Essays in Labor Economics: Work-related Migration and its Effect on Poverty Reduction and Educational Attainment in Nepal

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A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Economics.

Chapel Hill
2009

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Abstract

MIKHAIL BONTCH-OSMOLOVSKI: Essays in Labor Economics: Work-related Migration and its Effect on Poverty Reduction and Educational Attainment in Nepal. (Under the direction of Thomas Mroz.)

This dissertation is composed of two self-contained essays, which are concerned with the effects of work-related migration in Nepal on the outcomes of households with migrants. In the first essay, I evaluate the impact of work-related migration of adult males on the educational attainment of their children. I develop a framework of household decision-making and estimate migration decision and enrollment outcomes jointly under several sets of assumptions. I use lagged level of migrant networks as instrumental variables to identify selection of the migrants within the household. I find that migration of a father increases the probability of enrollment of his children in school by 16% points on average.

In the second essay (co-authored with Michael Lokshin) we measure the impact of local and international work-related migration on poverty in Nepal. We apply an instrumental variable approach to deal with nonrandom selection of migrants and simulate various scenarios for the different levels of work-related migration, comparing observed and counterfactual household expenditure distribution. Our results indicate that one fifth of the poverty reduction in Nepal occurring between 1995 and 2004 can be attributed to higher levels of work-related migration and remittances sent home. We also show that while the increase in international work-related migration was the leading cause of this poverty reduction, domestic migration also played an important role. Our findings demonstrate that strategies for economic growth and poverty reduction in Nepal should consider aspects of the dynamics of domestic and international migration.

Acknowledgments

I am extremely grateful to Thomas Mroz for being my teacher for so many years.

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Chapter 1

Introduction

This dissertation seeks to provide a partial answer to a very broad question: What are the costs and benefits of economic migration? In this introduction, I will demonstrate the overall importance of this question from both theoretical and practical points of view and highlight some of my more important results.

The practical importance of evaluating the costs and benefits of migration lies primarily in the fact that migration has become increasingly widespread and appears to have had a large impact on the world economy. This is illustrated by quotations from the 2009 World Development Report. According to the report, currently 200 million people-about 3% of the world's population-are foreign-born, and the share of migrants is even greater in poor and middle-income countries. This is a large number to begin with, but the share of the population directly affected by migration is still larger. While some migrants move together with their families, other migrants leave families behind and send remittances back home.[1] Remittances constitute the most tangible and immediate outcome of migration and a well-defined measure of migration impact. The total amount of remittances sent to developing countries was estimated at $283 billion in 2008, up from $230 billion in 2006. This amount

[1]For example, in the case of Nepal (the country which I use as a case study to investigate the effects of migration), adult male migrants make up five percent of the population. At the same time, thirty percent of the population reside in the households of these migrants and are thus directly affected by migration.

is more than twice the amount of all international aid directed towards developing countries. Overall, remittances make up 2% of GDP of all developing countries, but in some countries the share of remittances in GDP is larger. [2] The total number of internal migrants in the world is not documented, since it is harder to define and to measure. The extent of labor mobility within a given country can be judged somewhat by household survey data. Estimates of the share of internal migrants in the working population range from 40% for Paraguay and Bolivia to 10% in Kazakhstan and Tajikistan.

According to the World Development Report (2009), the largest international migration flows originate in developing countries in the South and move to the OECD countries of the North. These flows account for 37% of all migrants. The second biggest flow, South to South migration, accounts for 24% of all international migrants. In particular, migrants from South Asia account for 13% of all international migrants. In the dissertation, I investigate the effects of migration using the example of Nepal, a poor developing country in South Asia.

Nepal is an important case to study because of the exceptional extent of labor migration in the country: almost 14% of households reported receiving remittances from within Nepal in 2003-04, and almost 18% of households reported receiving remittances from abroad. Overall, almost one third of the households in Nepal had either an internal or international migrant. According to the estimates of the Nepalese Rastra Bank, international remittances sent through official channels contributed 17% to the country GDP in 2007-2008. However, there is no official account for the contribution of internal migration. The main destination for international migrants in Nepal was India (65% of all international migrants). High-income Middle Eastern countries accounted for 18% and other countries in South Asia accounted for 7%. As concerns internal migration flows, rural-to-rural migration accounts for 69% of the migrants and rural-to-urban - for 26%.

[2] For example, in Tajikistan and Moldova remittances make up 45% and 38% of GDP.

Migration policy in many countries is the subject of debate: should immigration be encouraged or discouraged? Regulated or not regulated? Should emigration out of country be encouraged or discouraged? Some countries, like China, attempt to control internal migration. Others, like North Korea, restrict emigration. Almost all countries control international immigration using regulatory measures such as entry visas and work permits. (Nepal is an extreme example of the results of such policies: Nepalese citizens need visas for every country in the world besides India.) If governments did not regulate migration at all, then the level of international migration would likely be much higher.

The main questions of the policy debate - whether migration should be regulated and if so, how–are normative, requiring a value judgment. To make an informed decision in this matter, one needs to know the answers to various positive questions concerning effects of migration on different economic entities and population subgroups. These positive questions include: does immigration lower wages for native workers? Does internal migration increase congestion and crime rates in the cities? Does migration of a household member help to increase consumption in that household? The answers to these questions vary by the choice of the outcome of migration, the choice of the migration event, and the reference population on which the effect of migration in that outcome is evaluated.

This dissertation is concerned with the so-called "direct" consequences of migration: the reference population consists of the migrants themselves and their households, and our interest is focused on the impact of migration on the household that a migrant has left behind. The direct effect of migration is sometimes called "partial-equilibrium effect", because it does not take into account the "general-equilibrium" effects of migration realized through changes on the local labor market, spill-over effects from remittances, and other indirect effects brought about by migration. Ignoring "indirect" effects in the analysis requires extra caution in the interpretation and generalization of the results. This is especially true when the results involve simulating large changes in migration rates, which can substantially change the general equilibrium.

The two essays which make up the dissertation are devoted to the direct effects of migration on two different yet complementary aspects of household behavior: household consumption and household investment. In the first essay, in Chapter 2, I attempt to answer the following question: what is the effect of migration of a household member on his/her household's welfare, in terms of per capita consumption? This choice of welfare measure has both advantages and disadvantages. Consumption is usually measured better than income in the survey data; it is less noisy and better reflects long-term household well-being. It is also a standard measure of welfare, allowing for cross-country comparisons with the results of other studies. Finally, using per capita consumption in application with the poverty lines calculated by the World Bank allows us to estimate the effects of different migration policies on poverty rates in Nepal. One drawback of using per capita consumption is that it ignores the direct effect that migration can have on household welfare through the economies of scale and lower household size.

The second essay, in Chapter 3, complements the first one, shifting the focus from consumption to investment. I investigate the impact of migration on the investment of households in human capital, specifically, in the education of children. I attempt to determine the effect of migration of a household member on the school enrollment of that household's children. The urgency of question comes from concerns that migration of a father may lower his children's educational outcomes, due to absence of parental supervision, family disruption or other negative effects. For example, McKenzie and Rapaport (2005) find that boys living in a migrant household in Mexico have 20% lower chance of finishing school. It must be acknowledged that enrollment in school can not be interpreted as a complete measure of educational achievement; this is particularly true in the context of Nepal, where many children remain enrolled in school for several years without advancing to the next grade. In other words, enrollment is necessary for educational achievement, yet in and of itself not sufficient. The advantage of using enrollment outcome is that it is well defined, easily measured and allows for cross-country comparisons.

I calculate effect of migration on both of the outcomes (consumption and enrollment) by comparing the counterfactual outcomes that a household would have with and without a migrant. The main analytical challenge lies in constructing the correct counterfactuals. First of all, as usual, the two potential outcomes are never observed simultaneously. An econometric model of each outcome (with and without migration) needs to be estimated to determine appropriate unobserved counterfactual outcome. Second, the econometric model needs to account for the possibility of confounding factors, which influence both migration and consumption or enrollment outcomes. Finally, to identify the effect of migration one needs to have proper identification restrictions. In this case, the variables that affect migration outcome, but do not directly influence either the consumption or enrollment outcomes. In both of the essays I deal with these problems using a common analytical approach. In the first essay, I develop an econometric model in which the migration event in the household and the counterfactual consumption outcomes are estimated jointly. In the second essay, the migration outcome of each adult male in the household and the enrollment outcomes of each child are estimated jointly. Both of the econometric models take into account the correlation between the error terms in migration and outcome equations and use established migrant networks as the instrumental variables for the identification of the parameters. My findings indicate that there are large and positive effects of migration on both household consumption and school enrollment of children in the household. In the first essay, I find that having a migrant working in Nepal increased the household's per capita consumption by 45%, relative to what it would be if the migrant remained in the household. In the second essay, I find that migration of a father increases the probability of enrollment of a child by about 16 percentage points on average, while migration of a brother or uncle increases enrollment probability by 7 percentage points. I estimate that the positive effect of migration is larger for poor households. In particular, among landless rural households, migration of a father raises the probability of a child's enrollment by 28 percentage points.

Chapter 2

Work-related migration and poverty reduction in Nepal

(co-authored with Michael Lokshin)

2.1 Introduction

Work migration and remittances, along with the higher agricultural growth, are usually considered the key factors behind declining poverty in Nepal since 1996. Indeed, more than a million prime-age (mostly male) adults are currently working outside Nepal. Remittances from expatriates grew at 30 percent per year and from less than 3 percent of GDP in 1995 to about 15 percent by the end of 2003 (World Bank 2004) , exceeding the combined share of tourism, foreign aid, and exports. According to official government statistics, about 1 billion dollars comes into the country as remittances, and inflows through private and unofficial channels could be even larger (Thieme 2003) .

The growing numbers of migrants who secure work and send remittances back home have a profound effect on many socioeconomic, demographic, and political issues in Nepal. At the same time, we are unaware of any research that formally investigates the micro-level relationship between work-related migration and household well-being in Nepal. A few, mostly descriptive, studies by Nepali scholars establish no causal relationship between work-related migration, remittances, and poverty (for example, Acharya 2001 and Chhetry 1999, 2002; see also Kumar 2003). With this paper, the intention is to fill this gap by providing empirical evidence of the effect of migration and remittances on poverty in Nepal.

While a large body of literature on international migration exists, the empirical research of the impacts of work-related migration and remittances on poverty and inequality is limited. A macro-level study of 74 low- and middle-income countries by Adams and Page (2005) find that remittances have strong poverty-reducing impact. Adams (1989, 1991) presents micro-evidence on the importance of remittances for poverty reduction in rural Egypt, while Adams (2005) summarizes the results of micro-level analysis in several countries, finding that poverty reduction in Bangladesh, Ghana, and Uganda could be attributed to the effects of remittances. Gustafsson and Makonnen (1993) report that removing remittances in Lesotho would raise the poverty rate from 52 to 63 percent, and Barham and Boucher (1998), in examining the net effects of migration and remittances on income distribution in Nicaragua, find that migration and remittances increase average household income and income inequality when compared with the no-migration counterfactuals. Du, Park, and Wang (2005) studied the effects of migration and remittances on poverty in China, finding that without migration and remittances the aggregate poverty rate would increase from 14.4 to 15.4 percent. Other recent papers by McKenzie and Rapoport (2005) and McKenzie et al. (2006) estimate the overall impact of remittances on income distribution in Mexico taking into account their direct and indirect effects on receiving households and the spillover effects on neighboring communities.

In this paper, we model the effect of remittances and work migration on consumption of households with a migrant. Using the cross-sectional sample of the nationally representative Nepal Living Standard Survey of 2004, we estimate a model of household migration decisions jointly with the consumption equations by the method of full information maximum likelihood (FIML) with instrumental variables. The method takes into account unobserved household characteristics that could simultaneously affect household migration decisions and household income. We simulate counterfactual expenditure distributions to determine the effect of work-related migration on the levels of aggregate poverty and inequality in Nepal. While most of the recent studies on the effect of migration on inequality and poverty have controlled for heterogeneity and selection in terms of unobserved characteristics, to the best of our knowledge this is the first paper using FIML to estimate the trivariate selection model in this context. The novelty of the paper resides on separating different effects of domestic and international migration on household welfare.

