logarithmic amount remitted obtained with the two-part model and with the Heckman selection model are quite similar to one another. In terms of the statistical significance of the variable coefficients, there are some differences between the probit estimates and the participation equation, and between the OLS estimates and the outcome equation of the Heckman selection model.

None of the above-mentioned differences, however, contradict the conclusions made earlier, so the implications of the two-part model results in terms of the motives for remitting are the same as discussed in the two previous sections. The Heckman selection model results should be more relied upon, anyways, due to the likelihood of remitting and the amount remitted being dependent of one another.

Table 5. Two-part model for probability and amount of remittances in Uganda

	Likelihood of remitting			Amount remitted		
Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Coefficient	Robust std. err.	Partial effect on the conditional expected log amount remitted
Sex	0.0674	0.1294	0.0166	-0.1951	0.1826	-0.1951
Married	0.2752	0.1696	0.0682	0.1398	0.2072	0.1398
Son	0.0400	0.1640	0.0098	-0.6455***	0.2175	-0.6455
Age	0.0089	0.0079	0.0022	0.0373***	0.0118	0.0373
Primary	0.1712	0.1614	0.0422	0.0812	0.2856	0.0812
Secondary	0.4406***	0.1525	0.1114	0.2277	0.2808	0.2277
Tertiary	0.7181***	0.1765	0.1914	0.9490**	0.4437	0.9490
Duration	-0.0049	0.0109	-0.0012	-0.0374	0.0261	-0.0374
OECD	0.8123**	0.3174	0.2136	2.0798***	0.5445	2.0798
Africa	0.1278	0.2354	0.0318	1.1343*	0.6385	1.1343
Urban Uganda	0.5136***	0.1854	0.1249	0.4645	0.2908	0.4645
Professional	0.2158	0.2715	0.0546	0.1640	0.4131	0.1640
Service	0.4921*	0.2704	0.1274	-0.2995	0.3891	-0.2995
Agriculture & Crafts	0.2961	0.2704	0.0736	-0.1826	0.3378	-0.1826
Reason	0.5866***	0.1649	0.1420	0.8182	0.4999	0.8182
Employed	0.8132***	0.2607	0.2021	0.0588	0.3607	0.0588
Alone	0.3715***	0.1367	0.0931	-0.2798	0.2209	-0.2798
Size of HH	-0.0094	0.0263	-0.0023	-0.0384	0.0417	-0.0384
Assets of HH	0.3820	0.2695	0.0881	0.0557	0.3288	0.0557
Expenditure of HH	-0.0302	0.0282	-0.0074	0.1046**	0.0513	0.1046
Constant	-3.2101***	0.5653		9.0196***	0.9229	
	Joint significance			Joint significance		
		Chi^2	Prob > Chi^2		F	Prob > F
	Education	19.62	0.0002	Education	1.56	0.2041
	Residence	13.09	0.0044	Residence	6.02	0.0008
	Occupation	4.10	0.2512	Occupation	0.51	0.6743
	Origin region	22.12	0.0002	Origin region	7.59	0.0000
	Model statistics			Model statistics		
	N	1097		N		340
	Log pseudolikelihood	-1481099.8		R^2		0.4226
	Pseudo-R^2	0.2891		Root MSE		1.3218

7.1.4. Two-part model for probability and amount of remittances by gender and destination

It may be reasonably assumed that migrants are not a homogeneous group, and differ in their motives for remitting. Thus, in this section the results of the two-part model are contrasted across genders and destinations separately by using the interaction variables described in section 6.2.1.2. Yet, it should be kept in mind that in the case of Uganda, the OLS estimates of the two-part model are likely to be inconsistent, as the decisions on whether to remit and on how much to remit are not independent of one another.

To save space, in the following tables, the coefficient estimates and standard errors are displayed only for those variables with which variables *male* and *OECD* are interacted. Partial effects on the probability of remitting and on the conditional logarithmic amount remitted are not explicitly displayed in the tables: the former effect would be miscalculated by Stata 11, and the latter effect is equal to the coefficient estimate obtained with the OLS estimation. In the tables, below the standard but misleading probit model, the true mean interaction effects of the interaction variables, their mean standard errors and mean z-statistics calculated with the correct method are reported. In addition, in figures 1 through 10 in appendix 3, the true interaction effects and statistical significances of the interaction variables in the probit estimations are displayed.

In table 6, the results by gender are presented. In the probit estimation, the coefficients for non-interacted variables *tertiary* and *employed* are statistically significant. However, none of the interaction effects are statistically significant, but this result may be misleading. According to the mean interaction effects, the effects are, on average, positive for all interaction variables except for the interaction *male*employed*, and all of them are, on average, statistically insignificant. Looking at figures from 1 to 5 in appendix 3, the interaction effects are both positive and negative depending on the predicted probability of the dependent variable, and the effects tend to have either a wave shape or an inverse U-shape. In terms of the statistical significance of the interaction effects, none of them are statistically significant on the 5 percent significance level for any of the observations.

In the OLS estimation, the amount of remittances respond statistically significantly to whether the migrant is residing in an OECD country, whether he has completed tertiary level education, and to what the recipient household's long-run expenditure is. These are statistically significant also in the two-part model estimation for all migrants. In addition, the effects of interaction variables *male*OECD* and *male*tertiary* are statistically significant, meaning that remittances of male migrants are differently affected by their residence and education level than those of female migrants.

Firstly, as the variable *male*OECD* is positive, male migrants respond more in terms of their remittances to their residence being an OECD country than female migrants: while residing in OECD countries is associated with about a 143 percent increase in remittances among female migrants, the increase is 142.78 + 95.81 = 238.59 percent among male migrants. As residing in an OECD country is one of the proxies for the migrant's income and is likely to increase

this income, the result implies that male migrants are willing to share a larger proportion of their increased income with their families back home than female migrants are. This may suggest that male migrants are more altruistic towards their families than female migrants, but is consistent with other motives, except for the insurance motive, for remittances, as well.

Table 6. Partial two-part model for probability and amount of remittances in Uganda by gender

	Likelihood of remitting			Amount remitted	
Independent variable	Coefficient	Robust std. err.		Coefficient	Robust std. err.
Male	-0.5239	0.6272		0.4422	1.2443
OECD	0.5615	0.3511		1.4278**	0.6248
Male*OECD	0.4651	0.4050		0.9581*	0.5260
Tertiary	0.6299***	0.1916		1.5772***	0.4858
Male*Tertiary	0.1033	0.2370		-0.8840*	0.4630
Employed	0.7719**	0.3297		0.3680	0.4859
Male*Employed	0.0682	0.2830		-0.4744	0.5353
Assets of HH	0.3672	0.3794		0.1630	0.3596
Male*Assets of HH	0.0926	0.4190		0.0251	0.5038
Expenditure of HH	-0.0465	0.0311		0.1165**	0.0547
Male*Expenditure of HH	0.0318	0.0389		-0.0041	0.0711
	Mean interaction effects				
	Mean	Std. err.	z		
Male*OECD	0.1074	0.1318	0.8160		
Male*Tertiary	0.0130	0.3087	0.0082		
Male*Employed	-0.0239	0.3022	-0.1262		
Male*Assets of HH	0.0073	0.2387	-0.0106		
Male*Expenditure of HH	0.0080	0.1016	0.0788		
	Model statistics			Model statistics	
	N	1097		N	340
	Log pseudolikelihood	-1477497.2		R^2	0.4374
	Pseudo R^2	0.2908		Root MSE	1.3153

Secondly, the other statistically significant interaction variable, *male*tertiary*, implies that male migrants increase their remittances less in response to their tertiary level education than female migrants, but the effect is not negative: while tertiary education increases remittances by 158 percent among female migrants, the increase among male migrants is only 157.72 – 88.40 = 69.32 percent. In terms of the motives for remitting, remittances responding positively to the level of education is consistent with the strategic and the investment motive. However, as the variable indicating the recipient household's long-run expenditure, a proxy for its long-run income, is statistically significant and affects the amount of remittances positively, it is more likely for the investment motive to be at work. The stronger influence of this motive on female migrants could arise from the possibility that the tertiary education of females – not likely to be more expensive in monetary terms than that of males – has entailed

higher opportunity costs to the household than that of males, increasing the value of the educational loans given to females and the amount of remittances needed to compensate for these. It could also be that female migrants have less bargaining power than male migrants relative to the recipient household, resulting in poorer terms of loan repayment for female migrants.

In table 7, the results by destinations of migrants are presented. According to the standard probit model, non-interacted variables *tertiary* and *employed* have statistically significant coefficients, like in the two-part model estimation for all migrants. Yet, none of the interaction effects are statistically significant, but this result may be misleading. In turn, the mean interaction effects imply that all the effects are on average positive, except for the effect of the interaction *OECD*expenditure of HH,* and all of them are, on average, statistically insignificant. Looking at figures from 6 to 10 in appendix 3, the interaction effects demonstrate wide variation across the different predicted probabilities of the dependent variable, and either a wave shape or an inverse U-shape. Regarding the statistical significance of the interaction effects, only for a few observations the interaction effects of the interactions *OECD*tertiary* and *OECD*employed* are statistically significant on the 5 percent significance level.

For the interaction *OECD*tertiary*, the significant observations correspond to migrants with a predicted probability of remitting of 35 percent and 65 percent: the interaction effect is slightly less than 2.5 percentage points for the group around 35 percent, and from a good 2 to 2.5 percent for the group around 65 percent. For the interaction *OECD*employed,* the significant observations correspond to migrants with a predicted probability of remitting of 30, 60 and 80 percent: the interaction effect for these groups is from about 2.5 to 3 percentage points. Because the interaction effects are statistically significant only for such a few observations, any conclusions drawn from them in terms of the motives for remitting might be misleading.

In the OLS estimation, the statistically significant non-interacted variables indicate whether the migrant has competed tertiary education and what the recipient household's long-run expenditure is – significant also in the two-part model estimation for all migrants. The interaction variables that are statistically significant are *OECD*employed* and *OECD*expenditure of HH*, meaning that in terms of the effects of being employed and the

recipient household's expenditure, the behaviour of migrants residing in OECD countries is significantly different from that of migrants residing in African countries.

Table 7. Partial two-part model for probability and amount of remittances in Uganda by destination

	Likelihood of remitting			Amount remitted	
Independent variable	Coefficient	Robust std. err.		Coefficient	Robust std. err.
Male	0.0420	0.1367		-0.2421	0.1953
OECD	-0.3555	1.3699		0.9901	1.6095
OECD*Male	0.6423	0.4111		0.6095	0.3986
Tertiary	0.6875***	0.1819		0.9333**	0.4682
OECD*Tertiary	0.7094	0.5649		0.5332	0.7905
Employed	0.8018***	0.2651		-0.0587	0.3703
OECD*Employed	0.9052	0.7339		1.8897**	0.9385
Assets of HH	0.4018	0.3158		0.0335	0.3131
OECD*Assets of HH	0.4191	0.7075		0.4901	0.8998
Expenditure of HH	-0.0250	0.0288		0.1355**	0.0557
OECD*Expenditure of HH	-0.0535	0.0776		-0.1384**	0.0657
	Mean interaction effects				
	Mean	Std. err.	z		
OECD*Male	0.1529	0.1606	0.8833		
OECD*Tertiary	0.1731	0.4319	0.5432		
OECD*Employed	0.2250	0.5490	0.6200		
OECD*Assets of HH	0.0840	0.3805	0.2393		
OECD*Expenditure of HH	-0.0050	0.2911	-0.0077		
	Model Statistics			Model Statistics	
	N	1097		N	340
	Log pseudolikelihood	-1475828.3		R^2	0.4327
	Pseudo R^2	0.2916		Root MSE	1.3207

The effect of *OECD*employed* is positive, while the sole effect of being employed is negative, though insignificant. Thus, among migrants residing in OECD countries, being employed is associated with an increase in remittances, while the remittances of migrants residing in African countries are unaffected by whether they are employed or not. This result is in contrast to the self-insurance hypothesis by Amuedo-Dorantes and Pozo (2006:229) who suggest that migrants under a larger income risk, i.e. unemployed migrants, remit more than migrants with less income risk. But, if the employment status of the migrant is interpreted as a proxy for the migrant's income, the result is consistent with the various motives predicting remittances to increase with the migrant's income.

The effect of the recipient household's expenditure, a proxy for its income, and that of its interaction with the variable *male* are almost counteracting: while among migrants residing in African countries, remittances increase on average by 13.6 percent for a one percent increase in the recipient household's income, among migrants residing in OECD countries remittances

decrease very slightly. This result could mean that while migrants residing in African countries may have some exchange or investment arrangements with their families back home, similar contracts may not exist between migrants in OECD countries and their families. Alternatively, the bargaining power of migrants in OECD countries relative to the recipient household could be higher than that of migrants in African countries, resulting in better contractual terms for migrants in OECD countries. It should be noted, however, that the effect of tertiary level education on the probability and amount of remittances is positive for both groups of migrants, suggesting that the presence of the investment motive may be more likely than that of the exchange motive.

7.1.5. Probit model for choice between official and unofficial remittance channels

The probit estimation results for the choice between official and unofficial remittance channels are presented in table 8. The coefficients of variables indicating whether the migrant is the son or daughter of the household head, whether he has completed tertiary level education, the duration of his migration, whether he is residing in an OECD or in an African country or in urban Uganda, and whether he has migrated for work are statistically significant. The coefficients of variables indicating the migrant's education, his current residence and his origin region are jointly statistically significant.

Of the significant variables, whether the migrant is residing in an OECD or an African country, and whether he has completed tertiary education have the largest partial effects on the probability of using official channels: migrants residing in OECD countries have a 64.2 percent higher, and migrants residing in African countries have a 44.3 percent higher probability of using official remittance channels than migrants residing in rural regions of Uganda, and migrants having completed tertiary education have a 27.5 percent higher probability of using official remittance channels than migrants with no education.

The result that international migrants residing in OECD and African countries are more likely to use official remittance channels than domestic ones gets support from Ngugi and Sennoga (2011:250), who find that international remittances are more often sent through official channels than domestic ones. Moreover, most official remittance service providers are located in urban centres of Uganda, which may at least partly explain why migrants residing in these regions are also more likely to remit officially than migrants in rural regions. Also, as these locations are expected to affect the migrant's income positively, migrants residing in the

above-mentioned locations may have better access to official channels and not be as liquidity constrained in their choice between remittance channels as migrants in rural Uganda. In addition, as shown in section 7.1.2, migrants residing abroad tend to send larger remittances and thus may value the reliability of official channels more than migrants remitting from rural Uganda.

Table 8. Probit model for choice between official and unofficial remittance channels in Uganda

Independent Variable	Coefficient	Robust std. err.	Partial effect on the probability of using official channels
Sex	-0.0501	0.2814	-0.0066
Married	0.1439	0.2640	0.0188
Son	-0.7734***	0.2926	-0.1050
Age	-0.0127	0.0194	-0.0017
Primary	-0.5751	0.5577	-0.0677
Secondary	0.3122	0.4433	0.0414
Tertiary	1.6667***	0.3580	0.2747
Duration	-0.0484**	0.0209	-0.0064
OECD	3.3009***	0.6163	0.6423
Africa	2.3768***	0.5868	0.4428
Urban Uganda	1.1057***	0.4122	0.1074
Professional	0.1197	0.4794	0.0161
Service	-0.1451	0.4556	-0.0189
Agriculture & Crafts	-0.0382	0.5744	-0.0050
Reason	2.1696***	0.5900	0.1601
Employed	-0.5062	0.4458	-0.0722
Alone	0.0355	0.2958	0.0047
Size of HH	-0.0186	0.0557	-0.0024
Assets of HH	-0.2656	0.6932	-0.0372
Expenditure of HH	0.1145	0.0698	0.0150
Constant	-5.0449***	1.4146	
Joint significance			
	Chi^2		$Prob > Chi^2$
Education	27.86		0.0000
Residence	34.55		0.0000
Occupation	0.57		0.9022
Origin region	36.13		0.0000
Model statistics			
N	337		
Log pseudolikelihood	-239474.79		
Pseudo-R^2	0.5217		

It is also quite intuitive why education increases the probability of using official channels: as income tends to increase with education, educated migrants are likely to have better access to and to be less liquidity constrained when choosing their remittance channel than less-educated migrants. In addition, Amuedo-Dorantes and Pozo (2005:560) hypothesise that educated

migrants are more likely to understand the operational principles of banks better and to hold bank accounts than less-educated ones – as banks are an official remittance channel, this may indeed partially explain the result. However, the duration of migration having a negative effect on the probability of using official channels goes against the authors' hypothesis of a longer work experience abroad increasing the likelihood of using banks (Ibid.).

7.1.6. Probit model for choice between international and internal migration

Table 9 displays the probit estimation results for the choice between international and internal migration.

Table 9. Probit model for choice between international and internal migration from Uganda

Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of sending the migrant abroad
Sex	0.1041	0.1678	0.0156
Married	-0.0713	0.1462	-0.0108
Son	-0.2493	0.1602	-0.0400
Age	0.0079	0.0065	0.0012
Primary	-0.2632	0.1950	-0.0372
Secondary	-0.1412	0.2182	-0.0205
Tertiary	0.1728	0.2555	0.0280
Duration	0.0062	0.0111	0.0009
Professional	0.0554	0.2381	0.0086
Service	0.1558	0.1895	0.0248
Agriculture & Crafts	-0.1251	0.2230	-0.0180
Reason	0.3109*	0.1779	0.0435
Employed	0.1235	0.2555	0.0183
Alone	-0.0299	0.1557	-0.0045
Size of HH	-0.0303	0.0322	-0.0046
Assets of HH	-0.1510	0.2038	-0.0249
Expenditure of HH	0.0634	0.0480	0.0096
Constant	-2.2854	0.5932	
Joint significance			
	Chi2		Prob > Chi2
Education	5.25		0.1546
Occupation	1.58		0.6634
Origin region	22.28		0.0002
Model statistics			
N	1093		
Log pseudolikelihood	-956138.27		
Pseudo-R^2	0.1114		

Only one variable, the reason for migration being work or search for work, explains statistically significantly the choice between international and internal migration. Its effect is positive, implying that the household may perceive the employment opportunities of other

African countries and OECD countries to be better than those of Uganda, and thus prefers to send migrants abroad. In turn, if the migrant's reason for migration is something else than work – education, for instance – remittances could be expected to be rather small, and the household may not even consider migration as a way for it to receive supplementary income. In this case, migration costs might become the most decisive factor in the decision on the location of the migrant, and the household may prefer other regions of Uganda, involving lower migration costs, to locations abroad.

7.2. Estimation results for Senegal

In sections 7.2.1, 7.2.2 and 7.2.3, the tobit, Heckman selection and two-part model estimation results for the determinants of the probability and amount of remittances in Senegal are presented and discussed, respectively. These results are contrasted across genders and destinations of migrants in section 7.2.4. In section 7.2.5, the effects of other migrants and parental funding on the probability and amount of remittances are discussed. The probit model results for the determinants of the choice between official and unofficial remittance channels are investigated in section 7.2.6, and in section 7.2.7, the probit model results for the determinants of the choice between international and internal migration are examined. The CLAD estimation results for the probability and amount of remittances in Senegal are presented in appendix 4, and may be compared to the tobit, Heckman selection and two-part model estimation results. It should be noted at the outset that variable *employed* is omitted from all of the estimations, as it is perfectly collinear with variable *professional*.

7.2.1. Tobit model for probability and amount of remittances

The estimation results of the tobit model are presented in table 10. Variables whose coefficient is statistically significant indicate whether the migrant is married, whether he has completed primary education, whether he is residing in an OECD country, whether he migrated for work, whether he is living alone, and what the recipient household's long-run expenditure is. In addition, the coefficients for variables indicating the current residence of the migrant and his origin region are jointly statistically significant.

When it comes to the partial effects of the significant variables, the probability of remitting and the conditional expected logarithmic amount remitted are most significantly affected by whether the migrant migrated for work, whether he is residing in an OECD country, and whether he has completed primary education. Interestingly and contrary to the two other

variables, having completed primary education has a negative effect on remittances. These migrants have a 4.8 percent lower probability of remitting, and they remit about 149 percent less than migrants with no education. In turn, migrants residing in OECD countries have almost an 11 percent higher probability of remitting, and remit about 340 percent more than migrants residing in rural regions of Senegal. When it comes to migrants intending to work or to search for work, they have a 12.5 percent higher probability of remitting, and remit about 387 percent more than those not intending to work.