The results of our simulations show that almost 20 percent of the decline in poverty in Nepal between 1995 and 2004 can be attributed to increased work-related migration and remittance inflows. If the level of migration and the amount of remittances remained at the 1995 level, the poverty rate in Nepal would increase from the currently observed 30 percent to 32 percent; the mean per capita expenditure would decline from about 15,000 to 14,000 NPR. Two-thirds of this increase in poverty can be explained by the higher number of the would-be-poor among the households with international migrants. Work-related migration and remittances, however, have only marginal impact of the changes in income inequality in Nepal.

2.2 Data and Measures

The analysis in this paper is based on the data from the second (2004) round of Nepal Living Standard Survey (NLSS). We also use the data from the first (1996) round of NLSS and Nepal Census of 2001 for descriptive results and to construct the aggregate lagged data at the ward and district levels.

The NLSS is a nationally representative survey of households and communities conducted between June 1995 and June 1996 (NLSS-I) and April 2003 and April 2004 (NLSS-II) by the

Nepal Central Bureau of Statistics. Both rounds use similar modules to collect data on the household consumption of a wide range of food and nonfood items. The survey's instruments gather detailed information about the household demographic composition, the labor status of the household members, their health and educational achievements, and various sources of household income, including income in-kind, individual wages, and remittance and transfers received in the year preceding the survey (Central Bureau of Statistics 2006).

We use per capita consumption expenditure as an indicator of household welfare. Our consumption aggregate includes monthly household expenditures on food and nonfood items, imputed housing expenditures and a stream of services from durables, as well as cash expenditures and imputed expenditures for home-produced goods. To assure comparability across the regions, all monetary indicators (household consumption, values of remittances, wages, and so on) are deflated to 2004 all Nepal prices. The poverty line for the analysis is constructed using cost-of-basic-needs approach. The cost of the poverty basket in 2004 all Nepal prices equals NPR 7,694 per year per person–equivalent to US$107 or US$590 in PPP (World Bank 2006).

A serious data limitation is that households with migrants can only be identified if they reported remittances in the previous year. Three groups of households could be misclassified under this definition. The first group consists of households with migrants who send no remittances. These could be households with a migrant who has just departed and is in the process of establishing him or herself, or households where a migrant brings the remittances home rather than sending them. The second group comprises households that receive remittances but do not report them. Such households might be afraid of revealing information on remittances because of the tax consequences or due to concerns for personal safety. Finally, some households could receive remittances from individuals who are not household members. Classifying the households in these groups as having no migrants would bias estimates of the impact of migration on household consumption. Although the direction of the bias is unclear a priori, the size of the bias is proportional to the sizes of these three groups of households.

To assess the extent of such misclassifications, we compare the proportion of migrants in the total population from the 2001 Nepal Census with the proportion of households with remittances in the NLSS data. The proportion of domestic migrants in the 2001 Census (4.8 percent) is statistically close to the proportion of migrants from households receiving domestic remittances in the NLSS (5 percent). The census-calculated proportion of households with international migrants (14 percent) is lower than the NLSS proportion of household receiving remittances from abroad (18 percent). The official statistics report about 1,000,000 prime-age male expatriates working outside Nepal. The equivalent NLSS figure is about 900,000. These relatively small discrepancies indicate that the bias resulting from misclassified households would most likely also be small[1].

2.3 Migration and Remittances in Nepal: Descriptive Analysis

The history of foreign employment in Nepal dates back almost 200 years, when Britain began recruiting men from the hillsides of Nepal, known as Gorkhas into the British armed forces. After India's independence in 1947, the Indian military also began enlisting Nepali men. Currently, about 3,500 Nepali solders serve in the British army and more than 50,000 Nepalese are enlisted in the Indian military. India was the first country to attract civilian migrants from Nepal. The inflow of working migrants to India has increased sharply since the 1950s (Sheddon 2005)[2].

[1]We are leaving out the sample of households that migrate together. We argue that the effect of omission of such households on our results is small. Kollmair et al., (2006) show that a small number of households migrates from Nepal to other countries and settle there. Our analysis of the 2001 Nepal Census indicates that only 1.78 percent of households changed the district of residence during five years prior to the Census.

[2]The "Treaty of Peace and Friendship" signed by the Indian and Nepali governments in 1950 allowed Nepali nationals to enter India without a visa and work there with no restrictions (Thapliyal 1999).

The Foreign Employment Act of 1985 was the first legislative document to officially recognize the benefits of international migration (Jha 1999). Around that time, foreign labor migration from Nepal extended from India to the countries of the Southeast and Far East, and later to Arab Gulf States. The total number of Nepali migrants working abroad reached 750,000 in 1997, contributing about NPR 35 billion to the country's economy in form of remittances (Sheddon, Gurung, and Adhikari 2000). The reform of the administrative system during 2000 and 2001 resulted in a boost in both domestic and international migration. Before the reforms, passports could only be obtained in the country's capital, but under the new regulations, district offices were given the authority to issue passports and other travel documents (World Bank 2006).

Domestic migration has increased in Nepal since the success of government's efforts to control endemic malaria in the Terai in early 1950s. The inter-district migration constitutes 13.2 percent of domestic migration (Central Bureau of Statistics 2003), while rural-urban migration represents 25.5 percent and rural-to-rural migration 68.2 percent. The poor rural regions of the mid- and far-west underwent a net out-migration, with migrants moving from the mountainous and hillside areas to the Terai and urban areas. These regions were also the most affected by the Maoists insurgency over the past 10 years (Do and Iyer 2007).

The NLSS is the first data source to provide statistically accurate estimates of levels of and trends in work-related migration from Nepal and on the amount of money sent home in remittances. According to NLSS, 23 percent of households in Nepal received remittances in 1995, and that proportion climbed to about 32 percent in 2004. Further, the share of households with remittances from abroad grew from 10 to 17 percent between the survey's two rounds. The average amount of remittances increased from about NPR 22,000 or 36 percent of mean household yearly consumption expenditure in 1995, to NPR 35,000 or 44 percent of mean expenditure in 2004.

The procedures for sending remittances to Nepal have been simplified over the last several years. National Bank of Nepal granted permits to 26 firms specialized in remittances transfers and manpower agencies are being permitted to open foreign exchange account in local banks in the receiving countries. The joint venture of Nepal-based Everest Bank and the Punjab National Bank in India allows migrants to open a bank account in India with their Nepalese identification card and remit money to Nepal (Thieme et al. 2005). In addition to the formal channels, working migrants use micro-credit organizations (knows as chit), and societies and committees run by migrant workers to send money to their families (Bhattrai 2007).

Figure 1 shows the incidence and the amount of remittances by household size for 1995 and 2004. Focusing first on the top panel of the graph, the proportion of households receiving remittances grows monotonically with household size. For example, in 2004 only about 10 percent of households with two or three members received money from abroad, while that proportion is more than three times higher for households with 11 or more members. The changes in the amounts of remittances by household size are shown on the lower panel of the graph. The plot indicates that in 1995 households with different sizes received almost the same amount of money, while the 2004 data show that remittances increase with household size[3].

The incidence of remittances is higher in rural than in urban Nepal. The proportion of households receiving remittances from within the country increased only marginally between 1995 and 2004, and even declined in Kathmandu (top section of Table 1). At the same time, the share of households receiving money from abroad increased uniformly across the country. For example, the rural eastern hills–the poorest region in Nepal–registered a fourfold increase in the number of households receiving money from abroad; that proportion more than doubled in "other urban areas" of Nepal. Thus, the overall increase in the proportion of households with remittances could almost entirely be attributed to the growth of remittances from abroad.

[3] An alternative explanation for these results could be that larger households have higher probability of having a migrant and a higher probability of having more than one migrant (implying more remittances)

There is no clear pattern in the distribution of the recipients of the remittances by the size of landholdings. The largest increase in the incidence of both domestic and international remittances is registered among households with two and more hectares of land.

Looking at the proportions of households receiving remittances by caste (bottom part of Table 1), Dalit households have the highest probability of receiving money from outside Nepal (25 percent), while the incidence of external remittances is much lower among Newars and Terai Janjatis. At the same time, only 10 percent of Dalit households receive remittances from Nepal. This might suggest that poor job opportunities at home prompt Dalit households to concentrate their job search efforts abroad.

Individual profiles constructed using NLSS data reveal that almost all international migrants are male (97 percent) aged 15 to 44 years, and either sons or husbands of the person receiving remittances. Brothers represent about 10 percent of the total number of donors. In 1995, 85 percent of Nepali migrants worked in India, and the rest were spread among Malaysia (11 percent), Bhutan, and Hong Kong. As of 2004, international migrants were living in 10 countries: 65 percent worked in India, 18 percent in Arab countries, and about 2 percent in United Kingdom, while some migrants lived as far away as Japan and the United States. Remittances from abroad constituted 76 percent of the total remittances in 2004. The largest share of international remittances came from Saudi Arabia, Qatar, and the United Arab Emirates (35 percent), followed by 30 percent from India, 17 percent from other Asian countries, and the remainder from United Kingdom, United States, and other countries.

The correlations between household income and the incidence and amount of remittances are shown in Figure 2. The main difficulty in illustrating this relationship is that current income is endogenous to the remittances. We attempt to address this problem by constructing a two-year-lagged asset index to proxy for pre-migration income[4]. Overall, the incidence of

[4]The lagged asset index was constructed based on the estimated cash value of the flow of services provided by the durable goods. In our calculations, we included only durable assets purchased by households at least two years prior the date of the survey (2001 and older). In justifying the exogeneity of the lagged asset index, the

remittances (or migration) is higher among (asset) poor households. It reaches 35 percent for the poorest households in Nepal and declines monotonically to about 10 percent for the richest households. The correlation between the amount of remittances and household wealth goes in the opposite direction. Households with the highest lagged asset index receive significantly larger amounts of money from working migrants than do poor households. These results, however, could indicate that households receiving the largest remittances have been receiving them for a long time, resulting in an accumulation of durable assets (Stark 1978).

2.4 Work-Related Migration and Poverty: Theoretical Considerations and Empirical Specification

Remittances sent home are the most tangible benefit of work-related migration for Nepali households. On the production side, remittances enable households to overcome the constraints of credit and risk on their ability to engage into modern and more productive activities (Stark 1991). Remittances can be spent on housing and schooling, and a significant proportion directly supports household consumption. But remittances are only one of the consequences of migration. When a young, able, and productive male household member leaves home, multiple adjustments need to be made among those left behind. Migration changes the relative productivity of the remaining household members; affects household preferences in terms of risk aversion and uncertainty; and provides new information–for example, on new technology, type of crops, and so on. Women who previously worked in the labor market may find it optimal to stop working and devote all their time to home production (Nandini 1999). Agricultural households might decide to augment their income with off-farm activities. Migration also has implications for the health and educational attainment of the migrant's children (Hilderbrandt

fact that the major increase in work migration in Nepal was initiated by the reforms of the administrative system of 2001 was taken into consideration (see Section 3).

and McKenzie 2004; McKenzie and Rapoport 2005).

The observed consumption behavior and poverty status of households receiving remittances are determined by the cumulative effects of these changes. Finding valid instruments to disentangle the effect of remittances from the overall impact of migration can be problematic. Even if such instruments exist, the question of the effect of migration on household well-being has more policy relevance than a narrower question focusing only on the effect of remittances. The goal of this study is to analyze the impact of work-related migration and remittances on the consumption of households at home and to estimate the effects of work-related migration on aggregate poverty and inequality in Nepal. As in any impact assessment, the welfare impact of work-related migration should be judged relative to the counterfactual of what have been observed in its absence. In particular, we model how the observed income distribution compares to the counterfactual distribution without migration and remittances.

Our theoretical framework relies on several assumptions. First, we assume that households have a choice to send a migrant to work within Nepal or abroad. This assumption imposes certain restrictions on the sample for empirical estimations. We also assume that migration has to be planned ahead. Before the migration takes place, multiple arrangements need to be made. If traveling abroad, a Nepali migrant has to apply for and obtain a visa, get an international passport, and purchase a ticket. And a migrant's household incurs expenses in the form of migration broker fees and traveling costs (Bhattrai 2005)[5]. This preparation process could take several years depending on the country of destination. This assumption is crucial for our identification strategy.