Table 10. Tobit model for probability and amount of remittances in Senegal

Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Partial effect on the conditional expected log amount remitted
Sex	2.2464	1.4040	0.0556	1.7250
Married	1.3561**	0.6513	0.0336	1.0414
Son	1.3284	0.8759	0.0329	1.0201
Age	0.0183	0.0782	0.0005	0.0141
Primary	-1.9380*	1.1064	-0.0479	-1.4883
Secondary	0.8265	0.8756	0.0204	0.6346
Tertiary	0.5879	2.2267	0.0145	0.4515
Duration	0.0739	0.0699	0.0018	0.0567
OECD	4.4296***	1.4932	0.1096	3.4016
Africa	1.0313	1.6771	0.0255	0.7920
Urban Senegal	1.9281	1.3465	0.0477	1.4806
Professional	-2.4419	1.6295	-0.0604	-1.8752
Service	0.8269	0.8550	0.0204	0.6350
Agriculture & Crafts	-0.9631	1.0202	-0.0238	-0.7396
Reason	5.0403***	1.7524	0.1247	3.8706
Employed	(omitted)			
Alone	1.6753**	0.8407	0.0415	1.2865
Size of HH	-0.0502	0.0494	-0.0012	-0.0385
Assets of HH	2.7354	2.5131	0.0677	2.1006
Expenditure of HH	1.0371***	0.3791	0.0257	0.7964
Constant	-19.3349***	6.2524		

Joint significance		
	F	Prob > F
Education	1.74	0.1565
Residence	3.86	0.00093
Occupation	1.91	0.1266
Origin region	5.59	0.0000

Model statistics	
N	991
Uncensored	761
Sigma	5.5656
Log pseudolikelihood	-1893771.5
Pseudo-R^2	0.0539
F	332.21
Prob > F	0.0000

The results demonstrate the positive effect that the migrant's income has on remittances, as the variables indicating that the migrant resides in an OECD country and that he lives alone, both proxies for the migrant's income, affect remittances positively and significantly. This result, however, only excludes the insurance motive, and is in line with all other motives for remitting. Yet, the negative impact of education on remittances may indicate that the exchange motive in particular may be behind migrants' remittance behaviour: educated migrants are less likely to return home, and thus remit less than uneducated ones (Rapoport and Docquier 2006:1164). However, as the effects of secondary and tertiary education, though insignificant, are positive, further support for this conclusion is needed.

This support is provided by the finding that the recipient household's long-run expenditure, a proxy for its long-run income, has a positive effect on remittances, suggesting that migrants may be driven by the exchange motive or the investment motive, since the other motives are consistent with the recipient's long-run income having a negative or no effect on remittances. However, the investment motive is characterised by the migrant's education having a positive effect on remittances, and by an inverse U-shaped relationship between the recipient household's income and remittances. As neither of these predictions hold true here, the results seem to imply that the prime concern of Senegalese migrants is to enter into exchange contracts with the recipient households and to compensate for the services performed by them with remittances.

The above implication needs to be qualified, however. Under the exchange motive, the probability and the amount of remittances should be inversely correlated, meaning that the probability of remittances should be negatively affected by the recipient household's income (Cox 1987:518). Yet, in the tobit model the partial effects of the recipient's long-run income on the probability of remitting and on the conditional expected logarithmic amount remitted are constrained to have the same sign, so further inspection of the Heckman selection model's coefficient estimates and partial effects is needed to determine, whether the inverse correlation holds true.

7.2.2. Heckman selection model for probability and amount of remittances

The results obtained with the Heckman selection model are presented in table 11. As the statistical significance of the correlation coefficient *rho* indicates, the participation and the outcome equation are not independent of one another, meaning that the participation equation should be taken into account when estimating the outcome equation. Also the coefficient of

the identification variable *duration > 1 year* is significant in the participation equation. However, the Heckman selection model is based on a bivariate normality assumption whose validity may be questioned.

Comparing the Heckman selection model estimates to those of the tobit model, the significance and signs of the variable coefficients in the Heckman selection model's participation equation are similar to those in the tobit model. However, while the coefficients of variables indicating whether the migrant is male and whether he is the son of the household head are statistically significant in the participation equation, they are insignificant in the tobit model. Conversely, the coefficient of the variable indicating whether the migrant has completed primary education is statistically insignificant in the participation equation, but significant in the tobit model.

The outcome equation, on the other hand, displays a completely different pattern of statistical significances than the participation equation, or the tobit model: in the outcome equation, coefficients of variables indicating the duration of migration, whether the migrants is residing in African countries or in urban regions of Senegal, whether he works in an agricultural or crafts occupation, and the size of his former household are statistically significant. There are thus no variables whose coefficients are statistically significant in both the participation and the outcome equation. However, coefficients of variables indicating the migrant's current residence, his occupation and his origin region are jointly statistically significant in both equations.

The partial effects implied by the Heckman selection model are not too similar to those obtained with the tobit model. Of the significant variables of the participation equation, the probability of remitting is most significantly affected by whether the migrant resides in an OECD country, whether he migrated for work, and whether he is male: migrants residing in OECD countries have a 14.4 percent higher probability of remitting than migrants residing in rural regions of Senegal ,and migrants migrating for work have a 20.5 percent higher probability of remitting than migrants migrating for other purposes – the corresponding percentages in the tobit model are 11 percent and 12.5 percent. From the significant variables of the outcome equation, variables indicating whether the migrant lives in an African country or in urban regions of Senegal have the largest partial effects on the conditional expected logarithmic amount remitted, and both of these effects are negative: they remit on average

40.9 percent and 59.1 percent less, respectively, than migrants residing in rural regions of Senegal.

Table 11. Heckman selection model for probability and amount of remittances in Senegal

	Likelihood of remitting			Amount remitted		
Independent Variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Coefficient	Robust std. err.	Partial effect on the conditional expected log amount remitted
Sex	0.5788***	0.2248	0.1407	-0.0797	0.2710	0.1360
Married	0.3461*	0.1773	0.0841	0.2127	0.2049	0.3417
Son	0.3634**	0.1796	0.0884	-0.0774	0.1707	0.0580
Age	0.0028	0.0191	0.0007	0.0092	0.0077	0.0103
Primary	-0.3694	0.2673	-0.0898	-0.0670	0.2214	-0.2047
Secondary	0.1698	0.2483	0.0413	-0.0368	0.2322	0.0265
Tertiary	0.2519	0.5212	0.0613	-0.0667	0.5087	0.0272
Duration	-0.0075	0.0177	-0.0018	0.0275***	0.0106	0.0247
OECD	0.5903**	0.2876	0.1435	0.3919	0.2620	0.6119
Africa	0.0383	0.3778	0.0093	-0.4235*	0.2376	-0.4092
Urban Senegal	0.4883	0.3008	0.1187	-0.7725***	0.2293	-0.5905
Professional	-0.4762	0.3576	-0.1158	0.4871	0.3577	0.3096
Service	0.2354	0.1956	0.0572	0.0186	0.1465	0.1063
Agriculture & Crafts	-0.2867	0.2301	-0.0697	0.4537**	0.2250	0.3468
Reason	0.8420***	0.3119	0.2047	0.3179	0.2710	0.6317
Employed	(omitted)			(omitted)		
Alone	0.3967**	0.2228	0.0965	0.1930	0.2026	0.3409
Size of HH	-0.0104	0.0138	-0.0025	-0.0184*	0.0112	-0.0223
Assets of HH	0.6813	0.4635	0.1657	0.0777	0.3929	0.3316
Expenditure of HH	0.2473**	0.1164	0.0601	0.0689	0.0910	0.1611
Duration > 1 year	0.4622**	0.1882	0.1124			
Constant	-5.4812***	1.6494		11.1963***	1.5869	
	Joint significance			Joint significance		
		Chi^2	Prob > Chi^2		Chi^2	Prob > Chi^2
	Education	5.03	0.1697	Education	0.11	0.9904
	Residence	7.83	0.0496	Residence	33.90	0.0000
	Occupation	11.33	0.0101	Occupation	7.20	0.0657
	Origin region	16.41	0.0886	Origin region	100.79	0.0000
	Model statistics					
	N	991				
	Uncensored	761				
	Log pseudolikelihood	-1065504.0				
	Chi^2	.				
	Prob > Chi^2	.				
	Rho	-0.8363				
	Rho = 0: Chi^2	7.75				
	Rho = 0: Prob > Chi^2	0.0054				

In terms of the motives for remitting, the results seem to take away support from the exchange motive implied by the results of the tobit model, as the effect of the recipient household's long-run expenditure, a proxy for its long-run expenditure, has a statistically significant and

positive impact on the probability of remitting. This should not be the case: the probability of remitting should decrease with the recipient household's income, as the likelihood of the remittance transfers being mutually beneficial decreases (Cox 1987:518). Moreover, the coefficient of the variable indicating whether the migrant has completed primary education is insignificant in both the participation and the outcome equation, contrary to the tobit model, further undermining the exchange motive.

There are a couple of interesting results in terms of significant variables in the outcome equation: the number of former household members affects the amount of remittances negatively, and the duration of migration has a positive effect on the amount of remittances. In terms of the number of household members, it could be expected that the larger the household is, the higher is its need for additional income and remittances, especially if the household is mainly composed of dependants not able to work. However, if the household have a high proportion of members that are able to work, remittances from migrants may not be as needed as in the former case and may even decrease remittances, which could be the case in Senegal.

In terms of the duration of migration, none of the motives are consistent with the probability and amount of remittances increasing with the duration of migration. The duration may, however, be interpreted as a proxy for the professional experience the migrant gains during his migration, and thus as a proxy for his income. Even though it is often expected that income first increases and then decreases with the worker's age and experience, this inverse U-shaped relationship is not supported by additional estimations. Thus, the positive effect of the duration of migration is in line with the general notion of a higher income of the migrant increasing the probability and amount of remittances, which is consistent with all motives for remitting, except for the insurance motive. This result is further supported by the effect of working in an agricultural or crafts occupation, a further proxy for the migrant's income, being positive on the amount of remittances. However, two contrasting findings cast some doubt to these conclusions: migrants residing in Africa and in urban regions of Senegal, where incomes could be expected to be higher, remit less than migrants residing in rural regions of Senegal.

7.2.3. Two-part model for probability and amount of remittances

The two-part model's probit estimation of the likelihood of remitting and the OLS estimation of the conditional logarithmic amount remitted are presented table 12. However, as the

correlation coefficient *rho* in the Heckman selection model is significant, the participation and the outcome equation are not independent of one another, and the OLS estimation of the logarithmic amount remitted is likely to be inconsistent. Still, the two-part model estimation results are briefly compared to the Heckman selection model estimation results.

Table 12. Two-part model for probability and amount of remittances in Senegal

	Likelihood of remitting			Amount remitted		
Independent Variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Coefficient	Robust std. err.	Partial effect on the conditional expected log amount remitted
Sex	0.5081*	0.2789	0.1220	0.0807	0.2344	0.0807
Married	0.3100*	0.1615	0.0744	0.3029*	0.1662	0.3029
Son	0.3380*	0.1966	0.0812	0.0326	0.1854	0.0326
Age	0.0012	0.0205	0.0003	0.0113**	0.0052	0.0113
Primary	-0.4230*	0.2544	-0.1016	-0.2335	0.2343	-0.2335
Secondary	0.2132	0.2449	0.0512	0.0295	0.1787	0.0295
Tertiary	0.1136	0.4912	0.0273	-0.0554	0.4574	-0.0554
Duration	0.0103	0.0178	0.0025	0.0324***	0.0092	0.0324
OECD	0.8980***	0.3301	0.2157	0.7000***	0.2578	0.7000
Africa	0.1472	0.3640	0.0354	-0.3585	0.2364	-0.3585
Urban Senegal	0.4851*	0.2726	0.1165	-0.6070***	0.2099	-0.6070
Professional	-0.5842*	0.3423	-0.1403	0.2298	0.3294	0.2298
Service	0.2642	0.2397	0.0634	0.1096	0.1451	0.1096
Agriculture & Crafts	-0.2337	0.2469	-0.0561	0.3471*	0.1947	0.3471
Reason	0.8681**	0.3480	0.2085	0.7305***	0.2073	0.7305
Employed	(omitted)			(omitted)		(omitted)
Alone	0.3798*	0.2293	0.0912	0.3315*	0.1771	0.3315
Size of HH	-0.0063	0.0145	-0.0015	-0.0210**	0.0094	-0.0210
Assets of HH	0.6255	0.5139	0.1502	0.3265	0.3734	0.3265
Expenditure of HH	0.2221**	0.1065	0.0533	0.1589*	0.0804	0.1589
Constant	-5.0627***	1.6429		8.4285***	1.2905	
	Joint significance			Joint significance		
		Chi^2	Prob > Chi^2		F	Prob > F
	Education	5.48	0.1401	Education	0.37	0.7750
	Residence	9.69	0.0214	Residence	18.12	0.0000
	Occupation	7.21	0.0656	Occupation	1.18	0.3227
	Origin region	39.16	0.0000	Origin region	10.08	0.0000
	Model statistics			Model statistics		
	N		991	N		761
	Log pseudolikelihood		-304281.3	R^2		0.5992
	Pseudo-R^2		0.1942	Root MSE		0.99508

The signs and magnitudes of the probit estimates are rather similar to those of the Heckman selection model's participation equation. In terms of statistical significance, however, there are a three variables – those indicating whether the migrant has completed primary level education, whether he resides in urban regions of Senegal and whether he works in a professional level occupation – whose coefficients statistically significant in the probit model

but not in the Heckman selection model's participation equation. When it comes to the OLS estimates, there are several differences in the signs, magnitudes and statistical significances of the variable coefficients when compared to the Heckman selection model's outcome equation. The partial effects of the independent variables on the probability of remitting and on the conditional expected logarithmic amount remitted, however, are rather similar in the two-part model and in the Heckman selection model.

The differences between the two models' estimates may arise precisely from the finding that the decision to remit and the decision on how much to remit are not independent from one another, and thus require an estimation method like the Heckman selection model that account for this phenomenon. Despite these differences, however, none of the results of the two-part model contrast the conclusions made earlier in terms of the motives for remitting. Thus, the results of the two-part model are not discussed further, and the results of Heckman selection model should be primarily referred to.

7.2.4. Two-part model for probability and amount of remittances by gender and destination

In this section, the results obtained with the two-part model in the previous section are contrasted across genders and destinations separately. In table 13, the results by gender are presented. In addition, in figures 11 through 15 in appendix 5, the correct interaction effects and statistical significances of the interaction variables in the probit model are presented. Yet, it should be kept in mind that the OLS estimates of the two-part model are likely to be inconsistent, as the decisions on whether to remit and on how much to remit are not independent of one another.

In the probit estimation, non-interacted variables *OECD* and *expenditure of HH* have statistically significant coefficients, like in the two-part model estimation for all migrants. In addition, the interactions *male*OECD* and *male*assets of HH* are statistically significant, but these results may be misleading. According to the mean interaction effects, the former effect is, on average, negative, while the latter is negative, but both of them are, on average, statistically insignificant. Looking at figures 11 and 14 in appendix 5 implies that, however, for some observations, the interaction effects of these variables are statistically significant. The interaction effect of interaction *male*OECD* is both negative and positive depending on the predicted probability of the dependent variable, while the interaction effect of interaction *male*assets of HH* is positive but varies widely. In terms of their statistical significance, for

quite many observations the effect of interaction *male*OECD* is statistically significant on the 5 percent significance level: these observations correspond to migrants with a variety of predicted probabilities of remitting, and to both positive and negative interaction effects. For the interaction *male*assets of HH*, the observations for which the interaction effect is statistically significant correspond to migrants with a good 60 percent predicted probability of remitting, and for them, the interaction effect is from around 2 to 2.5 percent. However, no conclusions should be made from these findings due to the low incidence of statistically significant interaction effects.

Table 13. Partial two-part model for probability and amount of remittances in Senegal by gender

	Likelihood of remitting		Amount remitted	
Independent variable	Coefficient	Robust std. err.	Coefficient	Robust std. err.
Male	3.1312	3.2085	-1.1082	1,3781
OECD	1.9156***	0.5016	2.0368***	0,4963
Male*OECD	-1.0754**	0.5423	-1.4333***	0,3965
Tertiary	-0.1338	0.6009	-0.9280**	0,4071
Male*Tertiary	0.1757	0.7227	0.9581*	0,5565
Employed	(omitted)		(omitted)	
Male*Employed	(omitted)		(omitted)	
Assets of HH	-1.0111	0.7599	1.3560***	0,2529
Male*Assets of HH	1.6897*	0.9200	-1.2259***	0,4003
Expenditure of HH	0.5504**	0.2235	-0.0747	0,1194
Male*Expenditure of HH	-0.3408	0.2394	0.2412**	0,1157
	Mean interaction effects			
	Mean	Std. err.	z	
Male*OECD	-0.2103	0.8791	-0.5042	
Male*Tertiary	0.0198	0.1535	0.1364	
Male*Employed	(omitted)			
Male*Assets of HH	0.1986	1.6301	0.2221	
Male*Expenditure of HH	-0.0114	1.8169	0.0083	
	Model statistics		Model statistics	
	N	991	N	761
	Log pseudolikelihood	-297450.12	R^2	0.6127
	Pseudo-R^2	0.2123	Root MSE	0.9809

In the OLS estimation, remittances respond statistically significantly to whether the migrant is residing in an OECD country, whether he has completed tertiary level education and whether the recipient household owns any land or buildings. Only the first one of these is statistically significant in the two-part model estimation for all migrants. In addition, the effects of interactions *male*OECD, male*tertiary* and *male*assets of HH* are also statistically significant, meaning that the remittance behaviour of male migrants is significantly different

from that of female migrants when it comes to the effects of residing in OECD countries, education and the recipient household's assets.

Firstly, male migrants residing in OECD countries increase their remittances less in response to their residence than female migrants do: residing in an OECD country is associated with an average 204 percent increase of remittances among female migrants, but the increase among male migrants is only 203.68 – 143.33 = 60.35 percent. As residing in an OECD country is one of the proxies for the migrant's income and likely to increase this income, the result implies that female migrants are willing to share a larger proportion of their increased income with their families back home than male migrants. While this could be interpreted as female migrants being more altruistic towards their families than male migrants, the result is consistent with other motives for remittances, as well, except for the insurance motive.

Secondly, while remittances of female migrants respond negatively to them having completed tertiary level education, the effect is slightly positive among male migrants. Education having a negative impact on remittances may be a sign of the exchange motive: highly-educated female migrants, being less inclined to return home than less-educated ones, are likely to send smaller remittances. However, as the effect of the recipient household's long-run expenditure, a proxy for its long-run income, on the probability of remitting is positive and statistically significant – and as its effect on the amount of remittances is statistically insignificant – among female migrants, this conclusion should be regarded with caution. In contrast, remittances of male migrants increase with education, implying that male migrants may be motivated by the strategic or the investment motive. However, as the effect of the interaction variable *male*expenditure of HH* on remittances is positive, the latter motive is more probable, and male migrants may send remittances to repay educational loans they have received from their former households.

Thirdly and lastly, remittances respond positively to whether the household owns any inheritable assets, but the response of male migrants' remittances is much smaller than that of female migrants' remittances: while the recipient household owning assets is associated with a 136 percent increase in remittances among female migrants, the increase among male migrants is only 135.60 – 122.59 = 13.01 percent. What this result implies is that female migrants are more concerned about the possible inheritance they will receive, and hence increase their remittances more than male migrants.

In table 14, the results by destinations of migrants are presented. In addition, in figures 16 through 20 in appendix 5 the correct interaction effects and statistical significances of the interaction variables in the probit model are presented. The statistically significant non-interacted variable coefficients in the probit estimation – *male*, *OECD* and *expenditure of HH* – are significant also in the two-part model estimation for all migrants. However, none of the interaction variables are statistically significant, but this result may be misleading. The mean interaction effects indicate that the effects of interactions *OECD*male* and *OECD*expenditure of HH* are on average negative, while the effects of the interactions *OECD*tertiary* and *OECD*assets of HH* are on average positive – all of them are, however, on average statistically insignificant.

Table 14. Partial two-part model for probability and amount of remittances in Senegal by destination

	Likelihood of remitting			Amount remitted	
Independent variable	Coefficient	Robust std. err.		Coefficient	Robust std. err.
Male	0.8259***	0.3072		0.5818***	0.2173
OECD	3.5875**	3.6764		2.9959*	1.6688
OECD*Male	-1.2554	0.5081		-1.1680***	0.3835
Tertiary	-0.2657	0.4813		1.3508**	0.5611
OECD*Tertiary	0.6261	0.6669		-2.1380***	0.6922
Employed	(omitted)			(omitted)	
OECD*Employed	(omitted)			(omitted)	
Assets of HH	0.1487	0.6024		0.4290	0.3900
OECD*Assets of HH	1.2183	0.9565		-0.7007	0.4923
Expenditure of HH	0.2777***	0.0991		0.1741*	0.0946
OECD*Expenditure of HH	-0.2199	0.2741		-0.0394	0.1309
	Mean interaction effects				
	Mean	Std. err.	Z		
OECD*Male	-0.2389	0.2352	-1.5875		
OECD*Tertiary	0.0699	0.4841	0.2022		
OECD*Employed	(omitted)				
OECD*Assets of HH	0.0881	1.5119	-0.0239		
OECD*Expenditure of HH	-0.0669	1.8362	-0.0584		
	Model statistics			Model statistics	
	N	991		N	761
	Log pseudolikelihood	-296973.86		R^2	0.6181
	Pseudo-R^2	0.2136		Root MSE	0.9741

The figures from 16 to 20 in appendix 5 show that the interaction effects vary widely across the different predicted probabilities of the dependent variable. However, looking at the statistical significance of the interaction effects, the figures imply that for some observations, the interaction *OECD*male* and the interaction *OECD*assets of HH* are statistically significant. The interaction effect of interaction *OECD*male* is significant and negative for

observations corresponding to migrants with a variety of predicted probabilities of remitting. In turn, the interaction effect of interaction *OECD*assets of HH* is statistically significant for only a few observations corresponding to migrants with a predicted probability of remitting around 80 percent: for these observations, the interaction effect is around 5 percentage points or slightly less than zero percentage points. Still, since for most observations the above interaction effects are insignificant, no robust conclusions can be drawn from the findings.

In the OLS estimation, the effects of variables indicating whether the migrant is male, whether he resides in an OECD country, whether he has completed tertiary level education and what the recipient household's long-run expenditure is are statistically significant. Of these variables, only variables *OECD* and *expenditure of HH* have statistically significant coefficients in the two-part model estimation for all migrants. Also the effects of interaction variables *OECD*male* and *OECD*tertiary* are statistically significant, meaning that when it comes to the effects of education and being male, migrants residing in OECD countries behave significantly differently from migrants residing in African countries.

The interaction between the migrant being male and residing in an OECD country is negative. Among migrants residing in African countries, being male is associated with an 58.2 percent increase in remittances. However, among migrants residing in the OECD countries, being male is associated with a decrease of 116.80 – 58.18 = 58.62 percent in remittances.

The effect of education on remittances of migrants residing in OECD countries is interesting, as they respond negatively to the completion of tertiary level education: tertiary education decreases remittances of migrants residing in OECD countries by 213.80 – 135.08 = 78.72 percent. However, tertiary education among migrants residing in African countries is associated with an increase in remittances. In terms of the motives for remitting, this result suggests that migrants residing in OECD countries, being less likely to return home due to their higher education, may decrease their remittances to the recipient households. While this kind of behaviour is consistent with the exchange motive, the behaviour of migrants residing in African countries falls under the investment motive, and they may send remittances at least partly to repay educational loans they have received from their former households. These conclusions are further supported by the positive effect that the recipient household's expenditure, a proxy for its income, has on the amount of remittances. However, its effect on the probability of remittances is positive and statistically significant, as well, which is inconsistent with the exchange motive.

7.2.5. Effects of other migrants and parental funding from recipient household on probability and amount of remittances

As mentioned in section 6.2.1.2, with the Senegalese data it was possible to test whether the number of international migrants from the same household and whether receiving funding for migration from parents affect migrants' decisions on whether to remit and how much to remit. The tobit, Heckman selection and two-part model estimations including these variables were carried out, and the coefficient estimates, standard errors and partial effects of the newly-included variables are presented in appendix 6, and are briefly discussed here.

First, the coefficient of the variable indicating the number of international migrants from the same household is positive but insignificant in the tobit model, but the coefficient of the variable squared is negative and significant – the coefficients are jointly statistically significant. The same is true in the Heckman selection model's participation equation, and in the two-part model's first equation. Second, the variable indicating whether the migrant's parents have funded the migration is statistically insignificant according to all estimations.

What the first result implies is that in Senegal, the number of international migrants from the same household first increase, and then decrease the probability of the migrant remitting to the household. Rapoport and Docquier (2006:1161) suggest the possibility of this kind of a relationship between the number of migrants and the amount of remittances: first, the competition between migrants from the same household increase remittances, but later on, the effect of competition is offset by the decreasing probability of the migrant receiving an inheritance. This kind of behaviour thus seems to indicate that migrants may be motivated by a possible inheritance, and are more likely to remit when there are only a small number of international migrants from the same household. The second result suggests that migrants do not consider the investment their parents have made in their migration when they make their remittance decisions, meaning that the investment motive and loan repayment is not driving their remittance behaviour. This finding is supported by earlier estimations, as well, where the coefficient of the variable indicating the recipient household's assets is insignificant.

7.2.6. Probit model for choice between official and unofficial remittance channels

The probit estimation results for the choice between official and unofficial remittance channels are presented in table 15. The coefficients of variables indicating the whether the migrant is male, whether he is the son or daughter of the household head, the duration of his

migration, whether he is residing in an OECD country or in urban regions of Senegal are statistically significant. In addition, the coefficients of variables indicating the migrant's current residence and his origin region are jointly statistically significant.

Of the significant variables, the largest partial effects on the probability of using official channels are induced by whether the migrant is residing in an OECD country or in the urban regions of Senegal, and whether the migrant is male. The two latter effects are negative: Migrants residing in urban regions of Senegal have an 11.3 percent lower probability of using official channels for remitting than migrants residing in rural regions of Senegal, while male migrants have a 8.6 percent lower probability of doing so than female migrants.

Table 15. Probit model for choice between official and unofficial remittance channels in Senegal

Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of using official channels
Sex	-0.6777*	0.3493	-0.0861
Married	0.4032	0.2932	0.0512
Son	0.5769**	0.2470	0.0733
Age	0.0017	0.0139	0.0002
Primary	-0.1840	0.3337	-0.0234
Secondary	-0.3563	0.2643	-0.0453
Tertiary	0.7440	0.5016	0.0945
Duration	0.0300*	0.0174	0.0038
OECD	2.1980***	0.4490	0.2793
Africa	0.5469	0.4950	0.0695
Urban Senegal	-0.8924**	0.4300	-0.1134
Professional	-0.6531	0.4070	-0.0830
Service	0.1561	0.2595	0.0198
Agriculture & Crafts	-0.0823	0.2930	-0.0105
Reason	0.5146	0.4513	0.0654
Employed	(omitted)		
Alone	0.1302	0.2265	0.0165
Size of HH	-0.0104	0.0154	-0.0013
Assets of HH	0.1900	0.4778	0.0241
Expenditure of HH	0.1537	0.1280	0.0195
Constant	-3.4651**	1.6270	
Joint significance			
	Chi^2		Prob > Chi^2
Education	6.24		0.1005
Residence	172.06		0.0000
Occupation	3.80		0.2834
Origin region	100.47		0.0000
Model statistics			
N	782		
Log pseudolikelihood	-130687.97		
Pseudo-R^2	0.6509		

In terms of the residence of the migrant, it could have been expected that as urban regions tend to be better covered by banks and money transfer operators than rural ones, urban migrants would be more inclined to use these official services for sending their remittances than rural migrants: this is not the case here, however. Yet, the result that remittances from OECD countries are preferably sent officially is a rather expected one, and may imply that migrants residing in OECD countries value the usually better reliability of official channels more than migrants residing in rural regions of Senegal. Also, as this variable may be interpreted as a proxy for the migrant's income, and is expected to increase this income, migrants residing in OECD countries may not be as liquidity constrained in their choice between remittance channels as migrants in rural regions of Senegal, and are likely to have a better access to official channels. Regarding the result that male migrants are more likely to resort to unofficial channels than female migrants, it may be that male migrants are less risk-averse than female migrants and thus ready to take the risks associated with remitting unofficially.

7.2.7. Probit model for choice between international and internal migration

Table 16 displays the probit estimation results for the choice between international and internal migration. The specification estimated here is slightly different from the one estimated with the Ugandan data, as it includes independent variables indicating the number of other international and internal migrants from the same household.

The choice of sending the migrant abroad is statistically significantly and positively affected by the migrant's age, whether he is married, whether he is likely to work in a service level or in an agricultural or crafts occupation, whether he intends to work or search for work, the assets of the recipient household, and the number of international migrants from the same household. In turn, the choice of sending the migrant abroad is statistically significantly and negatively associated with whether the migrant has completed primary education, the intended duration of his migration, whether he is likely to work in a professional level occupation, the size of his former household, and the number of internal migrants from the same household. In addition, the occupation-, migrant-, and origin region-related variable coefficients are also jointly statistically significant.

The results imply that migrants that are more likely sent abroad form a relatively experienced group: they are likely to be older, married, and intend to work or at least search for work in their country of destination. The finding that the sending household's assets affect the

probability of international migration positively is an expected one, as wealthier households are likely to be in a better financial position to fund the higher costs associated with travelling abroad than poorer ones. In contrast, as pointed out in section 4.1, the size of the household may have a negative effect on sending the migrant abroad, as larger households need to satisfy higher consumption needs than smaller ones, and may not have the spare funds needed to cover the costs of international migration.

Table 16. Probit model for choice between international and internal migration from Senegal

Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of sending the migrant abroad
Sex	0.1595	0.2963	0.0196
Married	0.4102*	0.2390	0.0503
Son	0.0509	0.2436	0.0062
Age	0.0322***	0.0105	0.0039
Primary	-0.7053**	0.3288	-0.0865
Secondary	0.1750	0.2271	0.0215
Tertiary	-0.2210	0.4703	-0.0271
Duration	-0.0211**	0.0107	-0.0026
Professional	-0.7419**	0.3710	-0.0910
Service	0.5059*	0.2257	0.0621
Agriculture & Crafts	0.5147*	0.3088	0.0632
Reason	0.4790*	0.2683	0.0588
Employed	(omitted)		
Alone	-0.3003	0.2193	-0.0368
Size of HH	-0.0411**	0.0204	-0.0050
Assets of HH	0.6654*	0.3597	0.0468
Expenditure of HH	0.0098	0.0802	0.0012
International migrants	1.4453***	0.2371	0.1773
Internal migrants	-0.5752***	0.0914	-0.0706
Constant	-2.1814	1.2922	
Joint significance			
	Chi^2		Prob > Chi^2
Education	5.49		0.1394
Occupation	12.25		0.0066
Other migrants	46.64		0.0000
Origin region	88.28		0.0000
Model statistics			
	N	992	
	Log pseudolikelihood	-152319.4	
	Pseudo-R^2	0.6882	

Also the positive effect of the number of international migrants from the same household has a rather intuitive explanation: if there is a household member, or several of them, already abroad, the household may perceive the risk of sending another one abroad to be smaller.

Especially, if the household decides to send the new migrant to the same destination as the other one, he will have an existing social network there to facilitate his adjustment to the new environment. Most likely for the same reason, the number of internal migrants from the same household affects international migration negatively, and the household may prefer to send the new migrant to the destination it has sent the previous one(s), i.e. to other parts of Uganda.

The negative effect of the migrant having primary education, and the negative effect of the migrant having the potential to work in professional level occupations on the probability of sending the migrant abroad, is interesting. In terms of the effect of the migrant's education, the household may regard the migrant with only primary education as not having that good chances of finding employment in international job markets, and thus prefers to send him only to other parts of Senegal. Also, the return to a low level of education abroad may not be much better than within Senegal to make it profitable for the household to consider sending a poorly-educated migrant abroad. Moreover, the reason for migration among migrants with low education may not even be to work, but to obtain further education. In this case, the household may not even aim at receiving supplementary income in the form of remittances, and thus may prefer to send migrants to closer locations with lower migration costs. Indeed, if migrants do not intend to work in their country of destination, the results above indicate that they are less likely sent abroad.

When it comes to the potential occupation of the migrant, it could be expected that a migrant who could work in professional level occupations would more likely be sent abroad where he could reap the full monetary benefits of his aptitude, as wages are presumably higher abroad than in Senegal. However, as hypothesised in section 4.2, it could also be possible that this potential of the migrant of being a professional level worker could only be realised within Senegal, as employers elsewhere might not be able to recognise his potential and skills, or would not regard the qualifications of the migrant as highly as Senegalese employers. Thus, high-skill migrants could end up working in occupations requiring less skills than they actually have. This latter hypothesis does seem to receive some support, as the potential of working in a professional level occupation affect the probability of sending a migrant abroad negatively.

In contrast, the recognition of the migrant's skills and qualifications may be easier or not as relevant abroad regarding lower-level occupations such as those in the service or agricultural sector, and thus migrants suitable for these occupations could actually work in these

occupations and get the higher international wage offered for these jobs. This hypothesis is also supported by the results, as the effect of the potential of working in a service level and agricultural and crafts occupation is positive on the probability of sending the migrant abroad.

7.3. Estimation results for Nigeria

In sections 7.3.1, 7.3.2 and 7.3.3, the tobit, Heckman selection and two-part model estimation results for the determinants of the probability and amount of remittances are presented and discussed, respectively. These results are contrasted across genders and destinations of migrants in section 7.2.4. In section 7.2.5, the effects of the recipient household's education, occupation and employment on the probability and amount of remittances are discussed. The probit model results for the determinants of the choice between official and unofficial remittance channels are investigated in section 7.2.6, and in section 7.2.7, the probit model results for the determinants of the choice between international and internal migration are examined.

7.3.1. Tobit model for probability and amount of remittances

The tobit estimation results are presented in table 17. Remittances are statistically significantly affected by whether the migrant is male, whether he is married, whether he is the son or daughter of the household head, whether he has completed tertiary education, the duration of his migration, whether he currently resides in an OECD or an African country or in urban regions of Nigeria, whether he works in a professional level occupation, whether he migrated for work, whether he is employed, and the recipient household's assets. Moreover, the coefficients of variables indicating the migrant's education, his current residence, his occupation and his origin state are jointly statistically significant.

Of these variables, the ones that have the strongest partial effect on the probability of remitting are whether the migrant is employed, and whether he is currently residing in an OECD country or in urban regions of Nigeria. While employed migrants have a 26.3 percent higher probability of remitting than unemployed ones, migrants residing in OECD and in African countries have a 14.5 and a 12.8 percent higher probability of remitting, respectively, than those residing in rural areas of Nigeria.

In terms of the partial effects on the conditional expected logarithmic amount remitted, residing in another African country and having completed tertiary education also have a considerable effect: migrants residing in African countries remit on average 307 percent more

than migrants residing in rural areas of Nigeria, and migrants having completed tertiary education remit on average 246 percent more than migrants with no education.

Table 17. Tobit model for probability and amount of remittances in Nigeria

Independent Variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Partial effect on the conditional expected log amount remitted
Sex	1.5752*	0.8783	0.0567	1.1016
Married	1.3787*	0.4754	0.0454	0.9904
Son	2.3139**	0.9150	0.0742	1.6704
Age	0.0005	0.0257	0.0000	0.0003
Primary	1.7221	1.4556	0.0515	1.2781
Secondary	2.3630	1.4881	0.0757	1.724
Tertiary	3.3007***	1.2819	0.1002	2.4578
Duration	0.0753**	0.0337	0.0024	0.0543
OECD	6.0603***	1.9615	0.1451	4.8357
Africa	3.8902**	1.8945	0.0963	3.0696
Urban Nigeria	3.3497*	1.8924	0.1280	2.2758
Professional	1.9104***	0.7298	0.0621	1.3883
Service	1.0429	0.7707	0.0329	0.7635
Agriculture & Crafts	-0.0741	0.9214	-0.0024	-0.0534
Reason	1.0521*	0.5786	0.0360	0.7496
Employed	5.5005***	1.1592	0.2628	3.401
Alone	0.3800	0.4665	0.0123	0.2748
Size of HH	-0.0915	0.0790	-0.0029	-0.066
Assets of HH	-0.8971**	0.4263	-0.0276	-0.661
Expenditure of HH	-0.0837	0.2436	-0.0027	-0.0604
Constant	-8.4331	5.7350		

Joint significance		
	F	Prob > F
Education	3.95	0.0082
Residence	10.48	0.0000
Occupation	4.70	0.0029
Origin state	31019.46	0.0000

Model statistics	
N	920
Uncensored	643
Sigma	4.7369
Log pseudolikelihood	-5047819.4
Pseudo-R^2	0.1115
F	.
Prob > F	.

Clearly, the migrant's income has a significant positive effect on remittances, especially through the proxy variable indicating the migrant's current residence, but also through the migrant's employment status and level of education and occupation – these effects again rule out the insurance motive. Also the positive effect of the duration of migration, a proxy for the migrant's working experience and thus for his income, on remittances is in line with the

above conclusion. However, this positive effect goes against the altruistic motive, which predicts remittances to decrease alongside fading altruistic feelings towards the recipient household (Rapoport and Docquier 2006:1153). The migrant's education having a positive effect on remittances suggest that migrants may be driven by the strategic or the investment motive: the educated migrant may be either bribing less-educated family members to stay home, or repaying educational loans his former household has given him in the past (Stark 1995:93; Rapoport and Docquier 2006:1156).

However, none of the motives for remittances, least of all the inheritance motive, are consistent with the recipient household's assets having a negative impact on remittances, which is found in these estimations. Yet, if these assets are interpreted as a proxy for the recipient household's long-run income, the negative effect could be an indication of a variety of motives. In turn, the positive effect that employment has on remittances goes against the suggestion made by Amuedo-Dorantes and Pozo (2006:229), according to whom migrants facing a higher income risk, e.g. unemployed migrants, should remit more than those facing a lower income risk in order to insure themselves.

7.3.2. Heckman selection model for probability and amount of remittances

The estimation results obtained with the Heckman selection model are presented in table 18. In contrast to the results obtained for Uganda and Senegal, the correlation coefficient *rho* is insignificant: the null hypothesis of independent equations cannot be rejected, and the participation equation and the outcome equation are likely to not be dependent of one another. Thus, OLS estimates of the independent variable coefficients are likely to be consistent. For this reason, the two-part model results are more deeply discussed and compared to results of the Heckman selection model in the following section, and here, only the statistical significance of the variable coefficients in the Heckman selection model is reviewed.

In the participation equation, the coefficients of variables indicating whether the migrant is married, whether he is the son or daughter of the household head, whether he has completed tertiary level education, whether he resides in OECD countries or in urban regions of Nigeria, whether he migrated for work, whether he is employed, and whether his migration has lasted for more than one year, are statistically significant. In the outcome equation, variables indicating whether the migrant is male, whether he is married, whether he has completed primary, secondary or tertiary level education, the duration of his migration, whether he lives

alone, the size of his former household, and what the recipient household's long-run expenditure is, have statistically significant coefficients.