Consider a simple two-period model of household utility maximization[6]. In time period 1, a household decides that one of its members will migrate. This involves three possible states:

[5]Fees to obtain travel documents, such as entry and identity cards charged by intermediaries vary by country and could be as high as US$15,000 (Yamanaka 2000).

[6]Several studies support the argument that migration is a household utility maximization decision (for example, Stark and Levhari 1982; Low 1986; Hoddinott 1994; Agesa and Kim 2001; Bhattacharyya 2005).

migration abroad, migration within Nepal, and no migration. Each state has an associated cost for a household. Such costs could, in case of migration, include transportation costs, visa and document processing fees, money to cover initial expenses, and so on. To decide whether to embark on migration or not, a household compares its expected net benefits in each state (in period 2) and selects the state with a highest utility payoff. Households observe the realized labor market outcomes in time period 2: once settled in the new location, migrants inform households about their wages and local market conditions become known. With this information, households make decisions about member participation and market work hours and investment, adjusting their consumption level accordingly.

In the simplest form, a household chooses between two states: to send or not send a household member to work in another location, whether locally or abroad. Let U be the household utility function which depends on household consumption (C_t) and the household characteristics X_t in period t, $(t = 0, 1)$. The household income Y_t comprises wage and non-wage income, as well as income from home-production. R is the expected benefits of migration (which could be positive and negative, including remittances and other consequences of migration). Let z define a set of regional factors affecting the cost of migration $P(X_0, z_0)$, $P_z < 0$ assumed at period 0. The household utility maximization can then be expressed in the form:

$$\max[U(Y_1(X_1) + R(X_1)) + U(Y_0(X_0) - P(X_0, z_0), U(Y_1(X_1)) + U(Y_0(X_0))] \qquad (2.1)$$

The first term in (2.1) is the household's indirect utility if it decides to proceed with migration, and the second term is the indirect utility in the case of no migration. The model predicts that the reduction in the cost of migration, P, and the higher expected returns from migration increase the probability of a household choosing to send a migrant. This specification can be extended to a case with three states of migration: international migration, migration inside Nepal, and no migration.

We assume that utility of a household in state s can be linearly approximated as

$$U_{is} = X_i\gamma_s + Z_i\varsigma_s + \eta_{is}, \quad s = 1, 2, 3 \tag{2.2}$$

where Z_i is a vector of household characteristics that includes both X_i and z_i, γ and ς are vectors of parameters, s is an indicator describing household migration choice, and η_i's are the error terms. The household selects the migration state s if

$$U_{is} > \max(U_{ij})_{j \neq s}, \quad s = 1, 2, 3 \tag{2.3}$$

Consumption C_{is} in a particular state is observed only if that state is chosen:

$$C_{is} = \beta_s X_i + \mu_{is}, \text{ if } U_{is} > \max(U_{ij})_{j \neq s} \tag{2.4}$$

where β_s is a vector of parameters, and μ_i's are the error terms.

The estimation of equation (2.4) in three states (migration abroad, migration within Nepal, and no migration) using ordinary least squares (OLS) enables inferences to be made about the returns to the observed household characteristics in each state under the assumption of independence of the error terms in equations (2.2) and (2.4) - that is, if we assume no systematic unobserved differences in household characteristics by migration state. Then it is possible to predict the counterfactual consumptions for households in the sample if international, internal or no migration decisions have been made. The probability of a household choosing migration state s could be estimated by a standard multi-nominal model. The inferences about the aggregate impact of work migration on poverty and inequality might also be obtained (see, for example, Adams 1991, 2005 and Taylor and Wyatt 1996).

However, some unobserved household and/or potential migrant's characteristics could affect both the household's decision to migrate and the household's consumption[7]. For example, it might be optimal for a household to send a member with high entrepreneurial abilities abroad. These abilities, which are usually unobserved by a researcher, could also allow a migrant to earn higher wages in comparison with the average migrant worker and send more money back home. The challenge for our empirical strategy is to estimate the system of equations (2.2) - (2.4) controlling for such unobserved factors.

If error terms μ's and η's are not independent, the nonrandom selection of households into different states will result in a correlation between the explanatory variables X and errors μ's in equation (2.4). To obtain unbiased and consistent parameter estimates under an assumption of joint dependence of the error terms, we use the method of full information maximum likelihood (FIML). The method estimates the household consumption equations jointly with the equation describing the household choice of migration state allowing for the correlation of the error terms across equations. The detailed discussion of our estimation methodology is shown in Appendix [8].

To estimate the impact of remittances and migration on poverty and inequality in Nepal, we simulate the counterfactual expenditure distributions under different migration scenarios.

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[7]Migrant selection was studied by Chiswick (1978), and Borjas (1987, 1990, 1991) developed a model of self-selection based on unobserved migrant characteristics. The problem of self-selection of migrants was also studied by Docquier and Rapoport (1998), Aydemir (2003) and Kanbur and Rapoport, (2005). Barham and Boucher (1998) build their model on the assumptions of potential endogeneity of household's migration and labor force participation decisions. A recent study by McKenzie, Gibson, and Stillman (2006) using the survey of the winners of a migration lottery concludes that migrants are positively selected in terms of both observed and unobserved skills.

[8]Several recent papers attempt to estimate the effect migration and remittances on poverty using the matching estimator methodology. Esquivel and Huerta-Pineda (2006) investigate the effect of remittances on poverty conditions among Mexican households. They use the propensity score matching approach to match the remittances receiving households with household that have similar characteristics but do not receive remittances. McKenzie, Gibson and Stillman (2007) apply matching approach to study the effect of migration on income and poverty of families with migrants in Tonga. Being econometrically more robust than the method we rely on, the matching methods disregard, by construction, the difference in unobserved characteristics between households with and without migrants. In this paper we argue that such unobservables have a strong effect both on the household migration decision as well as on the household consumption.

The FIML estimation of equations (2.2) - (2.4) identifies the parameters of five-variate distribution of the error terms. The observed outcomes of the migration decision truncate the joint distribution of consumption for each individual. Though analytical expressions for such truncated distributions are unattainable, we recover the distributions by randomly drawing the error terms from the five-variate truncated normal with 1,000 replications. This way, we generate the simulated universe of 3,620,000 household expenditures with a different realization of conditional errors. The poverty rates and Gini coefficients (or any other statistic) could then be calculated for the particular counterfactual scenario. Confidence intervals for the inequality and poverty measures are estimated by the jackknife method (see Appendix for the detailed description of the simulation technique).

2.4.1 Identification Strategy

Our theoretical model guides an identification strategy for the empirical estimation. The fact that migration and consumption decisions are separated in time allows us to assume that certain factors (variables) affecting the migration decision in time period 1 have no direct impact on household consumption in period 2. Such variables could be used as instruments in the FIML estimation of equations (2.2) - (2.4). A variation in these instrumental variables would identify the causal effects of migration and remittances on household consumption because the effect of this variation is entirely channeled through household migration decision. We use two instruments to identify the separate effects of international and domestic migration on household consumption.

The first instrument, the proportion of migrants in a ward in 2001, is constructed based on 2001 Nepal Census (Central Bureau of Statistics 2003). That proportion could be interpreted as a proxy for the extent of village-level migration networks. We argue that household consumption in 2004 should not be directly affected by the migration networks in 2001. Carringon, Detragiache, and Vishwanath (1996) and Munshi (2003) test the role of networks in promoting migration and find a greater propensity toward migration in villages with existing migrants–meaning that there is propensity for new migrants to follow in the footsteps of existing migrants. When in the host country, Nepali migrants develop extensive social networks that link them with their relatives and friends at home (Yamanaka 2000). Such networks lower the costs of migration for villagers by providing information about job opportunities outside Nepal, helping potential migrants secure employment, supplying credit to cover reallocation expenses, and ameliorating housing costs upon arrival. Indeed, as Thieme (2003) shows, in Nepal, migrants tend to follow their co-villagers and migrate to the same destinations. They are also likely to fill the same niches in the labor market in the host county. Relying on a similar identification strategy, Woodruff and Zenteno (2007) and McKenzie and Rapoport (2005) analyze the effects of migration on children's health and schooling outcomes in Mexico; Du et al. (2005) study the relationship between migration and rural poverty in China; and Taylor and Mora (2006) investigate the effect of migration on expenditure patterns of rural households in Mexico. We expect this instrument to affect the probability of international migration and have small or no influence on the probability of migration within Nepal.

To construct an instrument for the domestic migration, we use data from the first round of the NLSS. The variable for this instrument is the proportion of domestic migrants in a district in 1995[9]. The underlying rationale is similar to the one discussed above, and we expect this instrument to have a positive and significant effect on the probability of domestic migration.

Our identification strategy requires that lagged migrant networks influence household consumption only through current migration. The presence of ward or district characteristics or shocks that simultaneously influence migration and household consumption would violate our identification restrictions. For example, better road infrastructure in a ward or its proximity to

[9]We tried to add the proportion of migrants abroad in a district in 1995 as an instrument. This variable adds no extra identification power to our estimations, most likely because of a low district-level variation in foreign migration in 1995. In a specification with a distance to India as an instrument for abroad migration and a difference in non-agricultural employment in the district of residence and in contiguous regions as an instrument for domestic migration, both instruments were insignificant in the selection equation

a large urban center could reduce the costs of migration and, at the same time, affect a household's returns on productive activities by providing better access to markets. We endeavor to control for time-persistent unobserved factors by including a set of ward-level characteristics in our empirical specification. In particular, we include variables that specify local labor-market conditions, the occupational structure of the population in a ward, and the set of dummies for aggregated educational levels. In addition, we use the ward-level lagged (1995) mean expenditure and expenditure Gini. These variables describe the lagged regional poverty situation and can capture many unobserved factors affecting both the household's migration decision and its current consumption level. Nevertheless, we cannot completely rule out the presence of latent local characteristics that are correlated with our instruments and simultaneously affect household consumption behavior.

We can speculate about the effects of unobservable time-variant characteristics on our results. By having a larger number of migrants, locations with extensive migrant networks receive more remittances compared to those with fewer migrants. If invested in the development of local infrastructure, remittances would raise the local capital stock, and that in turn might positively affect residents' current earnings and incomes (see for example, Dustmann and Kirchkamp 2002). Past migration could also influence current consumption through its effect on the local labor market. Higher levels of remittances may increase aggregate demand and hence the demand for labor (Funkhauser 1992). The out-migration of prime-age males might tighten local labor markets, allowing better job opportunities for workers in the home communities.

Both scenarios would lead to a downward bias in our estimates. The consumption levels of nonmigrant households living in locations with more migrants would be positively affected by externalities related to work-related migration. The counterfactual consumption of a household with a migrant–that is, had that migrant stayed home–would be overestimated because of these externalities, thereby reducing the estimated impact of migration and remittances. In that case, our results would provide lower bounds for the true effect of work-related migration on household consumption.

Our identification strategy relies on the assumption of separability of household's migration and consumption decisions. In our model, households first decide about the work-related migration of its members and then about the household consumption. In the alternative framework of life-cycle maximization with perfect foresight and endogenous migration decision (Mesnard 2004) the exclusion restrictions for our instruments would not be valid. We can argue, however, that the sequential model of household decisionmaking better describes the behavior of households in a highly uncertain political and economic environment of Nepal.

2.4.2 Explanatory Variables and the Sample for Estimations

The predictions of the theoretical model determine the choice of our explanatory variables. The descriptive statistics for the main explanatory variables are reported in Table 2. These variables could be grouped conceptually into two categories. The first group describes factors affecting the household production. These include the household demographics, education of female household members, and variables describing ethnicity. We also include variables on a lagged land ownership and lagged asset index as proxies for household wealth. The lagged asset index was constructed based on the estimated value of the flow of services provided by the durable goods. In our calculation, we include durables purchased by households at least two years prior the date of the survey (2001 and older). We then divided all households in our sample into four groups according to the percentiles of their lagged asset index. Our specification also contains a variable on amount of pensions received over the past year. The second group of variables comprises characteristics related to the region and ward.