Table 18. Heckman selection model for probability and amount of remittances in Nigeria

	Likelihood of remitting			Amount remitted		
Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Coefficient	Robust std. err.	Partial effect on the conditional expected log amount remitted
Sex	0.3264	0.2606	0.0620	0.3017**	0.1464	0.3127
Married	0.2554**	0.1079	0.0520	0.3587*	0.1996	0.3669
Son	0.7696***	0.1965	0.1543	0.0923	0.1789	0.1168
Age	0.0053	0.0071	0.0010	-0.0180	0.0115	-0.0179
Primary	0.0675	0.3335	0.0133	1.3521**	0.6714	1.3542
Secondary	0.3083	0.3363	0.0604	1.5311**	0.6182	1.5407
Tertiary	0.6025**	0.2830	0.1187	1.6101**	0.6552	1.6283
Duration	0.0103	0.0096	0.0020	0.0207*	0.0121	0.0211
OECD	1.2694***	0.4615	0.2104	0.8666	0.6760	0.8985
Africa	0.6599	0.4302	0.1149	0.5969	0.7505	0.6148
Urban Nigeria	0.7106*	0.3819	0.1497	-0.2004	0.7104	-0.1758
Professional	0.5246**	0.2144	0.1065	0.2142	0.2137	0.2307
Service	0.1553	0.2562	0.0305	0.1028	0.1864	0.1077
Agriculture & Crafts	0.0222	0.2978	0.0044	0.0800	0.2487	0.0807
Reason	0.3523***	0.0890	0.0741	0.0928	0.3212	0.1044
Employed	1.3843***	0.3588	0.3375	0.3901	0.2690	0.4467
Alone	-0.0388	0.1635	-0.0077	0.3219**	0.1301	0.3206
Size of HH	-0.0092	0.0295	-0.0018	-0.0582**	0.0267	-0.0584
Assets of HH	-0.3335	0.2150	-0.0626	-0.0235	0.2091	-0.0334
Expenditure of HH	-0.0915	0.0863	-0.0183	0.1072**	0.0430	0.1043
Duration > 1 year	0.5398*	0.3081	0.1178			0.0193
Constant	-2.3641*	1.3823		6.9341***	0.9667	
	Joint significance			Joint significance		
		Chi^2	Prob > Chi^2		Chi^2	Prob > Chi^2
	Education	6.21	0.1016	Education	7.24	0.0647
	Residence	10.29	0.0163	Residence	83.25	0.0000
	Occupation	12.13	0.0069	Occupation	1.12	0.7723
	Origin state	7.6*10^6	0.0000	Origin state	6.2*10^5	0.0000
	Model statistics					
	N	918				
	Uncensored	640				
	Log pseudolikelihood	-3182148.0				
	Chi^2	.				
	Prob > Chi^2	.				
	Rho	-0.0689				
	Rho = 0: Chi^2	1.50				
	Rho = 0: Prob > Chi^2	0.2212				

7.3.3. Two-part model for probability and amount of remittances

The two-part model's probit estimation of the likelihood of remitting and the OLS estimation of the conditional logarithmic amount remitted are presented table 19. Comparing these

results to those obtained with the Heckman selection model, the probit and OLS estimates are very similar in their statistical significance, signs and magnitude to the Heckman selection model estimates, giving robustness to the results and indicating that the OLS estimates are indeed likely to be consistent.

Table 19. Two-part model for probability and amount of remittances in Nigeria

	Likelihood of remitting			Amount remitted		
Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Coefficient	Robust std. err.	Partial effect on the conditional expected log amount remitted
Sex	0.3565	0.2539	0.0775	0.3188**	0.1429	0.3188
Married	0.2917***	0.1104	0.0607	0.3529	0.2086	0.3529
Son	0.8042***	0.1735	0.1623	0.1016	0.1886	0.1016
Age	0.0051	0.0074	0.0009	-0.0176	0.0118	-0.0176
Primary	0.1035	0.3179	0.0121	1.3743*	0.6925	1.3743
Secondary	0.3592	0.3178	0.0612	1.5500**	0.6499	1.5500
Tertiary	0.6553**	0.2717	0.1209	1.6425**	0.6926	1.6425
Duration	0.0159**	0.0078	0.0032	0.0220*	0.0126	0.0220
OECD	1.3197***	0.4535	0.2173	0.9175	0.7011	0.9175
Africa	0.6899	0.4217	0.1202	0.6276	0.7754	0.6276
Urban Nigeria	0.7452**	0.3751	0.1617	-0.1718	0.7353	-0.1718
Professional	0.4978**	0.2256	0.0970	0.2268	0.2139	0.2268
Service	0.1966	0.2488	0.0343	0.0942	0.1925	0.0942
Agriculture & Crafts	0.0079	0.2970	-0.0002	0.0753	0.2505	0.0753
Reason	0.3051***	0.0833	0.0620	0.1091	0.3357	0.1091
Employed	1.4097***	0.3598	0.3510	0.4158	0.2858	0.4158
Alone	-0.0310	0.1574	-0.0075	0.3206**	0.1323	0.3206
Size of HH	-0.0102	0.0287	-0.0017	-0.0574*	0.0274	-0.0574
Assets of HH	-0.3413*	0.2015	-0.0731	-0.0293	0.2145	-0.0293
Expenditure of HH	-0.0895	0.0840	-0.0196	0.1034**	0.0456	0.1034
Constant	-2.0505	1.3834		6.8118***	1.0395	
	Joint significance			Joint significance		
		Chi^2	Prob > Chi^2		F	Prob > F
	Education	6.95	0.0735	Education	2.17	0.1313
	Residence	11.35	0.0100	Residence	27.65	0.0000
	Occupation	10.40	0.0154	Occupation	0.41	0.7463
	Origin state	1.5*10^7	0.0000	Origin state	27692.47	0.0000
	Model statistics			Model statistics		
	N		949	N		643
	Log pseudolikelihood		-762042.49	R^2		0.5387
	Pseudo-R^2		0.3927	Root MSE		1.2274

Only the variables indicating whether the migrant has completed tertiary education and the duration of his migration enter both equations significantly. Also the variables indicating the migrant's current residence and his origin region are jointly statistically significant in both equations. Comparing the probit and OLS estimates to the tobit estimates, the pattern of the statistical significance and signs of the tobit coefficient estimates follows quite closely the

pattern of the probit coefficient estimates, with a few exceptions. However, the pattern of the statistical significance of the OLS estimates differs quite clearly from that of the tobit estimates: for instance, the coefficients of variables indicating whether the migrant lives alone, the number of former household members, and what the recipient household's long-run expenditure is are statistically significant in the two-part model's equation for the amount remitted, but insignificant in the tobit model. Conversely, while all the coefficients of variables relating to the migrant's current residence are statistically significant in the tobit model, they are all insignificant in the two-part model's equation for the amount remitted.

In terms of the partial effects, the magnitudes of partial effects on the likelihood of remitting and on the conditional expected logarithmic amount remitted obtained with the two-part model are very similar to those obtained with the Heckman selection model. However, there are rather big differences between the magnitudes of partial effects on the probability of remitting obtained with the two-part model and those obtained with the tobit model, even though the pattern of their relative magnitude is similar. For instance, according to the two-part model, employed migrants have a 34.4 percent higher probability of remitting than unemployed ones, compared to the 26.3 percent implied by the tobit model. Moreover, while migrants residing in OECD countries have a 21.4 percent higher probability of remitting than migrants residing in rural Nigeria, the corresponding probability is only 14.5 percent according to the tobit model.

When it comes to the partial effects of the statistically significant variables on the conditional expected logarithmic amount remitted, differences between the partial effects obtained with the two-part model and the tobit model are notable, as well. In the two-part model, the largest semi-elasticities are for the variables indicating whether the migrant has completed primary, secondary or tertiary education: migrants having completed tertiary level education remit on average 164 percent more than migrants with no education – the corresponding figures for migrants with secondary or primary level education are 155 and 137 percent, respectively. According to the tobit model, migrants with tertiary level education remit on average 246 percent more than migrants with no education.

As the pattern of the statistical significance and signs of the variable coefficients in the two-part model's equation for the likelihood of remittances is similar to that of the tobit model, similar inferences to those made in section 7.3.1 in terms of the motives for remittances may be made. For its part, the two-part model's equation for the amount remitted gives further

support to some of the previous conclusions. For instance, several proxies for the migrant's income – the migrant's gender, his education, the duration of his migration and his living situation – again have a positive effect on the amount of remittances, which is consistent with all of the motives for remitting, except for the insurance motive. Moreover, the positive effect of education is even more pronounced in the two-part model's equation for the amount remitted than in the tobit model, and signifies the likely presence of either the strategic or the investment motive. The latter motive is supported by the positive effect that the recipient household's long-run expenditure, a proxy for its long-run income, has on remittances. However, the prediction of the investment motive, i.e. the inverse U-shaped relationship between remittances and recipient household long-run income in the constrained region of migration, does not receive support from additional estimations (Rapoport and Docquier 2006:1159).

7.3.4. Two-part model for probability and amount of remittances by gender and destination

In this section, the results obtained in the previous section are contrasted across genders and destinations separately. Table 20 displays the results by gender, and in figures 21 through 25 in appendix 7, the correct interaction effects and statistical significances of the interaction variables in the probit model are presented.

According to the standard probit model, the non-interacted variables *OECD, tertiary* and *employed* have statistically significant coefficients, like in the two-part model estimation for all migrants. The effects of interactions *male*tertiary* and *male*assets of HH* are statistically significant, but these results may be misleading. The mean interaction effects of both of these variables are, on average, negative but insignificant. But, according to figures 22 and 24 in appendix 7, the effects of both of these vary widely, and for the interaction *male*tertiary*, for some observations the interaction effect is positive.

Looking at the correct statistical significances of the interactions, interaction effects of interactions *male*OECD, male*tertiary* and *male*employed* are statistically significant for some observations. The interaction effect of interaction *male*OECD* is statistically significant for a wide variety of observations with different predicted probabilities of remitting, and the interaction effects vary widely between -4 and 4 percentage points. The significant interaction effects of interactions *male*tertiary* and *male*employed* are for observations that correspond mainly to migrants with the predicted probability of remitting of nearly 100 and 80 percent,

respectively. The interaction effect of the interaction *male*tertiary* for the statistically significant group varies from zero to around -4 percentage points, while the interaction effect of the interaction *male*employed* for the statistically significant group is around -5 and 5 percentage points. As the above effects are significant only for a relatively few observations, no robust conclusions from them should be made.

Table 20. Partial two-part model for probability and amount of remittances in Nigeria by gender

	Likelihood of remitting			Amount remitted	
Independent variable	Coefficient	Robust std. err.		Coefficient	Robust std. err.
Male	3.1148	2.4956		2.4872**	1.1149
OECD	1.0494**	0.4494		0.7633	0.7692
Male*OECD	0.1950	0.1493		0.1456	0.2480
Tertiary	1.1816***	0.4056		2.1141**	0.7394
Male*Tertiary	-0.5831*	0.3230		-0.5521***	0.1324
Employed	1.3272***	0.4065		0.5281	0.4933
Male*Employed	0.0863	0.5310		-0.1704	0.4814
Assets of HH	0.1597	0.3731		-1.2440**	0.5847
Male*Assets of HH	-0.6014*	0.3140		1.2624**	0.5909
Expenditure of HH	0.0738	0.1908		0.3452***	0.1095
Male*Expenditure of HH	-0.1952	0.2197		-0.2679**	0.1266
	Mean interaction effects				
	Mean	Std. err.	z		
Male*OECD	0.0545	0.2769	0.4784		
Male*Tertiary	-0.0688	2.0010	-0.0406		
Male*Employed	0.1836	3.0535	0.2262		
Male*Assets of HH	-0.0978	0.5014	-0.2913		
Male*Expenditure of HH	-0.0435	0.4788	-0.1338		
	Model statistics			Model statistics	
	N	949		N	643
	Log pseudolikelihood	-754564.46		R^2	0.5467
	Pseudo-R^2	0.3987		Root MSE	1.2218

In the OLS estimation, the effects of variables indicating whether the migrant is male, whether he has completed tertiary level education, the recipient household's assets, and what the recipient household's expenditure is are statistically significant. Of these variables, variable *assets of HH* is statistically insignificant in the two-part model estimation for all migrants. Additionally, the interactions *male*tertiary*, *male*assets of HH* and *male*expenditure of HH* are also statistically significant, meaning that when it comes to the effects of education, household assets and expenditure, remittance behaviour of male migrants is significantly different from that of female migrants.

The results imply that both male and female migrants increase their remittances in response to their higher education, but male migrants less so than female ones: while tertiary education

increases remittances by 211 percent among female migrants, the effect among male migrants is only 211.41 – 55.21 = 156.2 percent. This behaviour is consistent with the strategic and the investment motive, the latter one being more probable as the effect of the recipient household's expenditure on remittances is positive for both groups of migrants. Thus, it is likely that both male and female migrants are repaying their educational loans to their former households with remittances. However, as is the case in Uganda, the stronger response among female migrants may arise because the education of females may have entailed higher opportunity costs to the recipient household than that of males, or because females may have less bargaining power relative to the recipient households than males.

Interestingly, while female migrants respond negatively to whether their households own any inheritable assets, among male migrants the effect is just positive. Thus, female migrants do not seem to care about the possibility of inheriting, but male migrants do consider this when making their remittances decisions.

When it comes to the effect of recipient household's long-run expenditure, a proxy for its long-run income, male migrants respond to it positively, but significantly less than female migrants: while a one percent increase in the recipient household's expenditure is associated with a 34.5 percent increase in the amount of remittances among female migrants, the corresponding increase among male migrants is only 34.52 – 26.79 = 7.73 percent. This relative magnitude of these effects is similar to that of the effects of the migrant's education on the two groups of migrants, and together they suggest that it is the investment motive that quite likely motivates the remittance behaviour of male, and especially female, migrants.

In table 21, the results by destination are presented, and in figures 26 through 30 in appendix 7 the correct interaction effects and statistical significances of the interaction variables in the probit model are presented. In the probit estimation, the non-interacted variables *tertiary* and *employed* are statistically significant, like in the two-part model estimation for all migrants. None of the interaction effects are statistically significant according to the standard probit model, but this result may be misleading. The mean interaction effects, in turn, suggest that all the interaction effects are, on average, negative, except for the effect of the interaction variable *OECD*expenditure of HH*, and that all of them are, on average, statistically insignificant. Looking at the figures from 26 to 30 in appendix 7, the interaction effects vary widely across the different values of the predicted probability of the dependent variable, and tend to have either a wave shape or an inverse U-shape. When it comes to the statistical

significance of the interaction effects, only for a few observations, the effect of the interaction *OECD*employed* is statistically significant. These observations correspond to migrants with a good 90 percent predicted probability of remitting, and the interaction effect for these migrants is around -4 percentage points. Due to the sparse incidence of statistical significance, no conclusions should be drawn from this finding.

Table 21. Partial two-part model for probability and amount of remittances in Nigeria by destination

	Likelihood of remitting			Amount remitted	
Independent variables	Coefficient	Robust std. err.		Coefficient	Robust std. err.
Male	0.3550	0.2673		0.2881	0.2035
OECD	1.4173	1.3653		-1.4995	2.6017
OECD*Male	-0.1073	0.2133		0.0521	0.2406
Tertiary	0.6396**	0.2755		1.6739**	0.7057
OECD*Tertiary	-0.0873	0.3509		-0.0914	0.2588
Employed	1.5415***	0.4575		0.5061	0.4691
OECD*Employed	-0.8647	0.6496		-0.7195	0.8579
Assets of HH	-0.2856	0.2183		-0.0597	0.2089
OECD*Assets of HH	-0.3197	0.3155		0.4327	0.4661
Expenditure of HH	-0.0953	0.0928		0.0559	0.0645
OECD*Expenditure of HH	0.0920	0.0973		0.2375	0.1519
	Mean interaction effects				
	Mean	Std. err.	z		
OECD*Male	-0.0597	0.0849	-0.7137		
Male*Tertiary	-0.0946	1.1419	-0.1644		
OECD*Employed	-0.2598	2.3740	-0.2094		
OECD*Assets of HH	-0.0022	0.8169	0.0457		
OECD*Expenditure of HH	0.0225	0.5233	0.0542		
	Model statistics			Model statistics	
	N	949		N	643
	Log pseudolikelihood	-758440.86		R^2	0.5431
	Pseudo-R^2	0.3956		Root MSE	1.2267

According to the OLS estimation, the only variable that is statistically significant indicates whether the migrant has completed tertiary level education – significant also in the two-part model estimation for all migrants – which affects the amount of remittances positively and thus implies the presence of either the strategic or the investment motive. As none of the interaction variables are statistically significant, no significant differences in the remittance behaviour of migrants are likely to arise due to their different locations.

7.3.5. Effects of education, occupation and employment in recipient household on probability and amount of remittances

As mentioned in section 6.2.1.2, with the Nigerian data it was possible to test whether the education or occupation level, or the employment of a former household member affect the

migrant's decisions on whether to remit and how much to remit. The tobit model, Heckman selection model and two-part model estimations including these variables were carried out, and the estimates, standard errors and partial effects of the newly-included variables are presented in appendix 8, and briefly discussed here.

In the tobit model, the coefficient of the variable indicating whether a household member has completed primary education is negative and statistically significant, but all of the other tested coefficients are insignificant. The same result is obtained in the Heckman selection model's participation equation and in the two-part model's equation for the likelihood of remitting. The coefficients of variables referring to the household member's education and occupation level are jointly statistically insignificant according to all estimation methods. It is thus the decision on whether to remit that is affected by the one significant variable, and it is reflected also in the result obtained with the tobit model.

Whether a former household member of the migrant has completed primary education affects the migrant's decision on whether to remit negatively. If the household member's education level is interpreted as a proxy for the recipient household's income, this result would imply that Nigerian migrants are less likely to remit when a former household member is more educated and is thus more likely to have a higher income. When combined with the finding that the recipient household's long-run expenditure affects the amount of remittances positively according to the Heckman selection model and the two-part model reviewed in sections 7.2.2 and 7.2.3, respectively, this result gives support to the exchange motive, under which these inversely related effects are possible to reconcile. However, as the variables indicating the education level of the household member are jointly statistically insignificant, this implication should be regarded with caution.

7.3.6. Probit model for choice between official and unofficial remittance channels

The probit estimation results for the choice between official and unofficial channels are presented in table 22. The coefficients of variables indicating whether the migrant has completed primary, secondary or tertiary level of education, whether he works in a professional occupation, the size of his former household, and what the recipient household's long-run expenditure is are statistically significant. The coefficients of variables indicating the migrant's education, his current residence, his occupation and his origin state are jointly statistically significant.

Of the significant variables, the variables indicating the migrant's education level have the largest partial effects on the probability of using official channels: migrants who have completed tertiary, secondary or primary level of education have a 39.5, 28.0 and 18.8 percent higher probability of remitting through official channels than migrants with no education, respectively. In addition, a one percent increase in the recipient household's expenditure is associated with a 5.6 percent increase in the likelihood of remitting officially.

Table 22. Probit model for choice between official and unofficial remittance channels in Nigeria

Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of using official channels
Sex	0.0331	0.1381	0.0069
Married	0.1030	0.2152	0.0216
Son	0.2003	0.1836	0.0416
Age	-0.0033	0.0094	-0.0007
Primary	1.0680***	0.1828	0.1882
Secondary	1.5798***	0.1869	0.2796
Tertiary	1.7611***	0.2475	0.3952
Duration	0.0246	0.0157	0.0052
OECD	0.3048	0.5741	0.0656
Africa	0.3557	0.5574	0.0738
Urban Nigeria	-0.4666	0.5440	-0.1019
Professional	0.7623**	0.3142	0.1719
Service	0.2087	0.2980	0.0432
Agriculture & Crafts	-0.4165	0.3552	-0.0898
Reason	0.3336	0.1700	0.0700
Employed	0.2699	0.3612	0.0573
Alone	0.0558	0.1391	0.0117
Size of HH	-0.0655***	0.0233	-0.0138
Assets of HH	-0.1142	0.2030	-0.0239
Expenditure of HH	0.2650***	0.0974	0.0557
Constant	-5.2714***	1.3013	
Joint significance			
	Chi^2		$Prob > Chi^2$
Education	36.31		0.0000
Residence	12.89		0.0049
Occupation	13.52		0.0036
Origin state	9849.85		0.0000
Model statistics			
N	674		
Log pseudolikelihood	-593253.63		
Pseudo-R^2	0.4497		

The results are rather plausible. As explained in the context of Uganda, educated migrants are likely to have a higher income than less-educated ones, and may thus have better access to official remittance channels and not be liquidity constrained when it comes to their choice

between different remittance channels. Also, as shown in section 7.3.3, educated migrants are likely to remit larger amounts than less-educated migrants and thus may value the reliability safety often associated with official channels. The same reasoning applies also to the result that migrants working in professional level occupations are more likely to remit officially.

The findings that the recipient household's higher long-run expenditure and smaller size are associated with a higher probability of sending remittances through official channels are also likely to reflect the better access that these kinds of recipient households may have to official money transfer operators. Agu (2011:209-10) provides some support for this hypothesis: even though remittance recipients do not usually need to have an (costly) account with a remittance service provider in order to receive remittances, banks offering remittance services require the recipient to provide a selected means of identification – an international passport, national driver's licence, or national identity card, for instance – upon the collection of remittances. Employee identity cards generally do not suffice on their own, and some further identification items such as utility bills are often required to supplement these.