We restricted our sample to households that actually have or could have a working migrant. We excluded from the sample 30 households of migrants living alone. We also excluded 235 households without migrants whose members were not of working age (that is, children and the elderly). Using the language of impact evaluation, we therefore only estimate the "LATE" effect of work-related migration and remittances on the well-being of Nepali households.

2.5 Results

The results of the FIML estimation of equations (2.2) - (2.4) are shown in Table 3 (discrete part of the model) and Table 4 (continuous part of the model)[10]. Focusing first on the results for the choices of migration states, households living in wards with a historically higher proportion of international migrants are significantly more likely to migrate abroad compared with households without migrants. Households residing in districts with larger shares of domestic migrants are more likely to send their members to work in locations within Nepal. This relationship is consistent with the predictions of our theoretical model and indicates that our instruments have a significant effect on the households' choice of migration status.

Large households and households with a higher proportion of adult women and the elderly are more likely to have a migrant. Compared with Brahman and Chhetri, other castes are less likely to migrate within Nepal, and the Newars prefer not to migrate abroad. Land ownership does not affect the probability or destination of work-related migration, whether locally or abroad. The probability of a household having a domestic migrant is higher among poorer households compared with wealthier households (based on the percentiles of the lagged asset index). At the same time, individuals from both the poorest (those who reported no durables)

[10] According to the likelihood-ratio test, the specification that assumes that the error terms in equations (2.2)-(2.4) are independent is rejected in favor of the FIML estimation. The estimation results of the system of equations (2.2)-(2.4) assuming joint independence of the error terms are provided in Appendix. Three pairwise tests of the equality of coefficients between the regressions in equation (2.4) are rejected with at least 0.01 percent significance. The test on equality of coefficients in all equations is rejected with $\chi^2(68)$=149.32 (Prob > χ^2=0.0000), and the test on equality of coefficients between the consumption equation for abroad and domestic migrant is rejected with $\chi^2(34)$=67.72 (Prob > χ^2=0.0005). We attempted to estimate the system of equations (2.2)-(2.4) using a Semi-Parametric Maximum Likelihood estimator (for example, Mroz 1999), which relaxes the assumption of joint normality of the error terms in these equations. However, we were unable to achieve convergence even with the minimal number of points of support. For that reason, we reverted to the more restrictive FIML estimator.

and the wealthiest households are more likely to work abroad. We might speculate that the members of the wealthy households tend to migrate to Gulf States, while the poorest migrants mainly work in India.

Individuals residing in Katmandu are less likely to migrate compared with those living in other areas of Nepal. This could be attributed to better labor market conditions in the country's capital. The probability of international migration is higher among households from the rural western mountains and hills. Households in wards with a higher proportion of illiterate residents are less likely to have a member migrate to locations within Nepal, and households in the wards with a large share of self-employed residents are more likely to have members migrate for work within Nepal.

Table 4 shows the results of the FIML estimation of consumption equations for the three states of migration. Overall, the observed household characteristics, in particular geographical and ward characteristics play a more important role in determining the level of consumption in households without migrants compared with those with a migrant. While a household's human and productive capital has a strong effect on consumption in households without migrants, these factors become less important for households with a migrant when remittances contribute a significant share to the household budget. By comparing the estimation results of a three-choice model with the results of a model where international and domestic migration destinations are combined into one category, the log-likelihood test rejects the equality of the coefficients in the consumption regressions for international and domestic migrants. This justifies the assumptions of our theoretical model about the differences in returns on productive and human capital characteristics between international and domestic migrants.

The demographic composition and particularly the dependency ratio have a significant impact on per capita consumption expenditure. Households with larger shares of children aged 0 to 3 years have lower per capita consumption relative to other households.[11] Households

[11] The effects of household demographic variables will be different if we adjust for economies of scale on

with better educated female members have higher per capita consumption levels. The size of landholdings has a positive and significant impact on household consumption regardless of migration state. For households with international migrants, those possessing more than two hectares of land have significantly higher per capita consumption compared with landless households. Households from the upper percentiles of the lagged asset index and households receiving pensions have higher per capita expenditure regardless of migration status.

Our estimations also demonstrate strong regional variation in the level of household consumption for households without migrants: households residing in Katmandu have lower levels of consumption expenditures compared with households from other regions of Nepal. For households with international and domestic migrants, the regional effects are less pronounced. The coefficients on the distance-to-market variable are insignificant in the estimation of the probability to migrate and only significant in the consumption equation of households without migrants. These results seem to contradict the work of Fafchamps and Shilpi (2003) who find strong correlations between the distance to markets and the level of well-being of Nepali households.

Finally, certain local conditions seem to be significantly correlated with levels of household well-being. For example, households in wards with a high proportion of illiteracy are significantly poorer compared with the households in wards with better-educated population. Households either without migrants or with domestic migrants residing in wards with larger shares of self-employment are comparatively worse-off.

To ascertain the validity of our instruments we conduct a range of diagnostics tests. In the Hausman (1978) test for the endogeneity we compare the coefficients in three consumption equations estimated by FIML (Table 4), which are consistent in the case of endogenous selection, with the estimates obtained under the assumption of no selection (Table A4.1). The

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household size. This could be relevant for Nepal where the majority of the population lives in large households. However, currently there are no studies that assess the magnitude of economies of scale in Nepal, so we rely on the per capita definition.

later estimates are efficient under an assumption of no selection, but are inconsistent if sample selection is present. The hypothesis of no selection is strongly rejected by the Hausman test with χ^2=147.04 and Prob> χ^2=0.0024.

Another potential concern is the robustness of our results in the presence of weak instruments. We investigate that issue by adopting the weak instruments test by Stock and Yogo (2002). In particular, to investigate the weakness of the instrument for abroad migration, we calculate the value of Kleibergen-Paap (KP) Wald F statistic, in an instrumental variable linear regression of household expenditure on household characteristic and endogenous dummy for having an abroad migrant. Internal migration instrument is tested in a separate linear regression. For the abroad migration instrument- the hypothesis of weak instrument is rejected, with the KP F statistic of 39.466, and the critical values of Stock-Yogo test of 16.38 for 10% size of the Wald test. For the instrument of internal migration we obtain similar results[12].

2.5.1 Simulations

Using the estimated parameters of the system of equations (2.2)-(2.4), we simulate the effect of migration and remittances on distribution of per capita consumption under various counterfactual regimes of migration. Different levels of domestic and international migration are simulated through the changes in the values of the two instruments. When predicting household expenditures in a counterfactual state with no migration we use information on the number of distinct senders of remittances and their age and gender to adjust the household size for the presence of would-be-migrants, as well as all variables constructed using the household size and shares of various age-gender groups. A detailed discussion of the simulation technique is presented in Appendix.

We construct four counterfactual scenarios (Table 5). The first column of Table 5 shows

[12]We are unaware of the test of weak instruments for the non-linear models. The results of the tests conducted under an assumption of linearity of the dependent variables, while qualitatively supporting the choice of the instruments, cannot be directly applied to FIML estimation.

the actual rates of poverty, mean expenditure, and inequality for households exhibiting the three different states of migration[13]. In 2004, 29.9 percent of the Nepali population had per capita consumption below the poverty line; average per capita consumption was NPR 14,930 per year, and the Gini inequality reached 0.409.

In the scenario of no migration (the second column in Table 5), households with migrants have the same returns on their observed characteristics as households without migrants: the size of the migrant households is increased by the number of migrants, and remittances are set to zero. Our simulations show that without migration the overall poverty rate in Nepal would have increased from the current 30.0 to 33.6 percent. The share of the poor among households with a domestic migrant would have risen to about 46 percent, and for households with an international migrant poverty would have increased to 35 percent. Inequality would remain virtually unchanged. The consumption expenditure of households without a migrant would remain unaffected, while the average consumption of households with domestic or international migrants would fall.

In the second scenario the values of our two instruments are adjusted such that the aggregate proportions of domestic and international migrants are the same in 2004 as they were in 1995. This simulation results in higher overall poverty (a change from 30.0 to 31.8 percent), and higher poverty rates both among households with domestic migrants (a change from 22.9 to 30.0 percent) and among those with international migrants (32.8 to 37.2 percent). Inequality would decline. We can decompose the change in poverty between 1995 and 2004 into 3 components. These components represent the contributions of the changes in domestic and international migration (non-migrant households sending a migrant) to the total poverty change,

[13]The three groups of households in Table 5 are defined based on their observed (actual) household migration outcome. For example, the poverty rate for households without migrants remains unchanged between actual and no migration scenarios. The counterfactual poverty rate of 30.5 percent should be interpreted as the poverty rate for households without migrants in the observed state. At the same time, the poverty rate for a group of households with a migrant within Nepal increased from 22.4 to 45.6 percent, which shows the change in poverty status for households from this group under the counterfactual scenario when all migrants stay home.

and the interaction component. This decomposition demonstrates that the growth in international migration between 1995 and 2004 decreased the total poverty by 1.2 percentage points, while the growth in internal migration and the interaction component are responsible for a 0.6 percentage point reduction in poverty in Nepal.

The last two columns of Table 5 present the results of simulations for the hypothetical scenarios of a 10-percentage point growth in the levels of domestic and international migration. These simulations are based on implicit assumptions that this growth is caused by a decrease in the cost of migration and that the average amount of remittances a migrant sends home remains constant. Both scenarios lead to lower overall poverty rates, but the impact of the increase in domestic migration is larger. Poverty in Nepal would be reduced by 2.4 percentage points if domestic migration were 10 percent higher, and poverty would decline by 0.5 percentage points if international migration were 10 percentage points higher. Both scenarios lead to rising inequality.

The important conclusion that emerges from these simulations is that the elasticity of poverty reduction in Nepal over the past decade is significantly higher for domestic migration than it is for international migration. One explanation for the different effects of domestic and international migration could be that remittances derived from work in foreign countries are more likely to be invested in productive assets and real estate. This is often attributed to the notion that households receiving international remittances tend to treat such funds as positive transitory income shocks that should be invested. Local remittances are treated as a mixture of transitory and permanent income and are more often used for consumption (Alderman 1996;). At the same time, the surge of investment in housing that creates new employment opportunities for the local labor force could have a positive impact on local poverty rates (Adams 1998). Our estimation strategy overlooks such effects. It is not clear whether our results would hold if the general equilibrium consequences of changes in migration and remittances were taken into account.

In attempts to disentangle heterogeneity in the impact of migration and remittances on poverty, we simulate poverty rates for different types of households (Table 6). Households with a migrant living in other urban areas of Nepal and in rural western Terai experienced the most significant boost in consumption. Dalit households appear to gain less from sending their members to work in other regions of Nepal or abroad. Relative to the counterfactual scenario of no migration, landless (probably urban) households or those owning large land plots seem to benefit more from migration.

With an estimated increase in poverty of 3.6 percentage points, based on the counterfactual of no migration, the impact of changes in migration for work (together with associated remittances) in Nepal is somewhat lower than the impacts for other countries, even though most of these studies estimate the impact of remittances only. Adams (2005) attributes the effect of remittances to 5 percentage points of poverty reduction in Ghana, 6 percentage points in Bangladesh, and 11 percentage points in Uganda. Completely removing remittances would raise poverty rates by 8 percent points in Lesotho, while the poverty rate in poor areas of China would increase by 1 percentage point in the absence of migration and remittances (Du, Park, and Wang 2005). On a macro level, Adams and Page (2003) estimate the remittance elasticity of poverty to be of around -0.35. Our model predicts a slightly higher elasticity of -0.51.

2.5.2 Sensitivity Analysis and Caveats

Our main empirical specification relies on stringent assumptions that limit our estimation sample and restrict the set of variables included in the model. In this section we demonstrate how our results would change if these assumptions are relaxed[14].

The comparison of the main simulation results with simulations under an assumption of

[14]The simulated results for inequality and mean consumption expenditures for these specifications are available from the authors on request. The results of FIML estimations of the system of equations (2.2)-(2.4) under different specifications are shown in Appendix.

a joint independence of the error terms in equations (2.2)-(2.4) (simulation 1 in Table 7) reveals a systematic relationship between the decision to migrate and the level of household consumption, which is not accounted for by observed household characteristics. The differences in the returns on unobserved characteristics of households with a migrant between the actual and counterfactual scenarios account for more than 60 percent of the impact that work-related migration and remittances have on aggregate poverty rates. This indicates significant self-selection on unobservable characteristics that provide higher returns to the households if one of their members migrates.

We simulate the counterfactual distribution of consumption using a specification that includes remittance amounts in a set of explanatory variables. The results of this estimation are biased because remittances could be endogenous to consumption and are most likely badly measured in our data. Nevertheless, the magnitudes of the estimated effects of migration and remittances are similar for this and our preferred specification. Under the counterfactual of no migration, the poverty rate increases by 4.5 percentage points versus 3.6 percentage points in the preferred specification. For the 1995-96 scenario, the simulated changes in poverty rates based on a specification that includes remittance amounts are equal to 1.4 percentage points, while the preferred specification predicts about a 1.9 percentage point change in poverty. The simulated poverty rates under the specification where the amount of remittances is instrumented with the age of a migrant are very close to the poverty rates obtained from uninstrumented specification.

We next compare our main results with the simulations based on an unrestricted sample. We find that including the previously excluded households in our estimation (that is, those without men of working age and those consisting only of single men) increases the poverty rates in the counterfactual scenarios. Overall, however, the poverty impact of migration for the unrestricted sample is consistent with our main results.

We test the sensitivity of our results for the alternative classification where migrants to India are categorized as domestic migrants. The concern here is that characteristics of migrants to India could be similar to the characteristics of domestic migrants. Such migrants predominantly come from the rural Terai region of Nepal and are usually involved in agricultural or manual labor for low wages (Bhattrai 2007). At the same time, Nepalese working in Arab countries in the Gulf and the Far East are educated, employed in the better paying jobs, and can send more money home. Hence, combining households with migrants from India with those from other countries potentially underestimates the impact of international migration.

The comparison of simulations based on this categorization with those based on the preferred specification results in relatively small differences in the simulated poverty rates. The increase in the poverty rate under the scenario of no migration is smaller (2.8 percentage points) compared with the increase in poverty simulated with the preferred specification (3.6 percentage points). The scenario using 1995/96 levels of migration resulted in a 1.8 percentage point increase in poverty in the specification reclassifying Indian migrants versus a 1.9 percentage point increase using the specification classifying migrants to India as international migrants.

Finally, we estimate our model for alternative measures of household welfare such as household income and non-durable consumption expenditure. This would allow us to compare our results with the results of other papers that often use these measures of household wellbeing. Moreover, one might argue that a household with a migrant will behave as a household without one member in terms of consumption of non-durables (once controlling for observed and unobserved characteristics) while behaving as a complete household in terms of consumption of durables, because they expect the migrant to return. Table A6 in Appendix presents the results of simulations based on these alternative measures. The simulated changes in non-durable per capita expenditure for different migration scenarios are similar to the simulated changes in total per capita expenditure. The simulations based on household income are similar to the simulations based on preferred specification for all households. For households with a migrant abroad, the decrease in income is larger than the decrease in per capita expenditure in the scenarios of no migration and migration at the level of 1995/96. However, these differences could be driven to a large degree by the misreporting of income.

There are several qualifications to and possible caveats on our results. First, our results are obtained using the 2004 cross-sectional data. We have no instruments to control for possible household- or community-level endogeneity. In this sense, our estimations of the impact of work-related migration are valid only to the extent that unobserved family and community characteristics are captured by the variables included in our empirical specification.

Second, our analysis focuses only on the direct impact of migration and remittances on households with a migrant. Migration and remittances improve the welfare of households in the sending communities by stimulating local economic development. Migrants channel remittances into productive investment at home. Even when some households spend most of the remittances on current consumption, the resulting demand for goods and services can be met by other working adults in the community, thus generating strong positive externalities. We argue that our estimates provide lower bounds on the actual impact of migration for work and remittances on poverty in Nepal. Taking into account the general equilibrium consequences of work-related migration would demonstrate an even larger impact on living standards of Nepal.

2.6 Conclusions

This paper attempts to explain the role of migration and remittances in reducing poverty in Nepal between 1995 and 2003. We compared the observed poverty and inequality rates with the rates calculated under counterfactual scenarios. To construct these counterfactuals we estimated the model of household consumption expenditure identifying observed and unobserved differences in the returns on household characteristics based on migration status.

The results of our simulations show that almost 20 percent of the decline in poverty in Nepal between 1995 and 2004 can be attributed to increased work-related migration and the resulting remittances sent back home. In the absence of migration, the poverty rate in Nepal would increase from the currently observed 30.0 percent to 33.6 percent, and the mean per capita expenditure would decline from 15,000 to 14,000 NPR. Almost 58 percent of the aggregate increase in poverty could be accounted for by a higher number of the would-be poor among households with members who migrated internationally. Migration and remittances have only a marginal impact on income inequality in Nepal.

Migration and remittances have a strong impact on the living conditions of households with a migrant. The poverty rate among households with a member who migrates within Nepal would be twice as high as current levels if the migrant had stayed home. The poverty rate for households with a migrant working abroad would also be substantially higher had their members not migrated.

Our findings have important implications for public policy. They emphasize the role of migration for work and remittance inflows in raising the living standards of recipient families and reducing aggregate poverty in Nepal. Hence, strategies for economic growth and poverty reduction in Nepal should incorporate various aspects of the migration dynamics. Our results demonstrate that policies promoting both domestic migration and the export of labor–if such export were accompanied by remittances–could also have an important effect on poverty reduction in Nepal. Given that Nepal has such a plentiful supply of labor, migration for work provides employment and earning opportunities for a significant segment of the labor force. Unless the labor market situation changes dramatically, increasing numbers of Nepali men and women will seek job opportunities outside Nepal; migration and remittances could be expected to play even a greater role in the future economic development of the country.

Table 1: Percent of households receiving remittances by regions of Nepal and total

	Receive remittances from Nepal		Receive remittances from abroad		Receive any remittances	
	1995/96	2003/04	1995/96	2003/04	1995/96	2003/04
Regions						
Kathmandu	14.3	7.8	3.6	5.7	17.9	13.5
Other urban areas	13.1	17.1	6.0	14.3	19.2	31.3
Rural West mount/hills	10.6	11.1	19.6	29.4	30.2	40.4
Rural Eastern mount/hills	11.1	16.9	2.0	9.3	13.1	26.2
Rural western Terai	12.0	12.6	10.6	19.2	22.6	31.8
Rural eastern Terai	14.7	14.6	11.0	18.1	25.7	32.7
Land holdings a year ago.						
No farm plot	11.3	14.8	10.2	13.2	21.4	28.0
Farm plot < 0.5 ha	13.1	14.3	11.7	18.5	24.7	32.8
Farm plot 0.5-1 ha	11.7	11.7	10.7	20.0	22.5	31.8
Farm plot: 1-2 ha	12.8	13.7	11.4	17.5	24.2	31.2
Farm plot > 2 ha	11.9	17.3	6.2	18.3	18.1	35.6
Caste						
Brahman\Chhetri	13.4	15.8	11.1	19.9	24.5	35.7
Dalit	12.0	9.8	15.1	24.7	27.0	34.5
Newar	13.2	14.3	3.6	7.8	16.8	22.1
Terai-Hill Janajatis	9.8	14.6	9.4	15.4	19.2	30.0
Muslim\Other Minorities	13.1	12.1	11.4	18.3	24.4	30.3
Total	12.3	13.9	10.6	17.7	23.0	31.6

Table 2: Summary statistics of main explanatory variables for migrant and non-migrant households, 2004 cross-section

	Non-Migrant households		Domestic migrant households		International migrant household	
	Mean	*Std. Err.*	Mean	*Std. Err.*	Mean	*Std. Err.*
Household per capita expenditure x10^5	1.640	*0.036*	1.755	*0.069*	1.606	*0.067*
Household Demographic (before migration)						
Household size	5.683	*0.050*	5.803	*0.114*	6.491	*0.107*
Share of children age 0-3	0.092	*0.002*	0.066	*0.004*	0.091	*0.004*
Share of children age 4-7	0.101	*0.003*	0.062	*0.004*	0.099	*0.005*
Share of children age 8-15	0.192	*0.004*	0.149	*0.007*	0.163	*0.006*
Share of adult men 16-64	0.031	*0.002*	0.080	*0.007*	0.040	*0.004*
Share of women 16-64	0.286	*0.003*	0.279	*0.006*	0.279	*0.004*
Share of elderly age 65+	0.298	*0.003*	0.364	*0.007*	0.328	*0.006*
Number of married couples	1.314	*0.014*	1.205	*0.034*	1.491	*0.034*
Maximum education of women	1.011	*0.027*	1.035	*0.057*	1.052	*0.052*
Ethnicity						
Brahman/Chhetri	0.290	*0.009*	0.356	*0.021*	0.349	*0.019*
Dalit	0.073	*0.005*	0.058	*0.010*	0.113	*0.013*
Newar	0.086	*0.006*	0.076	*0.012*	0.032	*0.007*
Terai-Hill Janajatis	0.273	*0.009*	0.283	*0.020*	0.233	*0.017*
Muslim \ Other Minorities	0.279	*0.009*	0.227	*0.018*	0.273	*0.018*
Land holdings a year ago						
Landless households	0.246	*0.009*	0.232	*0.018*	0.174	*0.015*
Farm plot < 0.5 hectares	0.366	*0.010*	0.374	*0.021*	0.402	*0.019*
Farm plot: 0.5-1 hectares	0.211	*0.008*	0.190	*0.017*	0.224	*0.017*
Farm plot 1-2 hectares	0.121	*0.007*	0.131	*0.015*	0.141	*0.014*
Farm plot > 2 hectares	0.056	*0.005*	0.073	*0.011*	0.059	*0.009*
Lagged durable asset index						
No assets	0.397	*0.010*	0.409	*0.022*	0.431	*0.020*
Asset poor (1 – 33^{th} percentile)	0.222	*0.008*	0.246	*0.019*	0.212	*0.016*
(33^{th} - 66^{th} percentile)	0.209	*0.008*	0.216	*0.018*	0.212	*0.016*
Asset rich (66^{th} - 100^{th} percentile)	0.172	*0.008*	0.129	*0.015*	0.144	*0.014*
Geography dummies						
Katmandu	0.075	*0.005*	0.034	*0.008*	0.018	*0.005*
Other urban areas	0.107	*0.006*	0.128	*0.015*	0.084	*0.011*
Rural Western mountains/hills	0.172	*0.008*	0.170	*0.016*	0.359	*0.019*
Rural Eastern mountains/hills	0.226	*0.008*	0.260	*0.019*	0.111	*0.012*
Rural Western Terai	0.142	*0.007*	0.127	*0.015*	0.148	*0.014*
Rural Eastern Terai	0.278	*0.009*	0.281	*0.020*	0.280	*0.018*
Log Distance to market center	2.095	*0.028*	2.024	*0.057*	2.220	*0.048*
Per capita pension transfers	0.389	*0.050*	0.345	*0.094*	0.655	*0.116*
Ward level variables						
% illiterate, among age 15+	0.560	*0.004*	0.542	*0.009*	0.569	*0.009*
% literate or 1-4 years of education	0.180	*0.002*	0.191	*0.005*	0.187	*0.005*
% completed 5-7 years of education	0.108	*0.001*	0.114	*0.003*	0.114	*0.003*
% employed in wage job	0.145	*0.003*	0.127	*0.005*	0.141	*0.005*
% self employed	0.462	*0.005*	0.492	*0.010*	0.482	*0.009*
Average log expenditure	8.896	*0.007*	8.897	*0.014*	8.826	*0.013*
Gini coefficient	0.312	*0.001*	0.312	*0.003*	0.304	*0.003*
Casualties from conflict, district level	0.565	*0.014*	0.522	*0.023*	0.611	*0.027*
Number of Observations	2,464		523		633	