Due to this practice, some segments of Nigerians may be excluded from official remittance services: self-employed workers, employees in the informal sector, or casually employed workers in the formal sector rarely have any identity cards and may not be able to provide the supplementary documents, either. Moreover, many low-income individuals do not have the liquidity to acquire the required means of identification, and thus ask remittances to be sent to a third party go-between who meets the identification requirements. However, these arrangements are sometimes based only on social capital, and some go-betweens may demand a fee for collecting the remittances, making the possibility of fraud rather likely. (Ibid.) Thus, households with a better income, and with smaller consumption needs are likely to be more able to obtain the needed means of identification and thus more likely to have access to official remittance service providers than poorer and larger households.

7.3.7. Probit model for choice between international and internal migration

Table 23 displays the probit estimation results for the choice between international and internal migration. The specification estimated here is slightly different from the one estimated with the Ugandan data and Senegalese data, as the Nigerian data permits the estimation of the effects of independent variables indicating the education and occupation level of a former household member.

From table 23 it can be seen that only whether the migrant is the son or daughter of the household head, and whether he has completed secondary or tertiary education, affect the choice of the migrant's residence statistically significantly. Even though the education and occupation levels of the household are not individually statistically significant, they are jointly statistically significant, as are the variables indicating the migrant's education level and his state of origin.

Table 23. Probit model for choice between international and internal migration from Nigeria

Independent Variable	Coefficient	Robust std. err.	Partial effect on the probability of sending the migrant abroad
Sex	0.0517	0.1268	0.0122
Married	0.1120	0.1147	0.0267
Son	-0.330***	0.1236	-0.0788
Age	0.0076	0.0114	0.0018
Primary	0.0729	0.1850	0.0176
Secondary	0.6573***	0.1893	0.1592
Tertiary	0.6597***	0.2224	0.1607
Duration	0.0192	0.0139	0.0046
Professional	-0.1558	0.2795	-0.0373
Service	0.0298	0.1616	0.0071
Agriculture & Crafts	-0.2470	0.2090	-0.0561
Reason	-0.2113	0.1588	-0.0516
Employed	0.2723	0.4213	0.0614
Alone	0.0286	0.1137	0.0068
Size of HH	-0.0280	0.0293	-0.0067
Assets of HH	0.6262	0.5115	0.1301
Expenditure of HH	-0.0176	0.0574	-0.0042
Primary in HH	0.0399	0.2197	0.0096
Secondary in HH	0.0558	0.1632	0.0134
Tertiary in HH	0.2560	0.1753	0.0629
Professional in HH	-0.1685	0.1855	-0.0398
Service in HH	-0.3756	0.2511	-0.0835
Agriculture & Crafts in HH	0.2249	0.2391	0.0546
Constant	-2.5274	0.9559	
Joint significance			
	Chi^2		$Prob > Chi^2$
Education	24.67		0.0000
Occupation	2.18		0.5362
Education in HH	8.70		0.0335
Occupation in HH	23.05		0.0000
Origin state	20822.75		0.0000
Model statistics			
	N	802	
	Log pseudolikelihood	-792068.88	
	Pseudo-R^2	0.2306	

While the son or daughter of the household head is less likely sent abroad than other household members, the probability of sending the migrant abroad increases with the migrant's education. It could be that households prefer to send sons and daughters merely to other parts of Nigeria, where they are more easily reached in case they are needed by their parents at home. Moreover, household heads are likely to have more control over their own children than over other household members. Also the sons and daughters may prefer this arrangement, as their loyalty towards the household head may be higher than that of other household members.

When it comes to the reason for a higher education affecting the probability of international migration positively, it may be that the household considers better-educated migrants to have better chances to find employment in international job markets than less-educated ones, as hypothesised in section 4.2. Also, the returns to education abroad for better-educated migrants may be markedly better than within Nigeria, making international migration a more attractive option. Moreover, as education is positively correlated with remittances, the likelihood of larger remittances is higher when a better-educated migrant is sent abroad. Thus, in this case it seems that when a highly-educated migrant is sent abroad instead of a less-educated one, the high cost of international migration is outweighed by the potential the highly-educated migrant has in terms of earning a higher income, and by the higher likelihood of larger remittances.

7.4. Summary and discussion of findings

This section summarises the findings made in sections 7.1, 7.2 and 7.3 and establishes whether there are any differences in the motives for remitting, in the determinants of the choice between official and unofficial remittance channels, and in the determinants of the choice between international and internal migration between Ugandan, Senegalese and Nigerian migrants.

7.4.1. Motives for remitting

When it comes to Ugandan migrants, the results obtained with the tobit, Heckman selection and two-part model for all migrants seem to suggest that the migrants remittances behaviour is most likely motivated by exchange or investment considerations. On one hand, the positive effect the recipient household's long-run income has on the amount of remittances is consistent with both of the motives. However, neither the negative effect of the variable on

the probability of remittances, nor the inverse U-shaped relationship between the variable and remittances, are found to be statistically significant. On the other hand, the education level of migrants affecting remittances positively is in line with the investment motive, under which migrants repay the investments their families have made in their education. It is found that remittances increase with migrants' income, which can be reconciled with a variety of motives for remitting. There are no indications of inheritance or self-insurance driving the migrants' remittances.

In terms of the amount remitted, there are some differences between Ugandan male and female migrants, as well as between migrant residing in OECD countries and in African countries. First, remittances of male migrants increase more with their current residence being an OECD country than those of female migrants, but increase less with their education than those of female migrants. These results imply that male migrants, though possibly being more altruistic towards their former households, may also have a better bargaining position relative to their former households than female migrants. Second, remittances of migrants residing in OECD countries are barely influenced by the recipient household's long-run income, while its effect is positive on the remittances of migrants residing in African countries. This may suggest that migrants in African countries may have some exchange or investment arrangements with their families back home that migrants in OECD countries do not.

As for Senegalese migrants, their motives for remittances are rather ambiguous. Similarly to Ugandan migrants, remittances of Senegalese migrants increase with migrants' income, but otherwise, the results of different estimation methods give slightly different and inconsistent results. Even though the amount of remittances responds positively to the recipient household's long-run income, suggesting that the migrants may be driven by the exchange or the investment motive, further substantial support for these motives is lacking. However, the effect of the education level of migrants is negative, giving some support to the exchange motive: educated migrants are less inclined to return home and thus remit less than uneducated ones. Moreover, there is evidence that Senegalese migrants are also concerned with possible inheritance, as the relationship between remittances and the number of other migrants is inversely U-shaped.

One possible reason for the ambiguity of the results for Senegalese migrants is that there are rather significant differences between male and female migrants, and between migrants residing in OECD countries and in African countries in terms of the amount they remit. In

contrast to what was found among Ugandan migrants, remittances of male migrants increase less in response to their residence being and OECD country. Moreover, while remittances of males increase in response to their education level, those of female migrants decrease. In addition, remittances of male migrants respond less positively to the assets of the recipient household than those of female migrants, and respond positively to the expenditure of the recipient household. In conclusion, in terms of the motives for remitting, Senegalese male migrants may be considered to be less altruistic and less affected by possible inheritance than female migrants, and while male migrants are concerned about repaying their educational loans, educated female migrants send smaller remittances as they are less likely to return home than uneducated ones.

Moreover, being male affects negatively the amount of remittances of migrants residing in OECD countries, while the effect is opposite among migrants residing in African countries. Similarly, migrants residing in OECD countries decrease their remittances in response to their education, while migrants in African countries increase them. This result suggests that Senegalese migrants residing in OECD countries, being less inclined to return home due to their high education, may decrease their remittances to their former households, while migrants residing in African countries are possibly repaying their educational loans they have received in the past with remittances.

Regarding Nigerian migrants, remittances and migrants' income are again positively associated, which is consistent with most of the motives for remitting. Similarly to Ugandan and Senegalese migrants, remittances increase with the recipient household's long-run income, but further substantial support to either the exchange motive or the investment motive is lacking. Yet, the exchange motive receives some support from the finding that the probability of sending remittances is negatively affected by a former household member's education level, a proxy for the recipient household's income. The education level of migrants, however, having a positive effect on remittances suggests that remittances are intended to act as repayment of educational loans, so the results are rather inconclusive. What Nigerian migrants do not seem to be concerned about are possible inheritance or self-insurance.

There are some differences between Nigerian male and female migrants in terms of their remittance behaviour. Male migrants respond less positively to their higher education level and to the expenditure of the recipient household than female migrants. This suggests that

Nigerian male migrants may have higher bargaining power relative to their former households than female migrants, and are thus able to enjoy better contractual terms than female migrants when it comes to repayment of educational loans. In addition, while remittances of female migrants decrease with the assets of the recipient household, those of male migrants are barely affected. According to the estimations, there are no significant differences in remittance behaviour between Nigerian migrants residing in OECD countries and those residing in African countries.

The above findings from Uganda, Senegal and Nigeria seem to vindicate what has been found in previous studies of motives for remittances. On one hand, different groups of migrants tend to have different motives and concerns influencing their remittance behaviour, and on the other hand, it is likely that within any one migrant, several different motives for remitting coexist. Similarly to studies reviewed in section 2.8, the generally presumed altruistic motive does not receive explicit support in any of the countries under study, and more self-interested concerns and contractual arrangements between migrants and their families seem to override the purely altruistic ones (see e.g. Lucas and Stark 1985; Cox et al. 1998; de la Brière et al. 2002). On the whole, too, previous research seems to have reached the conclusion that remittances tend to be part of informal, social, intra-family arrangements. Still, altruism should not be refuted altogether, as it is often a precondition for any contract-like arrangement to arise in the first place. (Rapoport and Docquier 2006:1171)

In terms of the empirical execution of the estimations, none of the methods alone is perfect, and all of them entail weaknesses that may not be corrected for, as discussed in chapter 5. However, using them all together and comparing the results obtained with them, a certain degree of robustness may be reached that none of the methods would have reached alone. Especially the Heckman selection model and the two-part model provide valuable insight into how the decisions on whether to remit and on how much to remit may be influenced differently by the same variables.

Even though the Ugandan, Senegalese and Nigerian datasets were rather encompassing in their scope, the estimations would have provided more reliable results, if better and additional variables could have been utilised. For instance, when it came to the migrant's and the recipient household's income – probably two of the most important determinants of remittances – proxies had to be relied upon. Further, the presence of the insurance motive could have been better examined had there been a proxy for some kind of an income shock to

the household. Also the possibility of examining the effects of the migrant's home-community characteristics and the effects of the migrant's status and community in his country of residence on remittances would have deepened and extended the scope of the analysis.

7.4.2. Choice between official and unofficial remittance channels

Ugandan migrants that are highly-educated or reside in OECD or African countries migrants are particularly more likely to use official remittance channels. The latter results is supported by previous research finding that international remittances are mainly sent through official channels, possibly due to their usually better reliability and security (Ngugi and Sennoga 2011:250). Also, both residing abroad and education are expected to increase migrants' income: thus, migrants residing abroad or with a better education are likely to have better access to official remittance channels and to be less liquidity constrained in their choice of remittance channel. Moreover, migrants residing abroad also tend to remit more, and thus may value the safety of official channels more than migrants remitting from rural Uganda.

Among Senegalese migrants, female migrants and migrants residing in OECD countries are, in particular, more likely to use official remittance channels. The former result may suggest that male migrants may be less risk-averse than female migrants and thus more likely to resort to unofficial remittance channels. The latter result, on the other hand, may imply that the access migrants have to different remittance channels, the liquidity constraints they face, and the relative reliability of the channels are important in determining the choice between official and unofficial remittance channels. However, migrants residing in urban regions of Senegal are less likely to remit officially, contrary to what could be assumed.

When it comes to Nigerian migrants, more educated migrants, and migrants whose former households have a higher long-run income are, in particular, more likely to use official remittance channels. The latter effect may arise from the fact that wealthier households tend to have a better access to official money transfer operators than poorer ones and do not thus constrain the choice that migrants from these households make regarding remittance channels (Agu 2011:209-10).

The results partly reflect previous research that has been done in the field (see e.g. Amuedo-Dorantes and Pozo 2005). However, due to lack of data, the examination in this study was restricted to migrant- and recipient household-related characteristics determining the choice

between different channels. What would have especially improved the analysis would have been the possibility to incorporate a measure of the relative prices of using different remittance channels, as well as measures of the relative risk, reliability and accessibility of these channels.

7.4.3. Choice between international and internal migration

In Uganda, the decision to send a migrant abroad is influenced positively by his intention to work, implying that the employment opportunities of countries abroad are perceived to be better than those of Uganda. In addition, when the reason for migration is work, migration is likely to be considered as a way for the household to receive supplementary income. This may not be the case when the reason for migration is education, for instance.

In turn, Senegalese migrants are more likely to be sent abroad especially if the household has already sent other international migrants, or if migrants are likely to end up working in a service level or agricultural and crafts occupations. The former result implies that international migration may be perceived to be less risky when there already are other migrants abroad. In turn, the latter effect suggests that the skills of migrants suitable for lower-level occupations are more easily recognised, or less relevant, in international job markets than the skills required for more demanding occupations: less-skilled migrants may thus be better able reach the occupations they have the skills for than migrants with better skills. In addition, international migration is more likely when the sending household is wealthier or smaller.

In terms of Nigerian migrants, more educated migrants are more likely sent abroad, as they may have better chances to succeed in international job markets and have better returns to their education than less educated migrants. In addition, sons and daughters of household heads are less likely sent abroad, which may be preferred by both the sending household and migrants themselves: in Nigeria, they will be closer to their families in case support is needed back home. Moreover, household heads are likely to have more control over their own children than over other household members.

These findings seem to support the newly-developed model for migration decisions elaborated on in chapter 4, and vice versa. On one hand, the choice of variables for the estimations was guided by the theory, and on the other hand, some of the variables being statistically significant in the estimations gave support to the plausibility and predictions of the theory.

Like the other estimations, these estimations would have also benefited from the inclusion of some additional variables, such as a measure of the relative costs of migrating to different countries, and a measure of the relative chance of getting employed in different countries. However, these kinds of measures could not be found or constructed.

8 Conclusions

The objective of this study was to increase and deepen the existing knowledge of remittances to developing countries by providing a comprehensive theoretical and empirical economic analysis of three distinct research questions in the context of Uganda, Senegal and Nigeria. These questions addressed particularly the sending of remittances: first, the determinants of the probability and amount of remittances were examined to provide insight into the migrants' motives for remitting. Second, the determinants of the migrants' choice between official and unofficial channels were investigated to gain a better understanding of how the different features of the remittance markets in the countries under study are reflected in this choice. Third, the role of migrants' families and expected remittances in intra-household decisions regarding migration was modelled theoretically, and the choice between international and internal migration was studied empirically, to attain a better conception of intra-household decision making dynamics and the resultant migration patterns.

The empirical results of this study imply that there are a variety of motives influencing the remittance behaviour of Ugandan, Senegalese and Nigerian migrants. Not only may the motives differ between different groups of migrants from different countries, but several motives may also coexist within one individual. Similarly to previous research, the generally presumed altruistic motive is not explicitly supported by the estimations in any of the countries under study, and more self-interested concerns and contractual arrangements between migrants and their families – the exchange and investment motives, more specifically – seem to override the purely altruistic ones.

A diversity of factors also affects the migrants' decision on whether to use official or unofficial channels, as well as their choice between international and internal migration. In terms of the first choice, especially residing in an OECD country and having obtained a high level of education have a positive effect on the probability of using official channels: the former is supported by results from Uganda and Senegal, the latter by those from Uganda and Nigeria. Other factors affecting the choice are more country-specific. The choice between

international and internal migration, on the other hand, is determined by several factors that differ across the countries under study, including considerations regarding, inter alia, the migrants' reason for migration, their education and potential occupation. These findings reflect well the new model developed to depict the intra-household decisions on migration.

This study contributed to the existing remittance literature in several ways. Addressing both the theoretically modelled motives for remitting and the channels for remitting makes the analysis of this study more comprehensive than that of many previous studies. Also, the novel model for migration decisions introduced in this study brings forth especially the role of households in these decisions more explicitly than existing models do.

In the future, the knowledge of remittances and their dynamics could be quite significantly improved by more comprehensive and better-quality data. For instance, the estimations of this study – among others – would have benefited from data on several, rather crucial variables. However, even though the lack of data could be overcome, estimations could still be biased by endogeneity. An interesting way of dealing with these issues, adopted by Osili (2007) in his study on Nigerian migrants in Chicago, would be to collect a matched sample of migrants and their households, through which both the possible endogeneity of variables, and the possible omitted variable bias arising from lacking data on relevant migrant- or household-related characteristics, could be addressed (Ibid.:451-2). In addition, the existing data on official and unofficial remittance markets and channels, and specifically on the costs of remittances sent through different channels, could be improved in both quantity and quality. This data could then facilitate policy makers in both remittance-sending and remittance-receiving countries to devise policies that would develop the financial services around remittances and strengthen the financial systems of especially remittance-receiving countries.

Understanding the sending of remittances – migrants' motivations for remitting, the use of official and unofficial remittance channels, and the factors affecting households' decisions on migration, inter alia – is crucial for developing countries to be able to realise the developmental potential remittances possess. With its comprehensive analysis of sending remittances to Uganda, Senegal and Nigeria, this study increases the knowledge of the different aspects of sending remittances, and by so doing is relevant in aligning remittance markets better with the actual needs and motives of remitters; in facilitating the more efficient mobilisation of remittances through official channels; and in enabling the developmental impacts of remittances to expand and intensify further.