Table 3: FIML estimation of the migration choice part of the system (1-3)

Base category: No Migration	**Domestic Migration**		**International Migration**	
	Coefficient	*Std. Error*	Coefficient	*Std. Error*
Share of domestic migrants in district, 1995	1.059***	*0.343*	-0.418	*0.423*
Share of international migrants in a ward, 2001	0.165	*0.250*	1.267***	*0.268*
Household Demographics (before migration)				
Household size	0.158***	*0.017*	0.127***	*0.017*
Share of children 0-3: *Omitted variable*				
Share of children 4-7	-0.192	*0.364*	0.162	*0.318*
Share of children 8-15	-0.058	*0.276*	-0.416	*0.260*
Share of men 16-64	1.156***	*0.352*	0.236	*0.347*
Share of women 16-64	1.996***	*0.299*	1.312***	*0.306*
Share of elderly	2.952***	*0.355*	0.932**	*0.368*
Number of married couples	-0.379***	*0.056*	-0.089*	*0.049*
Maximum education of women in the household	0.005	*0.027*	0.024	*0.027*
Ethnicity: Reference Category: Brahman \ Chhetri				
Dalit	-0.268**	*0.120*	0.021	*0.114*
Newar	-0.244*	*0.133*	-0.452***	*0.141*
Terai-Hill Janajatis	-0.161**	*0.072*	-0.107	*0.087*
Muslim \ Other Minorities	-0.281***	*0.098*	-0.103	*0.095*
Land holdings a year ago: Reference Category: No farm plot				
Farm plot < 0.5 ha	-0.061	*0.076*	0.037	*0.079*
Farm plot 0.5-1 ha	-0.247**	*0.103*	-0.100	*0.098*
Farm plot: 1-2 ha	-0.144	*0.113*	-0.029	*0.111*
Farm plot > 2 ha	-0.156	*0.137*	-0.192	*0.143*
Lagged durable asset index: Reference Category: No durables				
Asset poor (1 – 33th percentile)	0.057	*0.069*	-0.135**	*0.068*
(33th - 66th percentile)	-0.056	*0.073*	-0.141*	*0.076*
Asset rich (66th – 100th percentile)	-0.324***	*0.097*	-0.139	*0.091*
Total pensions per capita	-0.015	*0.013*	0.016**	*0.008*
Geography dummies: Reference Category: Katmandu				
Other urban areas	0.702***	*0.167*	0.565***	*0.165*
Rural west mount/hills	0.563**	*0.229*	1.042***	*0.239*
Rural eastern mount/hills	0.574***	*0.198*	0.479**	*0.210*
Rural western Terai	0.655***	*0.225*	0.739***	*0.229*
Rural eastern Terai	0.807***	*0.196*	0.838***	*0.201*
Log of distance to market center	-0.041	*0.031*	-0.015	*0.029*
Ward level variables				
% illiterate, among age 15+	-0.544	*0.396*	0.029	*0.422*
% literate or 1-4 years of education	-0.556	*0.594*	0.416	*0.536*
% completed 5-7 years of education	-0.197	*0.610*	0.405	*0.577*
% employed in wage job	-0.053	*0.391*	0.481	*0.451*
% self employed	0.549**	*0.250*	-0.031	*0.332*
Log of average household expenditure, 1995	0.063	*0.135*	0.131	*0.139*
Gini coefficient, 1995	0.022	*0.584*	-0.914	*0.622*
Casualties from conflict, district level	-0.024	*0.060*	-0.036	*0.056*
Constant	-3.170**	*1.325*	-3.553***	*1.345*
Number of observations		3620		
Log-Likelihood		-4,264.00		

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table 4: FIML estimation of expenditure equations of the system (1-3)

	Domestic Migration		**International Migration**		**No Migration**	
	Coeff.	*Std.Err.*	Coeff.	*Std.Err.*	Coeff.	*Std.Err*
Household Demographics (before migration)						
Household size	-0.120***	*0.015*	-0.101***	*0.028*	-0.074***	*0.008*
Share of children 0-3: *Omitted variable*						
Share of children 4-7	0.319*	*0.189*	0.137	*0.147*	0.175	*0.109*
Share of children 8-15	0.278*	*0.144*	0.613***	*0.133*	0.359***	*0.072*
Share of men 16-64	0.161	*0.182*	0.386	*0.256*	0.228**	*0.103*
Share of women 16-64	0.272*	*0.154*	0.493	*0.344*	0.747***	*0.105*
Share of elderly	-0.180	*0.184*	0.222	*0.377*	0.260*	*0.148*
Number of married couples	0.150***	*0.044*	0.081*	*0.046*	0.067***	*0.018*
Maximum education of women	0.034**	*0.017*	0.081***	*0.015*	0.086***	*0.007*
Ethnicity: Reference Category: Brahman \ Chhetri						
Dalit	-0.151*	*0.086*	-0.233***	*0.065*	-0.170***	*0.038*
Newar	0.049	*0.070*	0.074	*0.120*	-0.002	*0.029*
Terai-Hill Janajatis	-0.075	*0.054*	-0.125***	*0.047*	-0.217***	*0.026*
Muslim \ Other Minorities	0.024	*0.068*	-0.151**	*0.064*	-0.132***	*0.031*
Land holdings a year ago: Reference Category: No farm plot						
Farm plot < 0.5 ha	-0.003	*0.053*	0.007	*0.053*	0.062**	*0.024*
Farm plot 0.5-1 ha	0.215***	*0.065*	0.055	*0.065*	0.143***	*0.030*
Farm plot: 1-2 ha	0.181***	*0.069*	0.120*	*0.067*	0.206***	*0.031*
Farm plot > 2 ha	0.266***	*0.086*	0.320***	*0.070*	0.330***	*0.041*
Lagged durable asset index: Reference Category: No durables						
Asset poor (1 – 33th percentile)	0.053	*0.049*	0.070	*0.055*	0.004	*0.020*
(33th - 66th percentile)	0.175***	*0.051*	0.185***	*0.054*	0.167***	*0.022*
Asset rich (66th - 100th percentile)	0.558***	*0.064*	0.518***	*0.079*	0.491***	*0.028*
Total pensions per capita	0.019**	*0.007*	0.022***	*0.005*	0.015***	*0.003*
Geography dummies: Reference Category: Katmandu						
Other urban areas	-0.103	*0.104*	-0.044	*0.193*	0.195***	*0.047*
Rural west mount/hills	-0.063	*0.134*	-0.284	*0.270*	0.241***	*0.075*
Rural eastern mount/hills	-0.102	*0.126*	-0.225	*0.175*	0.114**	*0.054*
Rural western Terai	0.039	*0.134*	-0.199	*0.212*	0.218***	*0.060*
Rural eastern Terai	-0.071	*0.133*	0.003	*0.218*	0.299***	*0.059*
Log of distance to market center	-0.024	*0.022*	-0.017	*0.017*	-0.023**	*0.010*
Ward level variables						
% illiterate, among age 15+	-0.250	*0.225*	-0.239	*0.220*	-0.369***	*0.116*
% literate or 1-4 years of education	0.029	*0.314*	-0.354	*0.448*	-0.115	*0.182*
% completed 5-7 years of education	0.516	*0.392*	-0.329	*0.380*	-0.603***	*0.200*
% employed in wage job	0.099	*0.330*	-0.080	*0.213*	-0.117	*0.147*
% self employed	-0.333**	*0.154*	-0.144	*0.143*	-0.223**	*0.093*
Log of average hh expenditure, 1995	0.148*	*0.076*	0.261***	*0.077*	0.320***	*0.041*
Gini coefficient, 1995	0.340	*0.287*	0.212	*0.345*	0.052	*0.212*
Casualties from conflict, district level	0.081**	*0.039*	0.027	*0.034*	-0.010	*0.021*
Constant	-0.504	*0.743*	-1.757	*1.181*	-2.782***	*0.390*
Number of observations			3,620			
Log-Likelihood			-4,264.00			

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table 5: Simulated levels of expenditure, poverty and inequality rates for different migration scenarios.

Migration scenarios	Actual	No migration	Level of migration as of 1995/96	+10% point increase in domestic migration	+10% point increase in international migration
Household types			*Poverty rate (%)*		
All Households	**30.0**	**33.6***	**31.8***	**27.6****	**29.5**
Households with no migrants	30.6	30.6	30.6	27.6**	29.3
Households with migrants within Nepal	22.9	46.3**	30.0**	22.9	25.5
Households with migrants abroad	32.8	34.9	37.2	30.7	32.8
			Average expenditure, NRP 10,000's		
All Households	**1.493**	**1.405***	**1.446***	**1.561***	**1.515**
Households with no migrants	1.493	1.493	1.493	1.585*	1.536
Households with migrants within Nepal	1.576	1.087**	1.401**	1.576	1.527
Households with migrants abroad	1.441	1.341	1.328	1.478	1.441
			Inequality rate (Gini)		
All Households	**0.409**	**0.405**	**0.407**	**0.412**	**0.412**

Note: Shaded cells indicate that the poverty rates and average expenditure of these households are not affected by the simulated policy changes.
* indicates that the difference between the actual and simulated values is statistically significant at least 5 percent level. The significance tests are calculated taking into account clustering at a ward level.

Table 6: Simulated changes in predicted per capita consumption for different counterfactual scenarios by household characteristics (NPR 10,000)

	Expected consumption				
Conditional on:	**Actual**	**No migration**	**Level of migration as of 1995/96**	**+10% point increase in domestic migration**	**+10% point increase in international migration**
Ethnicity					
Brahman/Chhetri	1.850	1.752	1.796	1.934	1.872
Dalit	1.052	1.033	1.030	1.088	1.059
Newar	2.670	2.557	2.611	2.770	2.696
Terai-Hill Janajatis	1.174	1.068	1.123	1.232	1.205
Muslim \ Other Minorities	1.254	1.182	1.213	1.316	1.269
Land holdings a year ago					
Landless households	1.862	1.737	1.804	1.937	1.891
Farm plot < 1 ha	1.296	1.224	1.255	1.362	1.314
Farm plot: 1-2 ha	1.549	1.465	1.501	1.619	1.571
Farm plot > 2 ha	1.876	1.762	1.810	1.943	1.912
Lagged durable asset index					
No Assets	1.021	0.963	0.989	1.068	1.035
Asset poor (1 - 33th percentile)	1.076	0.988	1.035	1.142	1.093
(33th - 66th percentile)	1.471	1.380	1.422	1.550	1.491
Asset rich (66th - 100th)	3.104	2.949	3.015	3.210	3.157
Geography dummies					
Katmandu	3.495	3.334	3.418	3.591	3.541
Other urban areas	2.476	2.291	2.391	2.572	2.527
Rural western mount/hills	1.187	1.154	1.157	1.241	1.203
Rural eastern mount/hills	1.137	1.064	1.105	1.196	1.150
Rural western Terai	1.269	1.177	1.223	1.368	1.280
Rural eastern Terai	1.388	1.300	1.336	1.443	1.414
Total	1.493	1.405	1.446	1.561	1.515

Table 7: Simulated changes in poverty rates in four migration scenarios estimated under the different assumption.

Migration scenarios	Actual	No Migration	Level of migration as in 1995-96	+10% point increase in domestic migration	+10% point increase in international migration
			Poverty rate (%)		
Preferred specification (from Table 5)	**30.0**	**33.6**	**31.9**	**27.3**	**29.5**
Alternative specifications					
Assuming independence of error terms in (1-3) [Tables A3.1 and A4.1]	30.1	31.1	30.8	29.9	30.1
Including amounts of remittances (not instrumented) [Tables A3.2 and A4.2]	29.0	33.5	30.4	26.9	29.4
Including amounts of remittances instrumented by age of a sender [Tables A3.3 and A4.3]	29.5	33.6	30.5	27.2	29.0
Unrestricted Sample (3,874 households) [Tables A3.4 and A4.4]	30.0	34.3	32.0	28.0	29.2
Treating India as domestic destination [Table A3.5 and A4.5]	29.9	32.7	31.7	28.4	27.2
Assuming equal returns in 3 states of migration in consumption equations [Table A3.6 and A4.6]	30.1	35.8	31.6	28.3	30.8

Note: that the "actual" poverty rates are simulations based on the model with the initial values of instrumental variables. So, the alternative specifications produce different poverty rates for the simulated "actual" scenario.

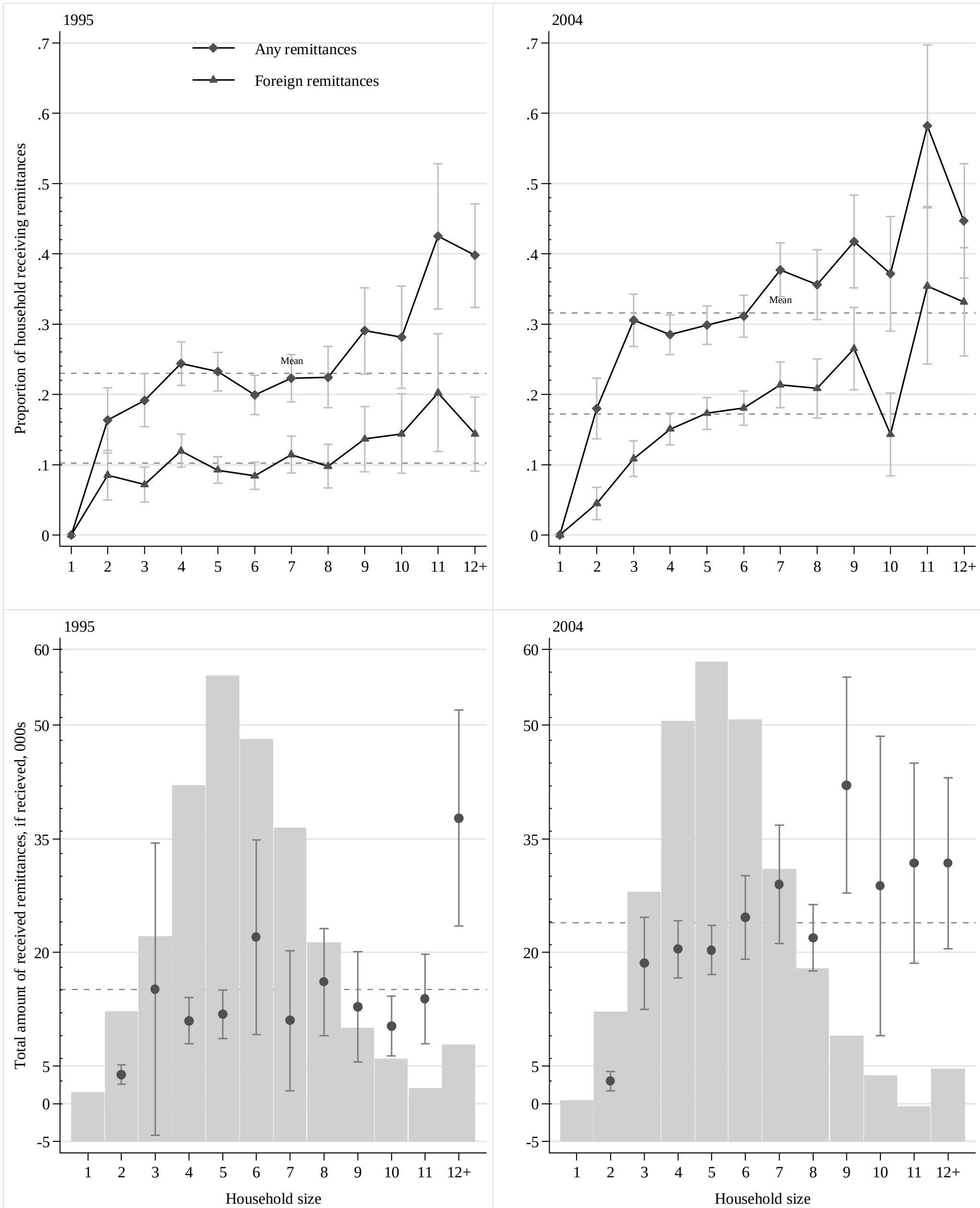

Figure 1: Incidence of migration and amount of remittances by the household size. Whiskers indicate 95% confidence intervals for the means. Histogram of the household size on the background of the lower two panels. NLSS 1995 and 2004

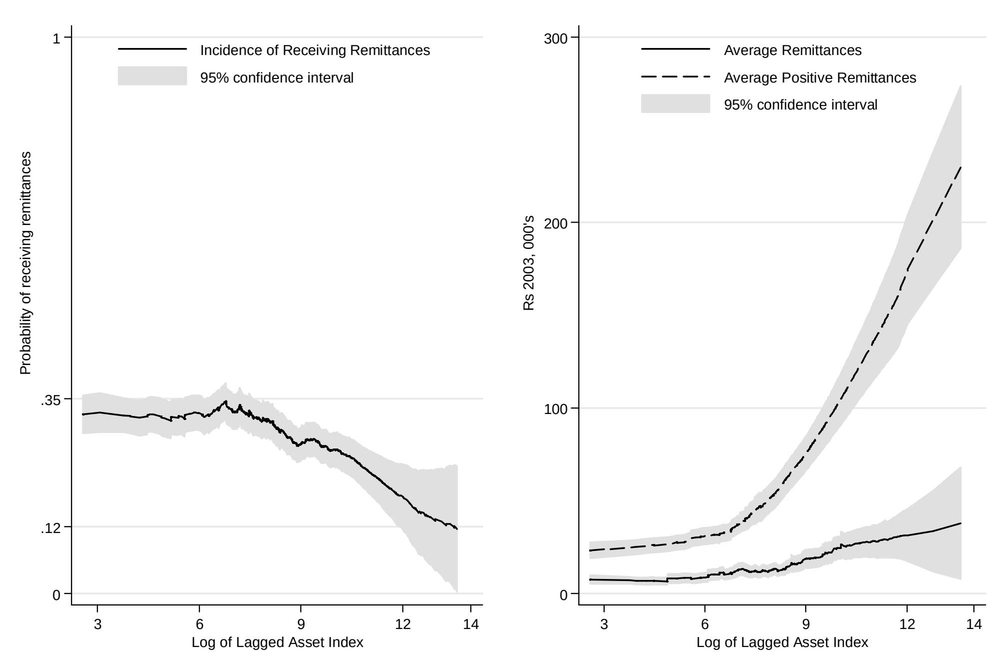

Figure 2: Non-parametric regression of the incidence of migration and amount of remittances by lagged asset index, NLSS 2004

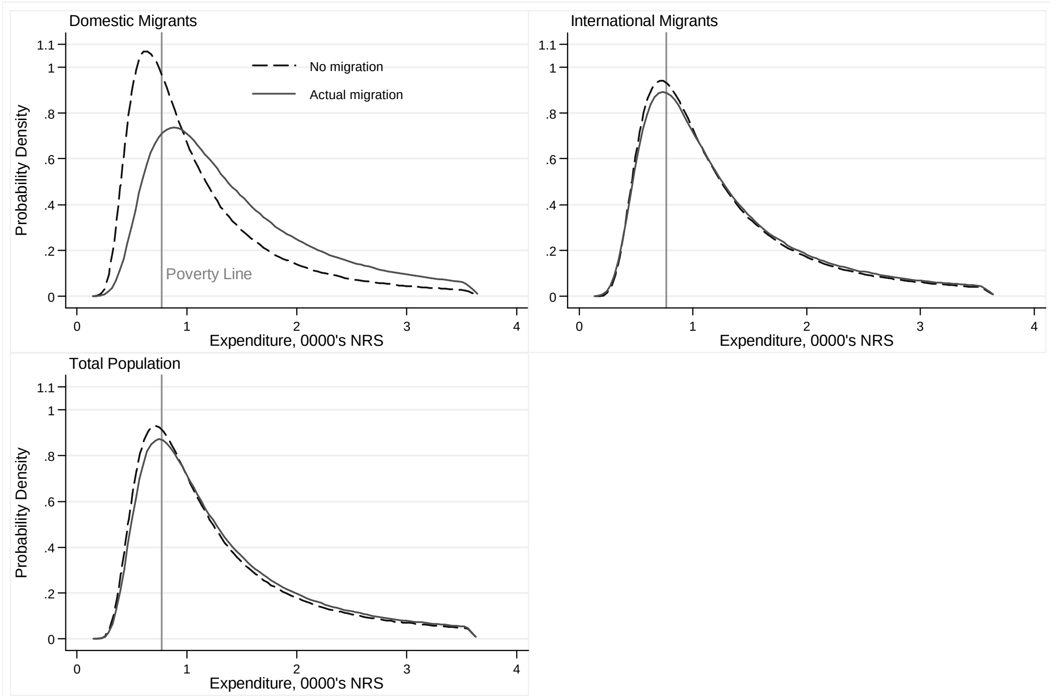

Figure 3: Simulated distributions of per capita household expenditure in the scenarios of the actual and of no migration by household migration status.

Appendix

The Likelihood function The condition (2.3) could be expressed in terms of value functions representing the pair-wise differences of utility functions (2.2). Define:

$$V_{i1} = U_{i1} - U_{i3} = Z_i(\gamma_1 - \gamma_3) + (\eta_1 - \eta_3) = Z_i\phi_1 + \epsilon_{i1} \tag{2.5}$$

$$V_{i2} = U_{i2} - U_{i3} = Z_i(\gamma_2 - \gamma_3) + (\eta_2 - \eta_3) = Z_i\phi_2 + \epsilon_{i2} \tag{2.6}$$

where $\phi_{1,2}$ are the unknown parameters and $\epsilon_{i1,2}$ are i.i.d. error terms. Migration choices and corresponding consumption outcome are observed if:

$$\text{State=1 if} \quad V_{i1} > V_{i2}, V_{i1} > 0 \qquad \Rightarrow \; C_{i1} = X_i\beta_1 + \mu_{i1} \tag{2.7}$$

$$\text{State=2 if} \quad V_{i2} > V_{i1}, V_{i2} > 0 \qquad \Rightarrow \; C_{i2} = X_i\beta_2 + \mu_{i2} \tag{2.8}$$

$$\text{State=3 if} \quad V_{i1} < 0, V_{i2} < 0 \qquad \Rightarrow \; C_{i2} = X_i\beta_3 + \mu_{i3} \tag{2.9}$$

Assume that all the random variables in the model are distributed as five-variate normal, with the following variance-covariance matrix.

$$f(\epsilon_1, \epsilon_2, \mu_1, \mu_2, \mu_3) = N(0, \Omega); \;\; \Omega = \begin{pmatrix} 1 & \alpha & \sigma_{11} & \sigma_{12} & \sigma_{13} \\ & 1 & \sigma_{21} & \sigma_{22} & \sigma_{23} \\ & & s_{11} & s_{12} & s_{13} \\ & & & s_{22} & s_{23} \\ & & & & s_{33} \end{pmatrix} \tag{2.10}$$

where α is a covariance between ϵ_1 and ϵ_1; σ's are covariances between ϵ_1, ϵ_2 and consumption error terms μ_1, μ_2, μ_3; and s's are covariances between μ_1, μ_2, μ_3. For identification, both variances of the errors in (2.1) are normalized to 1. The covariances $s12$, $s13$, and $s23$ are not estimated as we never observe a household's consumption simultaneously in two distinct migration states.