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Appendix 1. Summary statistics of variables used in estimations

Table 24. Definitions and sample summary statistics of variables used in estimations for Uganda

Variable	Definition	N	Mean	Std. Dev.	Max	Min
Log amount remitted (all obs.)	The amount of monetary remittances as logarithms of local currency	1639	3.4452	5.5908	17.0344	0
Log amount remitted (only positive obs.)	The amount of monetary remittances as logarithms of local currency	460	12.2755	1.7061	17.0344	8.2940
Sends money	Dummy variable indicating whether sends monetary remittances, 1 if yes	1645	0.2827	0.4504	1	0
Channel	Dummy variable indicating channel used for remitting, 1 if official	455	0.3297	0.4706	1	0
Destination	Dummy variable indicating destination of migrant, 1 if an OECD or African country other than Uganda	1584	0.1761	0.3811	1	0
Sex	Dummy variable indicating sex of migrant, 1 if male	1645	0.5550	0.4971	1	0
Married	Dummy variable indicating marital status of migrant, 1 if married	1645	0.4294	0.4951	1	0
Son	Dummy variable indicating relationship of migrant to the household head, 1 if son or daughter	1645	0.6195	0.4857	1	0
Age	Age of migrant	1645	28.4444	10.7046	87	0
Primary	Dummy variable indicating education level completed by migrant before migration, 1 if primary	1645	0.2547	0.4358	1	0
Secondary	Dummy variable indicating education level completed by migrant before migration, 1 if secondary	1645	0.2377	0.4258	1	0
Tertiary	Dummy variable indicating education level completed by migrant before migration, 1 if tertiary	1645	0.2164	0.41192	1	0
No Education	Dummy variable indicating education level completed by migrant before migration, 1 if no education	1645	0.2912	0.4544	1	0
Duration	Duration of migration in years	1517	6.0982	6.6365	60	0
Duration > 1 year	Dummy variable indicating duration of migration, 1 if more than a year	1517	0.7864	0.4100	1	0
OECD	Dummy variable indicating current residence of migrant, 1 if an OECD country	1590	0.0667	0.2495	1	0
Africa	Dummy variable indicating current residence of migrant, 1 if an African country other than Uganda	1590	0.1088	0.3115	1	0
Urban Uganda	Dummy variable indicating current residence of migrant, 1 if urban regions of Uganda	1590	0.5522	0.4974	1	0
Rural Uganda	Dummy variable indicating current residence of migrant, 1 if rural regions of Uganda	1590	0.2686	0.4433	1	0
Professional	Dummy variable indicating occupation of migrant, 1 if manager or professional worker	1645	0.1587	0.3655	1	0
Service	Dummy variable indicating occupation of migrant, 1 if service or clerical worker	1645	0.2006	0.4006	1	0
Agriculture & Crafts	Dummy variable indicating occupation of migrant, 1 if agricultural or crafts worker	1645	0.1033	0.3045	1	0
Elementary & Other	Dummy variable indicating occupation of migrant, 1 if assembler or elementary worker	1645	0.5374	0.4975	1	0
Reason	Dummy variable indicating reason for migration, 1 if work or search for work	1557	0.6590	0.4742	1	0
Employed	Dummy variable indicating employment of migrant, 1 if employed	1645	0.5514	0.4975	1	0
Alone	Dummy variable indicating living situation of migrant, 1 if lives alone	1645	0.2881	0.4530	1	0
Size of HH	Number of household members at origin	1645	5.6036	3.1171	16	1
Assets of HH	Dummy variable indicating assets of household, 1 if owns land or buildings	1753	0.8688	0.3377	1	0
Expenditure of HH (all obs.)	Expenditure of household during previous six months as logarithms of local currency	1314	12.7317	2.3428	17.1384	0
Expenditure of HH (only positive obs.)	Expenditure of household during previous six months as logarithms of local currency	1292	12.9485	1.6652	17.1384	6.9078

Table 25. Definitions and sample summary statistics of variables used in estimations for Senegal

Variable	Definition	N	Mean	Std. Dev.	Max	Min
Log amount remitted (all obs.)	The amount of monetary remittances as logarithms of local currency	2187	7.8435	6.0848	16.0562	0
Log amount remitted (only positive obs.)	The amount of monetary remittances as logarithms of local currency	1382	12.4122	1.3628	16.0562	8.5172
Sends money	Dummy variable indicating whether sends monetary remittances, 1 if yes	2187	0.6319	0.4824	1	0
Channel	Dummy variable indicating channel used for remitting, 1 if official	1440	0.5451	0.4981	1	0
Destination	Dummy variable indicating destination of migrant, 1 if an OECD or African country other than Senegal	2170	0.5069	0.5001	1	0
Sex	Dummy variable indicating sex of migrant, 1 if male	2277	0.7795	0.4147	1	0
Married	Dummy variable indicating marital status of migrant, 1 if married	2207	0.6575	0.4747	1	0
Son	Dummy variable indicating relationship of migrant to the household head, 1 if son or daughter	2207	0.5578	0.4968	1	0
Age	Age of migrant	2277	34.2156	12.3575	99	0
Primary	Dummy variable indicating education level completed by migrant before migration, 1 if primary	2207	0.1676	0.3736	1	0
Secondary	Dummy variable indicating education level completed by migrant before migration, 1 if secondary	2207	0.2198	0.4142	1	0
Tertiary	Dummy variable indicating education level completed by migrant before migration, 1 if tertiary	2207	0.1296	0.3359	1	0
No Education	Dummy variable indicating education level completed by migrant before migration, 1 if no education	2207	0.4830	0.4998	1	0
Duration	Duration of migration in years	2207	7.3262	7.5899	69	0
Duration > 1 year	Dummy variable indicating duration of migration, 1 if more than a year	2207	0.8061	0.3955	1	0
OECD	Dummy variable indicating current residence of migrant, 1 if an OECD country	2170	0.3189	0.4661	1	0
Africa	Dummy variable indicating current residence of migrant, 1 if an African country other than Senegal	2170	0.1880	0.3908	1	0
Urban Senegal	Dummy variable indicating current residence of migrant, 1 if urban regions of Senegal	2170	0.4313	0.4953	1	0
Rural Senegal	Dummy variable indicating current residence of migrant, 1 if rural regions of Senegal	2170	0.0618	0.2408	1	0
Professional	Dummy variable indicating occupation of migrant, 1 if manager or professional worker	1569	0.1192	0.3241	1	0
Service	Dummy variable indicating occupation of migrant, 1 if service or clerical worker	1569	0.2900	0.4539	1	0
Agriculture & Crafts	Dummy variable indicating occupation of migrant, 1 if agricultural or crafts worker	1569	0.1989	0.3992	1	0
Elementary & Other	Dummy variable indicating occupation of migrant, 1 if assembler or elementary worker	1569	0.3920	0.4883	1	0
Reason	Dummy variable indicating reason for migration, 1 if work or search for work	2207	0.7222	0.4480	1	0
Employed	Dummy variable indicating employment of migrant, 1 if employed	2207	0.7109	0.4534	1	0
Alone	Dummy variable indicating living situation of migrant, 1 if lives alone	2199	0.2792	0.4487	1	0
Size of HH	Number of household members at origin	2277	11.133	6.8972	44	1
Assets of HH	Dummy variable indicating assets of household, 1 if owns land or buildings	2277	0.9570	0.2030	1	0
Expenditure of HH (all obs.)	Expenditure of household during previous six months as logarithms of local currency	2277	12.1883	1.1194	15.0221	0
Expenditure of HH (only positive obs.)	Expenditure of household during previous six months as logarithms of local currency	2276	12.1937	1.0901	15.0221	7.4384
Migrants	Number of international migrants from same household	2277	1.4146	1.7581	12	0
Parental funding	Dummy variable indicating whether parents of migrant have funded migration, 1 is yes	2194	0.4795	0.4997	1	0
International migrants	Number of international migrants from same household	2277	1.4146	1.7581	12	0
Internal migrants	Number of internal migrants from same household	2277	1.3882	1.6522	10	0

Table 26. Definitions and sample summary statistics of variables used in estimations for Nigeria

Variable	Definition	N	Mean	Std. Dev.	Max	Min
Log amount remitted (all obs.)	The amount of monetary remittances as logarithms of local currency	3041	4.9666	5.4098	16.7059	0
Log amount remitted (only positive obs.)	The amount of monetary remittances as logarithms of local currency	1427	10.5840	1.7009	16.7059	4.6052
Sends money	Dummy variable indicating whether sends monetary remittances, 1 if yes	3155	0.4865	0.4999	1	0
Channel	Dummy variable indicating channel used for remitting, 1 if official	1532	0.5522	0.4974	1	0
Destination	Dummy variable indicating destination of migrant, 1 if an OECD or African country other than Senegal	3293	0.2408	0.4276	1	0
Sex	Dummy variable indicating sex of migrant, 1 if male	3328	0.6451	0.4785	1	0
Married	Dummy variable indicating marital status of migrant, 1 if married	3304	0.4452	0.4971	1	0
Son	Dummy variable indicating relationship of migrant to the household head, 1 if son or daughter	3330	0.5605	0.4964	1	0
Age	Age of migrant	3296	28.4463	10.8829	99	1
Primary	Dummy variable indicating education level completed by migrant before migration, 1 if primary	3235	0.1422	0.3493	1	0
Secondary	Dummy variable indicating education level completed by migrant before migration, 1 if secondary	3235	0.4451	0.4971	1	0
Tertiary	Dummy variable indicating education level completed by migrant before migration, 1 if tertiary	3235	0.3329	0.4713	1	0
No Education	Dummy variable indicating education level completed by migrant before migration, 1 if no education	3235	0.0798	0.2710	1	0
Duration	Duration of migration in years	3216	5.6035	5.6843	55	0
Duration > 1 year	Dummy variable indicating duration of migration, 1 if more than a year	3216	0.8750	0.3308	1	0
OECD	Dummy variable indicating current residence of migrant, 1 if an OECD country	3293	0.1755	0.3805	1	0
Africa	Dummy variable indicating current residence of migrant, 1 if an African country other than Nigeria	3293	0.0653	0.2471	1	0
Urban Nigeria	Dummy variable indicating current residence of migrant, 1 if urban regions of Nigeria	3293	0.6562	0.4750	1	0
Rural Nigeria	Dummy variable indicating current residence of migrant, 1 if rural regions of Nigeria	3293	0.1029	0.3039	1	0
Professional	Dummy variable indicating occupation of migrant, 1 if manager or professional worker	2161	0.5016	0.5001	1	0
Service	Dummy variable indicating occupation of migrant, 1 if service or clerical worker	2161	0.2226	0.4161	1	0
Agriculture & Crafts	Dummy variable indicating occupation of migrant, 1 if agricultural or crafts worker	2161	0.1189	0.3238	1	0
Elementary & Other	Dummy variable indicating occupation of migrant, 1 if assembler or elementary worker	2161	0.1569	0.3638	1	0
Reason	Dummy variable indicating reason for migration, 1 if work or search for work	3312	0.4795	0.4997	1	0
Employed	Dummy variable indicating employment of migrant, 1 if employed	3220	0.6295	0.4830	1	0
Alone	Dummy variable indicating living situation of migrant, 1 if lives alone	3272	0.3359	0.4775	1	0
Size of HH	Number of household members at origin	1427	5.7057	3.1098	24	1
Assets of HH	Dummy variable indicating assets of household, 1 if owns land or buildings	1415	0.8544	0.3528	1	0
Expenditure of HH (all obs.)	Expenditure of household during previous six months as logarithms of local currency	3344	4.7301	5.5643	14.2973	0
Expenditure of HH (only positive obs.)	Expenditure of household during previous six months as logarithms of local currency	1420	11.1389	1.2263	14.2973	5.4806
Primary in HH	Dummy variable indicating education level completed by household member, 1 if primary	2893	0.2122	0.4090	1	0
Secondary in HH	Dummy variable indicating education level completed by household member, 1 if secondary	2893	0.3353	0.4722	1	0
Tertiary in HH	Dummy variable indicating education level completed by household member, 1 if tertiary	2893	0.2254	0.4179	1	0
No Education in HH	Dummy variable indicating education level completed by household member, 1 if no education	2893	0.2271	0.4190	1	0
Professional in HH	Dummy variable indicating occupation of household member, 1 if manager or professional worker	1896	0.3296	0.4702	1	0
Service in HH	Dummy variable indicating occupation of household member, 1 if service or clerical worker	1896	0.2078	0.4058	1	0
Agriculture & Crafts in HH	Dummy variable indicating occupation of household member, 1 if agricultural or crafts worker	1896	0.3249	0.4683	1	0
Elementary & Other in HH	Dummy variable indicating occupation of household member, 1 if assembler or elementary worker	1896	0.1377	0.3446	1	0
Employed in HH	Dummy variable indicating employment of household member, 1 if employed	2778	0.6523	0.4763	1	0

Appendix 2. Test of appropriateness of tobit model

As mentioned in section 3.1.3, there is a way of informally evaluating whether the tobit model for the probability and amount of remittances is appropriate for the estimation purposes in this study. The problem with the tobit model is that the effects of an independent variable x_j on the probability of observing a positive value of the dependent variable, and on the conditional expected value of the dependent variable, are both proportional to β_j, and both functions multiplying β_j are positive and depend on the vector x only through $x\beta/\sigma$, where σ is the standard deviation of the tobit model error term. Thus, the independent variable is not allowed to affect the probability of the dependent variable negatively and value of the dependent variable positively, or vice versa.

However, whether the tobit model estimates for Uganda, Senegal and Nigeria – discussed in sections 6.1.1, 6.2.1 and 6.3.1 – hold or not may be tested by comparing the tobit model estimates to the estimates obtained with the probit model, which was carried out as the first part of the two-part model for the probability and amount of remittances in sections 6.1.3, 6.2.3 and 6.3.3. For the tobit model to be appropriate, the probit coefficient estimate γ_j for some independent variable x_j should be "close" to the ratio β_j/σ, which are the tobit estimates. However, due to sampling error, these will never be identical (Wooldridge 2009:595).

Wooldridge (2009:595) points out that one should not be too concerned about differences in the signs or magnitudes of these measures, if the variables in question are statistically insignificant in both models. Hence, only the variable coefficients that are statistically significant in both the tobit and probit estimations are chosen to gauge the appropriateness of the tobit model. The different estimates from each of the countries under study, and the level and percentage differences between the ratio β_j/σ and the probit coefficient γ_j are presented in table 27.

Looking first at the differences between the ratio of β_j/σ and the probit coefficient γ_j in the second to last column of table 27, most of them are less than 0.1 in absolute value, which could be considered to be a rather small difference. However, when proportioned to the size of the probit estimates in the last column, the differences prove to be rather large – only a half of the 24 percentage differences are less than 10 percent in absolute value. It thus might be

said that this comparison test casts some doubt on the appropriateness of the tobit model and the estimates obtained with it. Yet, it should be noted that the test is informal and the expression "being close" is at best vague. Further, as pointed out by Wooldridge (2009: 595), the coefficient and the ratio will never be identical anyway due to sampling error.

Table 27. Comparison of tobit and probit coefficient estimates in estimations of probability and amount of remittances in Uganda, Senegal and Nigeria

Uganda					
Independent variable	Tobit coefficient β_i	Probit coefficient γ_i	Ratio β_i/σ	Difference $\beta_i/\sigma - \gamma_i$	Difference (%) $[(\beta_i/\sigma - \gamma_i) / \gamma_i]*100$
Secondary	4.8995	0.4406	0.4496	0.0090	2.0427
Tertiary	6.7967	0.7181	0.6237	-0.0944	-13.1458
OECD	10.7303	0.8123	0.9846	0.1723	21.2114
Urban Uganda	5.9273	0.5136	0.5439	0.0303	5.8995
Service	4.5916	0.4921	0.4213	-0.0708	-14.3873
Reason	6.9863	0.5866	0.6411	0.0545	9.2908
Employed	8.4466	0.8132	0.7750	-0.0382	-4.6975
Alone	3.8235	0.3715	0.3508	-0.0207	-5.5720
Sigma σ	10.8982				
Senegal					
Independent variable	Tobit coefficient β_i	Probit coefficient γ_i	Ratio β_i/σ	Difference $\beta_i/\sigma - \gamma_i$	Difference (%) $[(\beta_i/\sigma - \gamma_i) / \gamma_i]*100$
Married	1.3561	0.3100	0.2437	-0.0663	-21.3871
Primary	-1.9380	-0.4230	-0.3482	0.0748	-17.6832
OECD	4.4296	0.8980	0.7959	-0.1021	-11.3697
Reason	5.0403	0.8681	0.9056	0.0375	4.3198
Alone	1.6753	0.3798	0.3010	-0.0788	-20.7478
Expenditure of HH	1.0371	0.2221	0.1863	-0.0358	-16.1189
Sigma σ	5.5656				
Nigeria					
Independent variable	Tobit coefficient β_i	Probit coefficient γ_i	Ratio β_i/σ	Difference $\beta_i/\sigma - \gamma_i$	Difference (%) $[(\beta_i/\sigma - \gamma_i) / \gamma_i]*100$
Married	1.3787	0.2917	0.2910	-0.0007	-0.2356
Son	2.3139	0.8042	0.4885	-0.3157	-39.2564
Tertiary	3.3007	0.6553	0.6968	0.0415	6.3330
Duration	0.0753	0.0159	0.0159	0.0000	0.0000
OECD	6.0603	1.3197	1.2794	-0.0403	-3.0537
Urban Nigeria	3.3497	0.7452	0.7072	-0.0380	-5.0993
Professional	1.9104	0.4978	0.4033	-0.0945	-18.9835
Reason	1.0521	0.3051	0.2221	-0.0830	-27.2042
Employed	5.5005	1.4097	1.1612	-0.2485	-17.6279
Assets of HH	-0.8971	-0.3413	-0.1894	0.1519	-0.4451
Sigma σ	4.7369				

Appendix 3. Interaction effects in probit estimation of two-part model for probability and amount of remittances in Uganda

In the left-hand side figures, the interaction effects of the interaction variables in the probit estimation of the two-part model, plotted against predicted probabilities of the dependent variable, are displayed. The blue dots indicate the correct interaction effect for each of the observations, and the purple dashed line depicts the incorrect marginal effect. In the right-hand side figures, the z-statistics of the corresponding interaction effects, plotted against predicted probabilities of the dependent variable, are presented. The blue dots indicate the actual value of the z-statistic for each of the observations, and the purple lines signify the values of the z-statistic corresponding to the 5 percent significance level, 1.96 and -1.96.

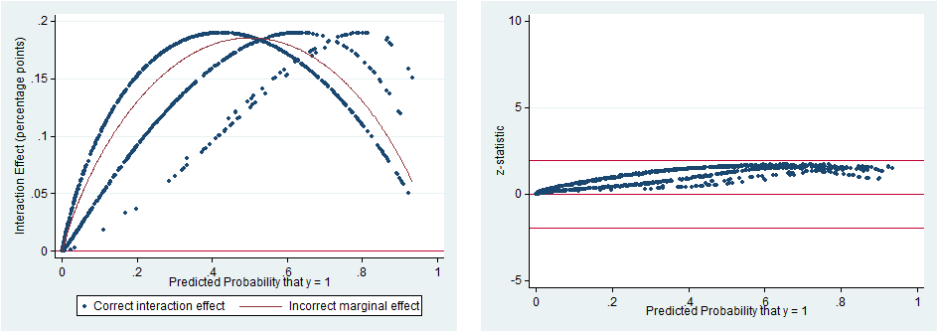


Figure 1. Probit interaction effect and statistical significance of interaction male*OECD in two-part model for probability and amount of remittances in Uganda

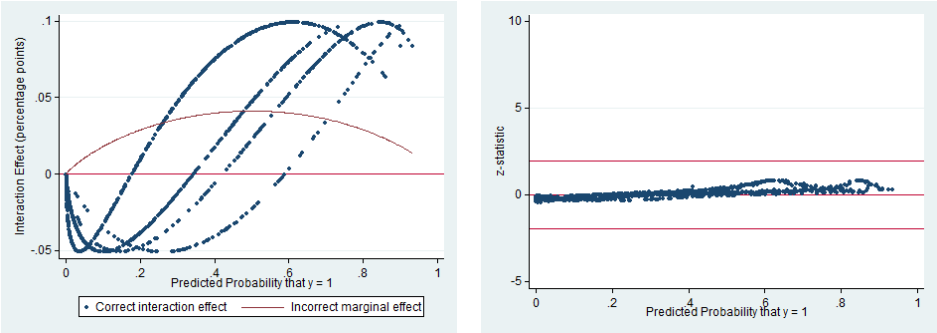


Figure 2. Probit interaction effect and statistical significance of interaction male*tertiary in two-part model for probability and amount of remittances in Uganda

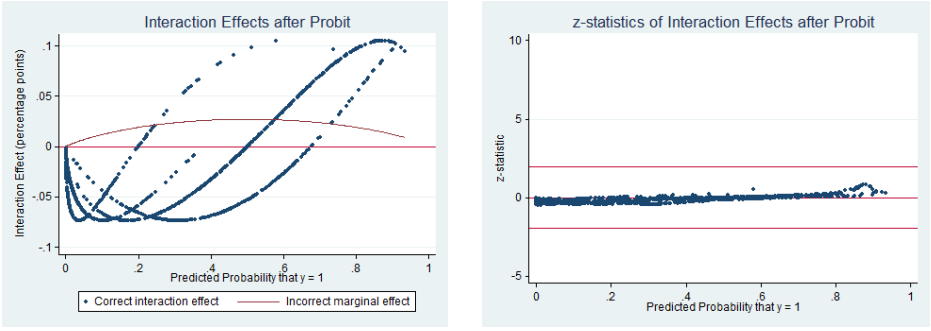


Figure 3. Probit interaction effect and statistical significance of interaction male*employed in two-part model for probability and amount of remittances in Uganda

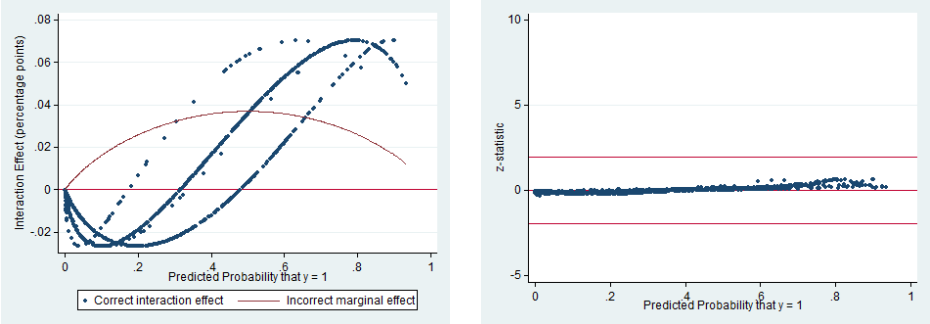


Figure 4. Probit interaction effect and statistical significance of interaction male*assets of HH in two-part model for probability and amount of remittances in Uganda

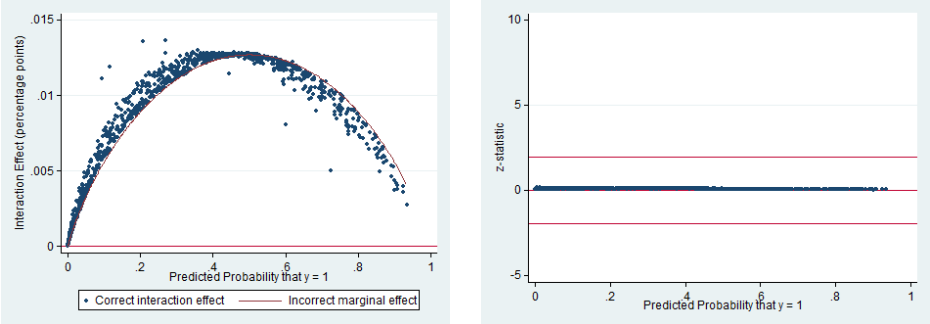


Figure 5. Probit interaction effect and statistical significance of interaction male*expenditure of HH in two-part model for probability and amount of remittances in Uganda

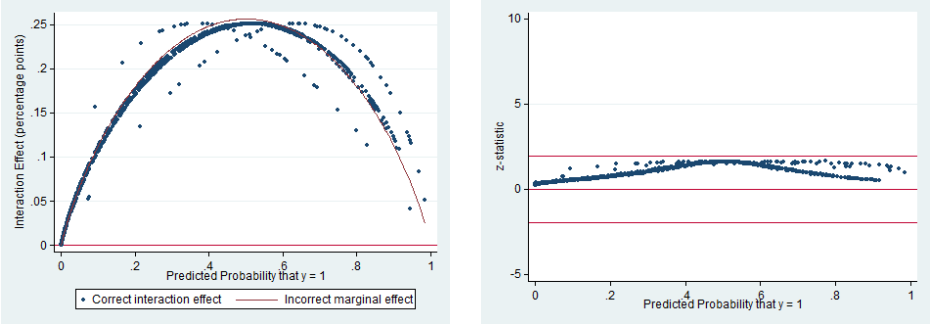


Figure 6. Probit interaction effect and statistical significance of interaction OECD*male in two-part model for probability and amount of remittances in Uganda

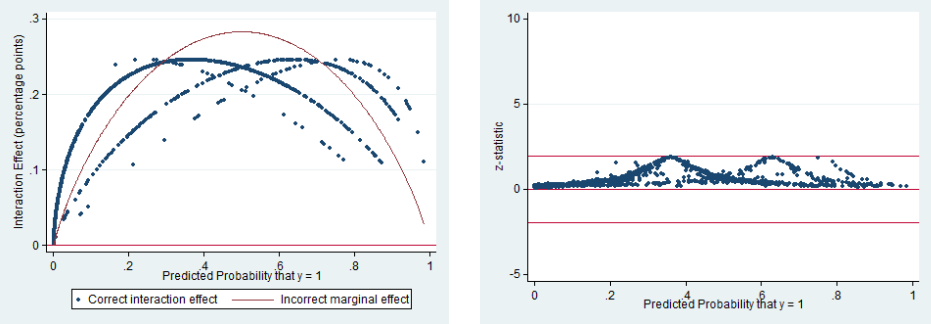
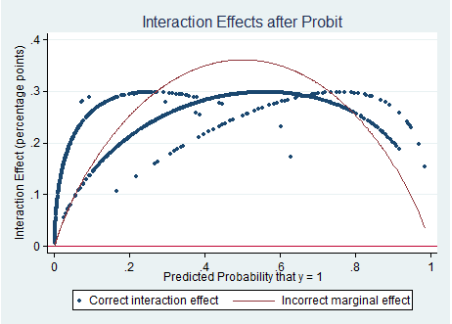


Figure 7. Probit interaction effect and statistical significance of interaction OECD*tertiary in two-part model for probability and amount of remittances in Uganda



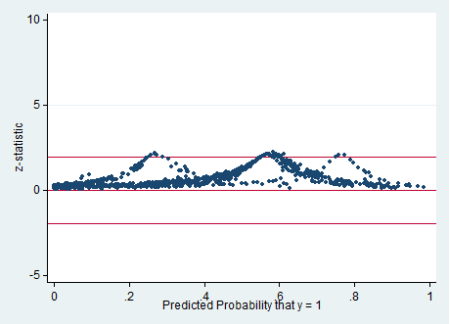
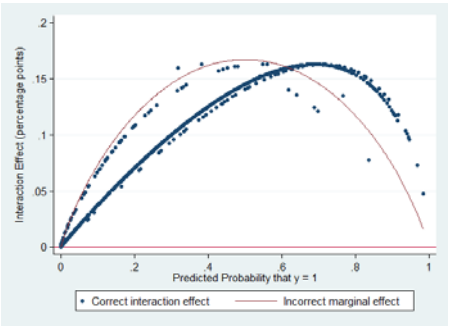


Figure 8. Probit interaction effect and statistical significance of interaction OECD*employed in two-part model for probability and amount of remittances in Uganda



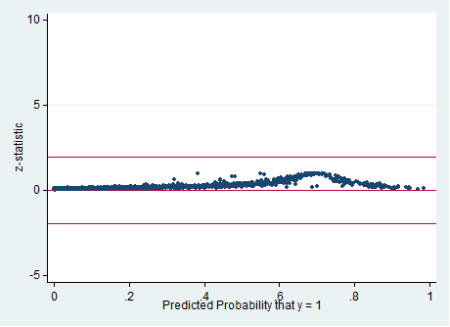
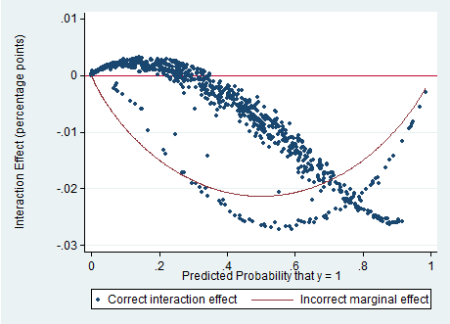


Figure 9. Probit interaction effect and statistical significance of interaction OECD*assets of HH in two-part model for probability and amount of remittances in Uganda



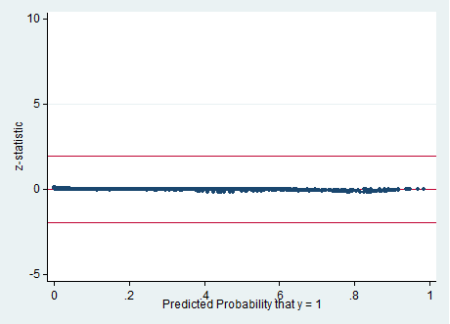


Figure 10. Probit interaction effect and statistical significance of interaction OECD*expenditure of HH in two-part model for probability and amount of remittances in Uganda

Appendix 4. CLAD estimation for Senegal

Table 27 presents the results obtained with the CLAD estimation of the probability and amount of remittances for Senegal. The program for CLAD estimation in Stata 11 developed by Jolliffe et al. (2000) employs the bootstrap method, so the table presents bootstrap estimates of the standard errors, as well as the bootstrap estimate of the bias of these estimates. These were obtained with a standard bootstrap which, incorrectly, assumes that the sample was selected using a simple random design. The alternative assumption, and a more accurate one, would have been that the sample was selected in two stages – however, convergence was not achieved under this assumption. The default of 100 bootstrap replications were performed. (Ibid.:14) For an account of the bootstrap principle, see Efron and Tibshirani (1993). Similarly to other tables in this study, ***, ** and * indicate the statistical significance of the coefficients on the 1%, 5% and 10% significance level.

Table 28. CLAD estimation of probability and amount of remittances in Senegal

Independent variable	Coefficient	Bias	Std. err.
Sex	0.4219**	-0.0813	0.2105
Married	0.9479***	0.0430	0.2030
Son	0.1041	0.0230	0.1329
Age	0.0328***	-0.0001	0.0069
Primary	-0.4439**	0.0732	0.2167
Secondary	0.0665	-0.0625	0.1832
Tertiary	0.2670	0.0629	0.3028
Duration	0.0114	0.0024	0.0083
OECD	2.3788	1.3492	3.3100
Africa	1.2461	1.3574	3.3052
Urban Senegal	1.0606	1.3633	3.2876
Professional	0.1709	0.0467	0.2352
Service	0.0553	-0.0079	0.1366
Agriculture &Crafts	-0.2460	-0.0194	0.2167
Reason	1.3819***	0.0589	0.4293
Employed	(omitted)		
Alone	0.0107	0.0357	0.1173
Size of HH	-0.0214**	-0.0041	0.0096
Assets	0.2554	-0.0916	0.4304
Expenditure of HH	0.3137***	0.0081	0.0908
Constant	2.5415	-1.3969	3.6028
	Model Statistics		
	Initial sample size	2187	
	Final sample size	1525	
	Pseudo-R^2	0.0924	

When comparing these estimates to those obtained for Senegal in sections 6.2.1, 6.2.2 and 6.2.3, all in all there are quite stark differences in the signs and statistical significances of the estimates. However, the statistically significant variable coefficients estimated with the four different methods display more similarities to one another. According to the CLAD estimation, coefficients of variables indicating whether the migrant is male, whether he is married, his age, whether he has completed primary education, the reason for his migration, the size of his former household, and what the expenditure of the recipient household is are statistically significant. These variable coefficients have the same signs as those obtained with the tobit model in section 6.2.1, as those obtained with the Heckman selection model for the participation equation in section 6.2.2, and as those obtained with the two-part model in section 6.2.3. Moreover, these variable coefficients are statistically significant according to one or more of the three models estimated before. Altogether, the CLAD estimation seems to support the findings made from the results obtained with more conventional estimation methods.

Interestingly, according to the CLAD estimation, the coefficient of the variable indicating whether the migrant resides in an OECD country is not statistically significant, even though it is significant according to all other models. This result, however, should be regarded with caution, as the upward bias of the bootstrap estimate of the standard error is particularly large for this variable. However, even if the bias of 1.3492 were deducted from the standard error estimate of 3.3100, and the z-statistic were calculated with this new standard error estimate of 1.9608, according to the z-statistic the variable coefficient would still remain insignificant. Yet, these kinds of bias-corrected standard error estimates are not used, as the estimate of the mean bias tends to be very noisy (Efron and Tibshirani 1993:138).

Appendix 5. Interaction effects in probit estimation of two-part model for probability and amount of remittances in Senegal

In the left-hand side figures, the interaction effects of the interaction variables in the probit estimation of the two-part model, plotted against predicted probabilities of the dependent variable, are displayed. The blue dots indicate the correct interaction effect for each of the observations, and the purple dashed line depicts the incorrect marginal effect. In the right-hand side figures, the z-statistics of the corresponding interaction effects, plotted against predicted probabilities of the dependent variable, are presented. The blue dots indicate the actual value of the z-statistic for each of the observations, and the purple lines signify the values of the z-statistic corresponding to the 5 percent significance level, 1.96 and -1.96.

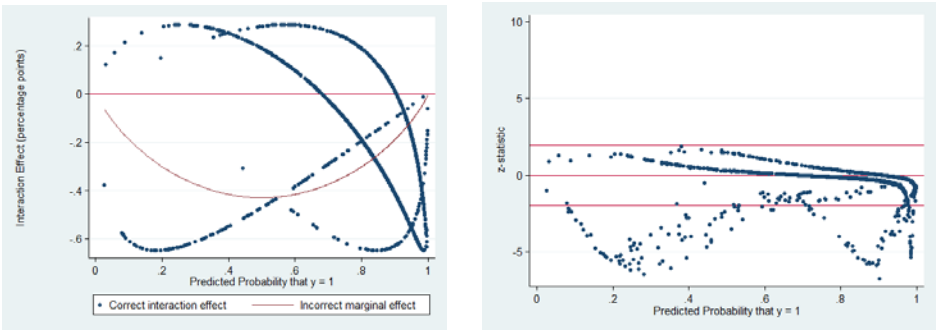


Figure 11. Probit interaction effect and statistical significance of interaction male*OECD in two-part model for probability and amount of remittances in Senegal

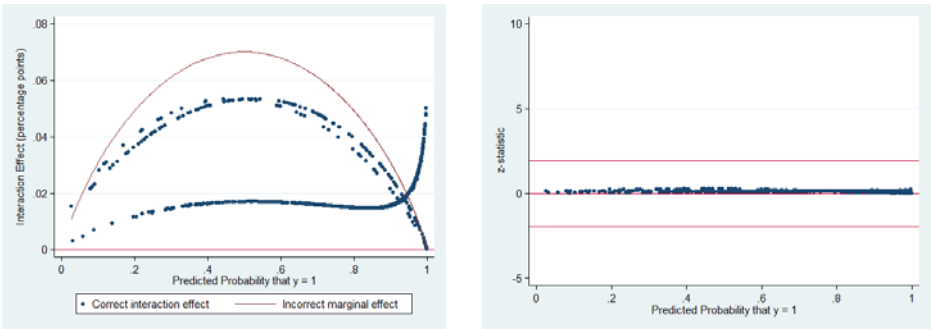


Figure 12. Probit interaction effect and statistical significance of interaction male*tertiary in two-part model for probability and amount of remittances in Senegal

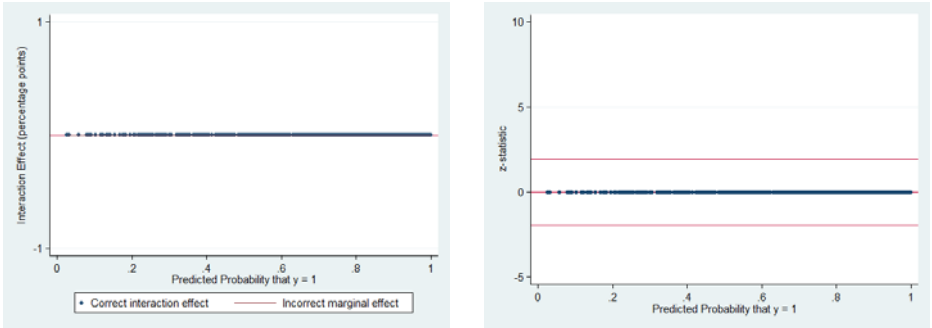


Figure 13. Probit interaction effect and statistical significance of interaction male*employed (omitted) in two-part model for probability and amount of remittances in Senegal

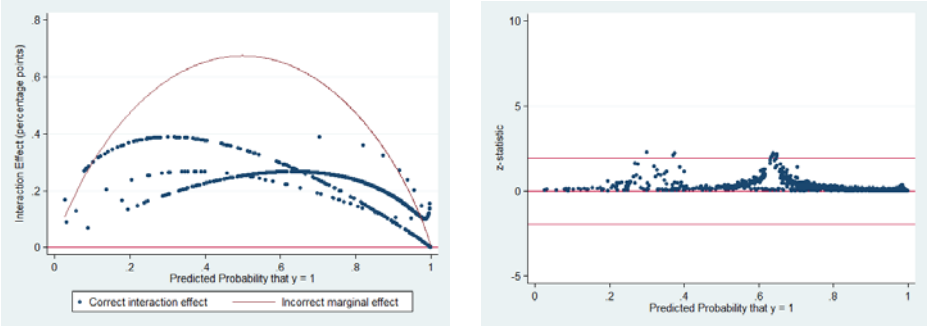


Figure 14. Probit interaction effect and statistical significance of interaction male*assets of HH in two-part model for probability and amount of remittances in Senegal

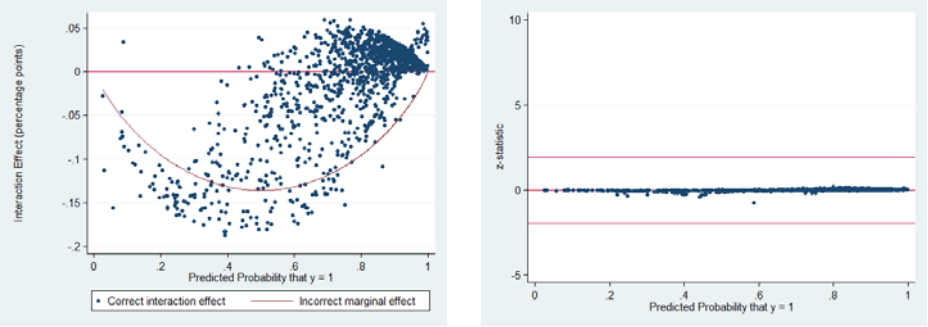


Figure 15. Probit interaction effect and statistical significance of interaction male*expenditure of HH in two-part model for probability and amount of remittances in Senegal

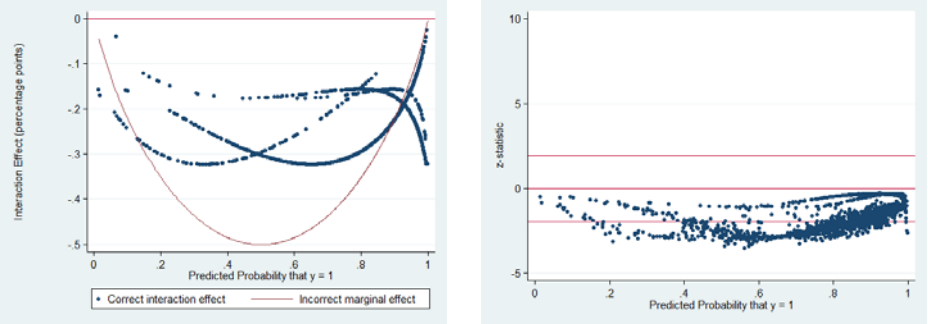


Figure 16. Probit interaction effect and statistical significance of interaction OECD*male in two-part model for probability and amount of remittances in Senegal

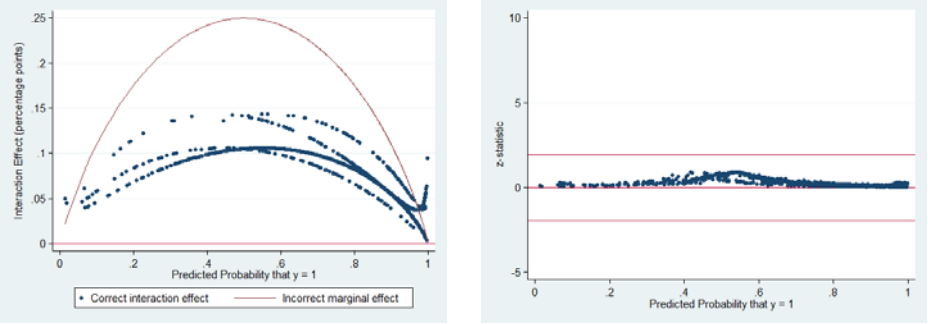


Figure 17. Probit interaction effect and statistical significance of interaction OECD*tertiary in two-part model for probability and amount of remittances in Senegal

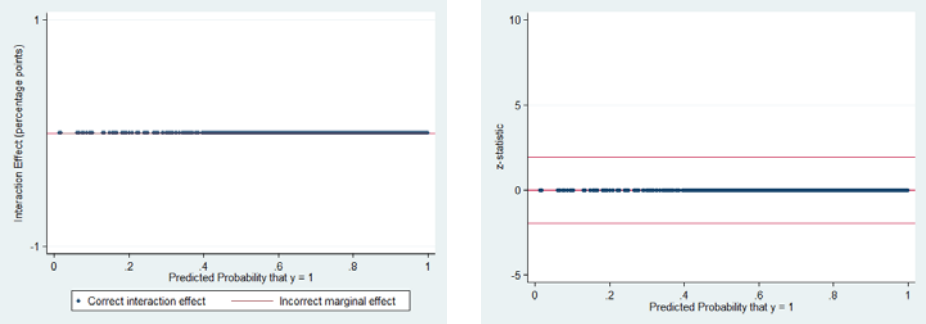


Figure 18. Probit interaction effect and statistical significance of interaction OECD*employed (omitted) in two-part model for probability and amount of remittances in Senegal

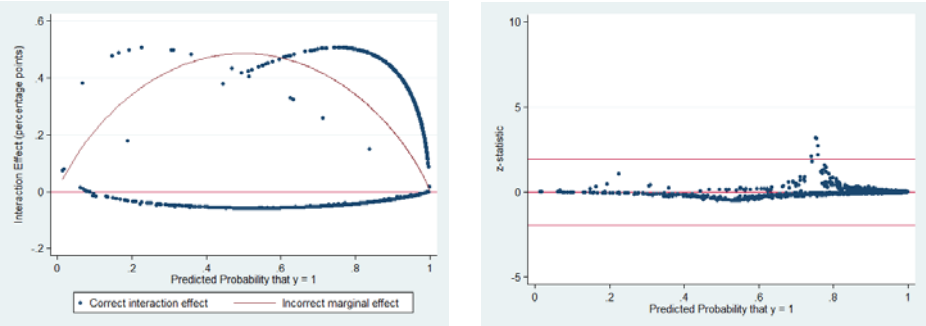


Figure 19. Probit interaction effect and statistical significance of interaction OECD*assets of HH in two-part model for probability and amount of remittances in Senegal

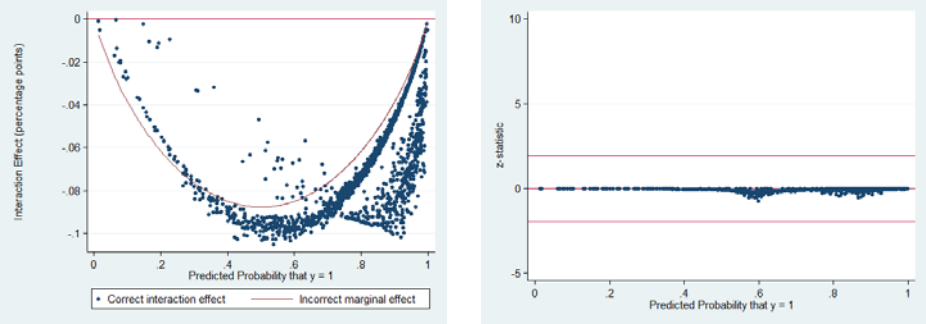


Figure 20. Probit interaction effect and statistical significance of interaction OECD*expenditure of HH in two-part model for probability and amount of remittances in Senegal

Appendix 6. Effects of other migrants and parental funding on probability and amount of remittances in Senegal

Table 29. Partial tobit model for additional estimation of probability and amount of remittances in Senegal

Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Partial effect on the conditional expected log amount remitted
International migrants	0.7084	0.4574	0.0176	0.5445
International migrants^2	-0.0902**	0.0376	-0.0022	-0.0693
Parental funding	0.0186	0.7180	0.0005	0.0143
Joint significance				
		F	Prob > F	
	Migrants	3.56	0.0287	
Model statistics				
	N		989	
	Uncensored		759	
	Sigma		5.5439	
	Log pseudolikelihood		-1890300.3	
	Pseudo-R^2		0.0553	
	F		323.69	
	Prob > F		0.0000	

Table 30. Partial Heckman selection model for additional estimation of probability and amount of remittances in Senegal

	Likelihood of remitting			Amount remitted		
Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Coefficient	Robust std. err.	Partial effect on the conditional expected log amount remitted
International migrants	0.1640	0.1479	0.0394	-0.1390	0.1106	-0.0799
International migrants^2	-0.0212*	0.0127	-0.0051	0.0113	0.0114	0.0036
Parental funding	-0.0126	0.2037	-0.0030	-0.1237	0.2041	-0.1282
	Joint significance			Joint significance		
		Chi^2	Prob > Chi^2		Chi^2	Prob > Chi^2
	Migrants	5.04	0.0805	Migrants	1.91	0.3852
	Model Statistics					
	N		989			
	Uncensored		759			
	Log pseudolikelihood		-1060364.0			
	Chi^2		.			
	Prob > Chi^2		.			
	Rho		-0.8229			
	Rho = 0: Chi^2		9.82			
	Rho = 0: Prob > Chi^2		0.0017			

Table 31. Partial two-part model for additional estimation of probability and amount of remittances in Senegal

	Likelihood of remitting			Amount remitted		
Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Coefficient	Robust std. err.	Partial effect on the conditional expected log amount remitted
International migrants	0.1897	0.1251	0.0451	-0.0763	0.1086	-0.0763
International migrants¨2	-0.0235**	0.0104	-0.0056	0.0035	0.0113	0.0035
Parental funding	0.0130	0.2085	0.0031	-0.1037	0.1829	-0.1037
	Joint significance			Joint significance		
		Chi^2	Prob > Chi^2		F	Prob > F
	Migrants	6.95	0.0309	Migrants	0.82	0.4431
	Model statistics			Model statistics		
	N		989	N		759
	Log pseudolikelihood		-301380.22	R^2		0.6015
	Pseudo-R^2		0.2018	Root MSE		0.9945

Appendix 7. Interaction effects in probit estimation of two-part model for probability and amount of remittances in Nigeria

In the left-hand side figures, the interaction effects of the interaction variables in the probit estimation of the two-part model, plotted against predicted probabilities of the dependent variable, are displayed. The blue dots indicate the correct interaction effect for each of the observations, and the purple dashed line depicts the incorrect marginal effect. In the right-hand side figures, the z-statistics of the corresponding interaction effects, plotted against predicted probabilities of the dependent variable, are presented. The blue dots indicate the actual value of the z-statistic for each of the observations, and the purple lines signify the values of the z-statistic corresponding to the 5 percent significance level, 1.96 and -1.96.

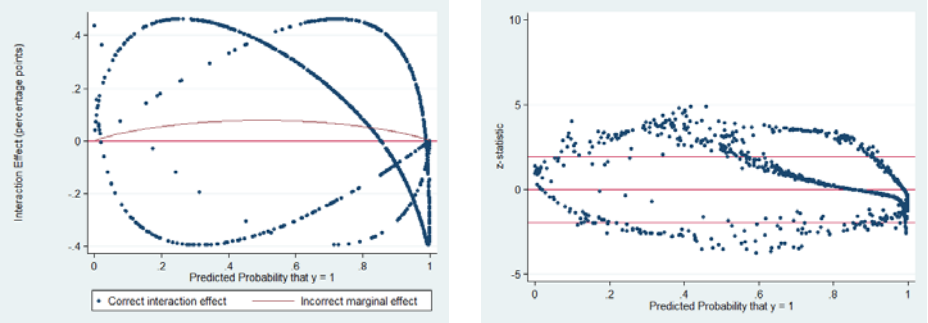


Figure 21. Probit interaction effect and statistical significance of interaction male*OECD in two-part model for probability and amount of remittances in Nigeria

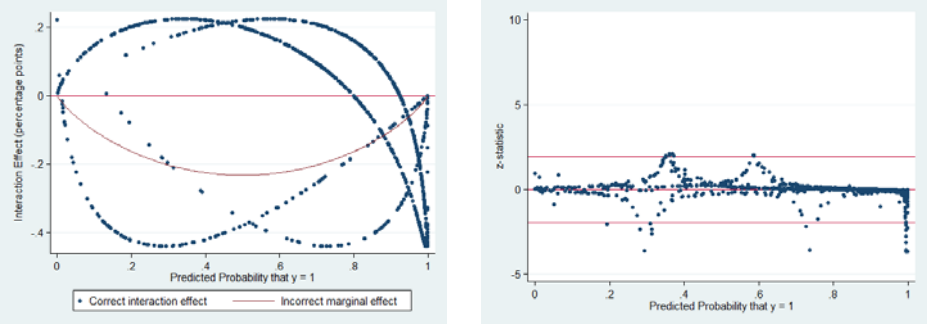


Figure 22. Probit interaction effect and statistical significance of interaction male*tertiary in two-part model for probability and amount of remittances in Nigeria

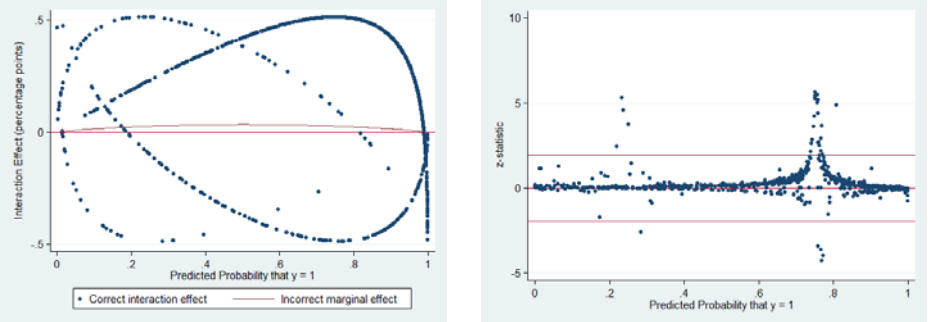


Figure 23. Probit interaction effect and statistical significance of interaction male*employed in two-part model for probability and amount of remittances in Nigeria

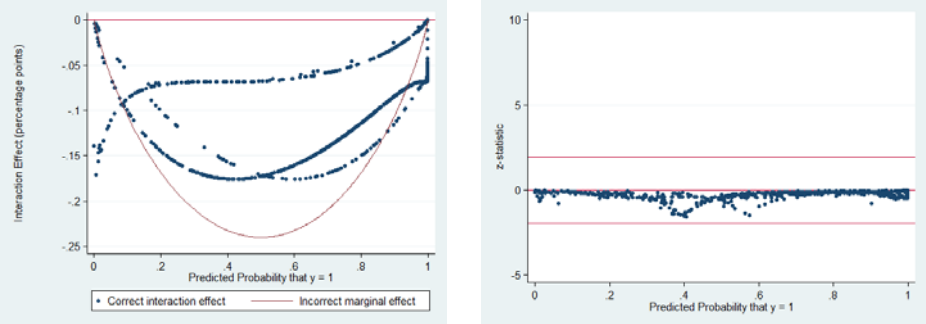


Figure 24. Probit interaction effect and statistical significance of interaction male*assets of HH in two-part model for probability and amount of remittances in Nigeria

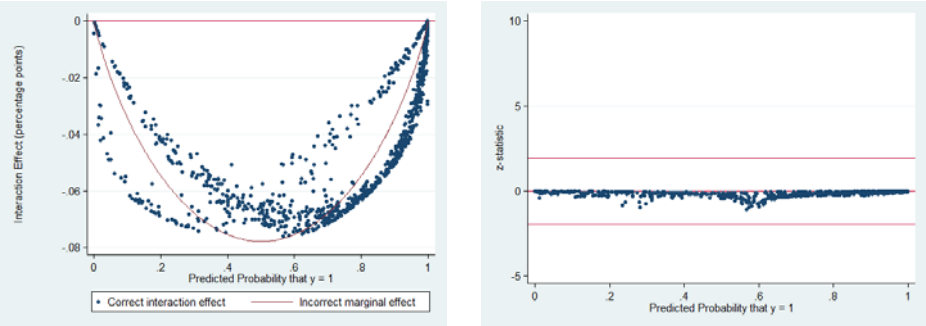


Figure 25. Probit interaction effect and statistical significance of interaction male*expenditure of HH in two-part model for probability and amount of remittances in Nigeria

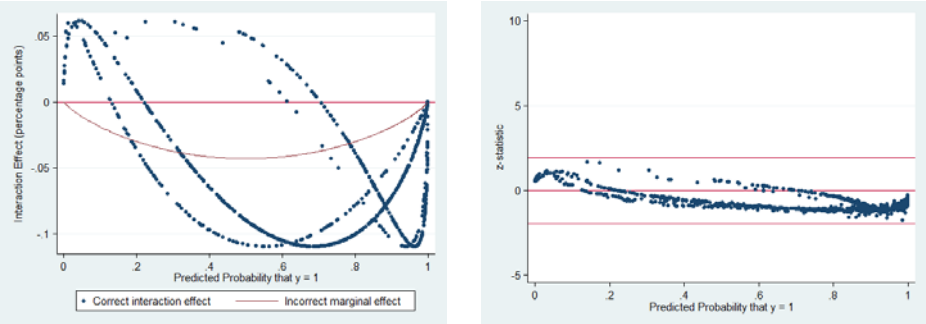


Figure 26. Probit interaction effect and statistical significance of interaction OECD*male in two-part model for probability and amount of remittances in Nigeria

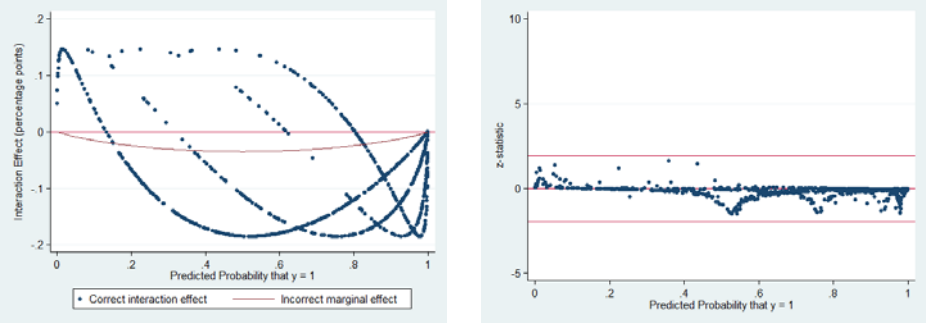


Figure 27. Probit interaction effect and statistical significance of interaction OECD*tertiary in two-part model for probability and amount of remittances in Nigeria

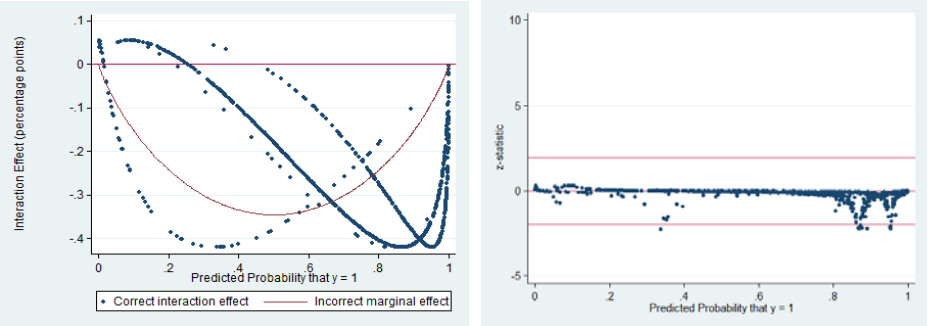


Figure 28. Probit interaction effect and statistical significance of interaction OECD*employed in two-part model for probability and amount of remittances in Nigeria

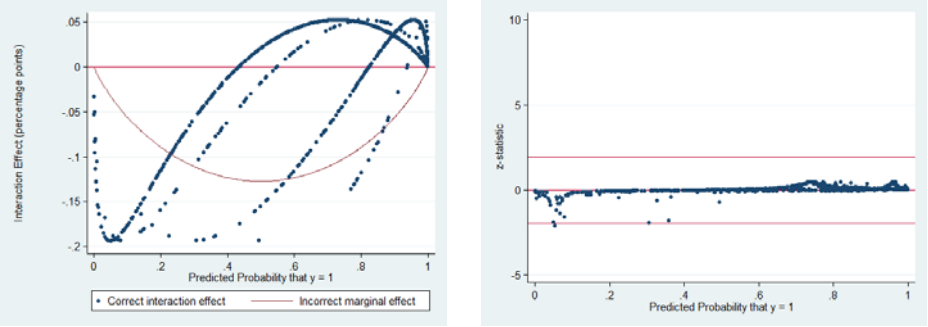


Figure 29. Probit interaction effect and statistical significance of interaction OECD*assets of HH in two-part model for probability and amount of remittances in Nigeria

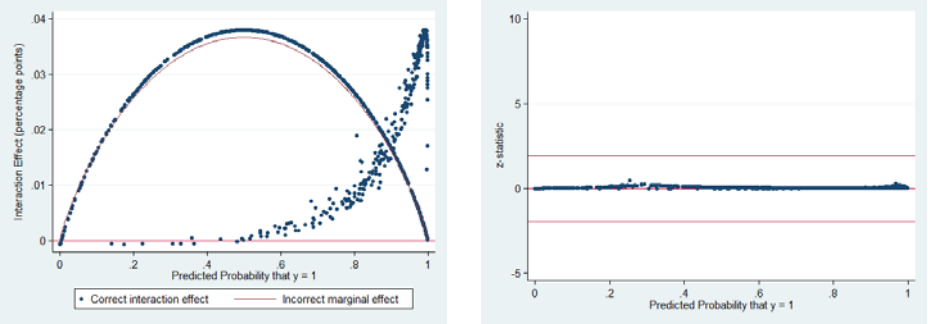


Figure 30. Probit interaction effect and statistical significance of interaction OECD*expenditure of HH in two-part model for probability and amount of remittances in Nigeria

Appendix 8. Effects of education, occupation and employment in recipient household on probability and amount of remittances in Nigeria

Table 32. Partial tobit model for additional estimation of probability and amount of remittances in Nigeria

Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Partial effect on the conditional expected log amount remitted
Primary in HH	-1.4956**	0.6318	-0.0506	-1.0653
Secondary in HH	-0.6478	0.6130	-0.0214	-0.4680
Tertiary in HH	-0.8795	0.7653	-0.0294	-0.6322
Professional in HH	0.8432	1.1407	0.0265	0.6193
Service in HH	1.1071	1.3068	0.0337	0.8235
Agriculture & Crafts in HH	1.6815	1.4326	0.0523	1.2412
Employed in HH	-0.5603	0.7054	-0.0173	-0.4145
		Joint significance		
		Chi^2	$Prob > Chi^2$	
	Education in HH	1.94	0.1224	
	Occupation in HH	0.53	0.6592	
		Model statistics		
		N	767	
		Uncensored	532	
		Sigma	4.6489	
		Log pseudolikelihood	-4324358.3	
		Pseudo-R^2	0.1146	
		F	.	
		Prob > F	.	

Table 33. Partial Heckman selection model for additional estimation of probability and amount of remittances in Nigeria

	Likelihood of remitting			Amount remitted		
Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Coefficient	Robust std. err.	Partial effect on the conditional expected log amount remitted
Primary in HH	-0.5948**	0.2734	-0.1191	0.1239	0.1583	0.1289
Secondary in HH	-0.2143	0.1755	-0.0411	0.0867	0.1948	0.0884
Tertiary in HH	-0.3162	0.2639	-0.0611	0.1124	0.1523	0.1149
Professional in HH	0.2121	0.3188	0.0394	0.0455	0.2398	0.0439
Service in HH	0.3453	0.3909	0.0621	-0.1046	0.1642	-0.1071
Agriculture & Crafts in HH	0.7063	0.4612	0.1301	-0.2138	0.1883	-0.2190
Employed in HH	-0.1866	0.2688	-0.0342	0.0921	0.2900	0.0935
	Joint significance			Joint significance		
		Chi^2	Prob > Chi^2		Chi^2	Prob > Chi^2
	Education in HH	4.93	0.1766	Education in HH	0.67	0.8805
	Occupation in HH	1.76	0.6239	Occupation in HH	2.21	0.5291
	Model statistics					
	N	766				
	Uncensored	531				
	Log pseudolikelihood	-2689065.0				
	Chi^2	.				
	Prob > Chi^2	.				
	Rho	0.0178				
	Rho = 0: Chi^2	0.05				
	Rho = 0: Prob > Chi^2	0.8189				

Table 34. Partial two-part model for additional estimation of probability and amount of remittances in Nigeria

	Likelihood of remitting			Amount remitted		
Independent variable	Coefficient	Robust std. err.	Partial effect on the probability of remitting	Coefficient	Robust std. err.	Partial effect on the conditional expected log amount remitted
Primary in HH	-0.5637**	0.2517	-0.1127	0.1309	0.1701	0.1309
Secondary in HH	-0.2005	0.1696	-0.0384	0.0843	0.2046	0.0843
Tertiary in HH	-0.3158	0.2618	-0.0612	0.1121	0.1630	0.1121
Professional in HH	0.2329	0.3179	0.0431	0.0449	0.2461	0.0449
Service in HH	0.3682	0.3804	0.0658	-0.1031	0.1704	-0.1031
Agriculture & Crafts in HH	0.7095	0.4536	0.1304	-0.2110	0.2000	-0.2110
Employed in HH	-0.1718	0.2683	-0.0315	0.0996	0.2999	0.0996
	Joint significance			Joint significance		
		Chi^2	Prob > Chi^2		F	Prob > F
	Education in HH	5.14	0.1621	Education in HH	0.21	0.8908
	Occupation in HH	2.78	0.4261	Occupation in HH	0.43	0.7374
	Model statistics			Model statistics		
	N	791		N	532	
	Log pseudolikelihood	-616650.96		R^2	0.5575	
	Pseudo-R^2	0.4235		Root MSE	1.2198	