The probability of observing a particular consumption outcome at a certain migration state can be decomposed into the product of conditional and unconditional probabilities:

$$L_i^k = P(\text{State} = k, C_{ik} = X\beta_k + \mu_{ik} = P(\text{State} = k|\mu_{ik})P(\mu_{ik}) \tag{2.11}$$

The unconditional part of (2.11) is the univariate normal density. After rescaling:

$$P(\mu_{ik} = C_{ik} - X\beta_{ik}) = \phi(\frac{C_{ik} - X_i\beta_k}{s_{kk}}) \tag{2.12}$$

where ϕ is standard normal density function. The conditional part of (2.11), for example for a household choosing state 1, can be expressed as:

$$\begin{aligned} P(\text{State} = 1|\mu_{i1}) = P(V_{i1} - V_{i2} > 0, V_{i2} > 0|\mu_{i1}) = \\ |\text{Substituting: } \eta_{i1}^1 = \epsilon_2 - \epsilon_1, \eta_{i2}^1 = -\epsilon_{i1}| = P(\eta_{i1}^1 < Z_i\phi_1 - Z_i\phi_2, \eta_{i2}^1 < Z\phi_{i1}|\mu_1) \end{aligned} \tag{2.13}$$

where η_{i1}^1 and η_{i2}^1 are distributed as:

$$f(\eta_1, \eta_2|\mu_1) = N\left(\begin{pmatrix} \frac{(\sigma_{21}-\sigma_{11})\mu_1}{s11} \\ \frac{-\sigma_{11}\mu_1}{s11} \end{pmatrix}, \begin{pmatrix} 2 - 2\alpha - \frac{(\sigma_{21}-\sigma_{11})^2}{s_{11}} & 1 - \alpha + \frac{\sigma_{11}(\sigma_{21}-\sigma_{11})}{s_{11}} \\ & 1 - \frac{\sigma_{11}^2}{s_{11}} \end{pmatrix}\right) \tag{2.14}$$

After normalization

$$\tilde{\eta}_{i1}^1 = \frac{\eta_{i1}^1 - E(\eta_{i1}^1)}{\sqrt{V(\eta_{i1}^1)}}, \tilde{\eta}_{i2}^1 = \frac{\eta_{i2}^1 - E(\eta_{i2}^1)}{\sqrt{V(\eta_{i2}^1)}}, \rho_1 = Cov(\tilde{\eta}_{i1}^1, \tilde{\eta}_{i2}^1) \tag{2.15}$$

(2.14) can be expressed as a standard bivariate normal:

$$P(\text{State} = 1|\mu_{i1}) = \Phi(\tilde{\eta}_{i1}^1, \tilde{\eta}_{i2}^1, \rho_1) \tag{2.16}$$

Then, a contribution to the likelihood function of the observation i in State k is:

$$L_i^k = \Phi(\tilde{\eta}_{i1}^k, \tilde{\eta}_{i2}^k, \rho_k)\phi(\frac{\mu_{ik}}{s_{kk}}), \ \ k = 1, 2, 3 \tag{2.17}$$

However, (2.16) and (2.17) are different in every state. Log likelihood is formed as the sum of individual log-likelihoods (2.17) over all observations and all states:

$$L = \sum_i \sum_k \ln L_i^k I(\text{State} = k), \ \ i = 1, 2, \ldots, N, k = 1, 2, 3 \tag{2.18}$$

where I is an indicator function for a migration state. To improve the fit of our estimation we use the Box-Cox transformation of the continuous dependent variables in our model (Heckman and Sedlacek 1990). The "Box-Cox parameter" λ=-0.4 provides best fit in terms of minimization of the sum of square residuals of the continuous part of the model. The log-likelihood function (2.18) is maximized using a standard Newton-Raphson algorithm of Maximum Likelihood procedure in Stata. The maximization routine relies on analytical gradient and analytical Hessian that we programmed to improve convergence properties and speed of the estimation. The performance of maximization algorithm is crucial for the jackknife simulations we conduct in the paper.

Simulation techniques In the simulations, we keep the characteristics of the household at 2004 level, while changing the level of migration to match a particular scenario. For example, when predicting the poverty rates at the level of migration in 1995 we, given the estimated parameters in 2004, change the constant of the regression of migration to match the probability of migration domestically and the probability of migration internationally in 1995. Then we draw randomly the errors from the 5-error distribution estimated in 2004, to estimate the migration decision and the consumption. We use this approach to simulating the counterfactual scenarios because we are interested in the question of what would happen to households in

2004 if the migration levels were different.

We treat household expenditure as a random variable that comes from some distribution the parameters of which we estimate. This random variable is a sum of observed and unobserved components. The observed component is a product of household characteristics and the returns on these characteristics in a particular migration state. The unobserved component is determined by the choice of the migration state according to rules (A.1) and (A.2). We cannot recover the exact value of the unobserved component but can only estimate the parameters of the distribution of that component in each counterfactual state. We need to simulate the distribution of counterfactual expenditures in order to calculate the poverty and inequality measures in various counterfactual scenarios.

To simulate the expenditure distribution for each household in different states of migration we draw error terms ϵ_1, ϵ_2, μ_1, μ_2, μ_3 from unconditional 5-variate normal distribution with the estimated variance-covariance matrix (2.10). In every draw m household i is assigned to a particular migration state s, according to rule (2.5) and (2.7):

$$U_{is} - U_{ij} = \hat{\phi_{sj}} Z_i + \epsilon^m_{i(sj)} > 0; \;\; U_{is} - U_{ik} = \hat{\phi_{sk}} Z_i + \epsilon^m_{i(sk)} > 0 \tag{2.19}$$

where $\phi_{sj,sk}$ are the estimated parameters as in (2.5) and$\epsilon^m_{i(sj),(sk)}$ are the values of the error terms in draw m. The expenditure of household i in draw m is:

$$C^m_{is} = \hat{\beta}_s X_i + \mu^m_{is} \tag{2.20}$$

So, in every draw only migration choice is realized and the counterfactual expenditure derived for that choice. By repeating this process M times for all households in our sample we generate the simulated expenditure distribution in all migrations states. Any distributional statistics could be calculated using this distribution. For example, the simulated poverty rate for households with migrants working outside Nepal in case of no abroad migration is:

$$p^{AM} = \frac{\sum_{m=1}^{M}\sum_{i=1}^{N} I(X_i\hat{\beta}_1 + \mu_{i1}^m < \text{PL}, s_i^m = 3)}{\sum_{m=1}^{M}\sum_{i=1}^{N} I(s_i^m = 3)} \tag{2.21}$$

where N is a total number of households in the sample, PL is the poverty line, and I is an indicator function. The expressions for other measures of poverty and inequality could be derived in a similar way.

The actual calculation of these statistics is more involved as we use a Box-Cox transformation for the household expenditures in our estimation. We apply inverse of a Box-Cox transformation on the last stage of simulation to obtain poverty and inequality measures of a non-transform distribution. The later step is crucial for calculation of the measures of inequality and inequality sensitive poverty measures. The counterfactual poverty rates could be calculated on the transformed distribution as the Box-Cox transformation preserve the expenditure ranking. The confidence intervals for poverty and inequality measures are estimated by the method of jackknife (e.g. Efron 1981). The jackknife estimate of the parameter θ is given by:

$$\hat{\theta}_J = \frac{\sum \hat{\theta_{(i)}}}{n} \tag{2.22}$$

The jackknife estimate of the standard error of $\hat{\theta}_j$ is

$$\hat{\sigma}_{\hat{\theta}_j} = [\frac{n}{n-1}\sum_{i=1}^{n}(\hat{\theta}_{(i)} - \hat{\theta}_J)^2]^{1/2} \tag{2.23}$$

where n is the sample size, and $\hat{\theta_{(1)}}, \hat{\theta_{(2)}}, \ldots, \hat{\theta_{(n)}}$ are the estimates of θ on n subsamples each of size n-1. We draw the jackknife sample from the simulated distribution that accounts for clustered structure of our data.

We repeat the simulation process based on 1000 draws for each jackknife iteration. We were not able to use a bootstrap to calculate the standard errors for our simulations because of the large number of non-convergences of our estimator on the bootstrapped samples. Efron (1981) demonstrates that the jackknife estimates of the standard errors are typically larger than the bootstrap estimates.

Figure A1 demonstrates how well our simulations fit the actual distribution of per capita consumption in the total population and in the subgroups of households with different migration status. Each graph on Figure A1 shows three cumulative distributions. The solid line presents the cumulative distribution of the actual per capita expenditures generated from our sample of 3,620 observations. The consumption distribution that is simulated using the estimated parameters of the system (2.1)-(2.3) and the estimated variance-covariance matrix ((2.10) is shown as a dash line. The counterfactual distribution simulated under scenario of no migration is shown as a dotted line.

Comparing the actual (solid line) and predicted (dash line) distributions for the total population demonstrates a reasonably good fit achieved by our simulations. The number of households with simulated expenditures below the poverty line is almost identical to the actual number of the poor households in our sample. The distribution simulated under scenario of no migration exhibits the first order dominance over the actual distributions. This indicates that relative to the actual consumption distribution the no-migration scenario would result in higher poverty rates regardless of the choice of the poverty line. Similar to results in Table 5, the no migration scenario has a largest negative impact for the consumption of households with domestic migrants.

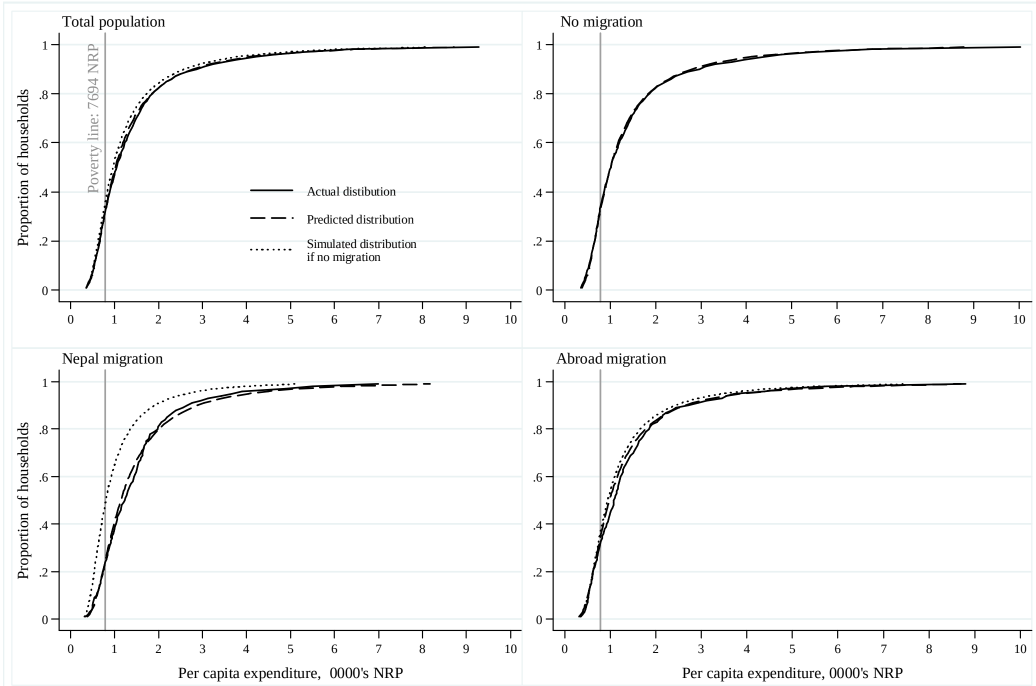

Figure A1: Actual, simulated actual and counterfactual expenditure distribution under scenario of no migration for households with domestic migrants, international migrants, no migrants, and the total population.

Table A3.1: Multinomial probit estimation of the migration choice in the system (2-4)

Base category: No Migration	**Domestic Migration**		**International Migration**	
	Coefficient	*Std. Error*	Coefficient	*Std. Error*
Share of domestic migrants in district, 1995	0.856*	*0.459*	-0.747	*0.582*
Share of international migrants in a ward, 2001	0.191	*0.319*	1.762***	*0.357*
Household Demographics (before migration)				
Household size	0.221***	*0.024*	0.179***	*0.023*
Share of children 0-3: *Omitted variable*				
Share of children 4-7	-0.288	*0.509*	0.224	*0.449*
Share of children 8-15	-0.022	*0.371*	-0.599	*0.364*
Share of men 16-64	1.501***	*0.461*	0.272	*0.485*
Share of women 16-64	2.876***	*0.413*	1.888***	*0.434*
Share of elderly	4.334***	*0.473*	1.428***	*0.515*
Number of married couples	-0.536***	*0.082*	-0.127*	*0.070*
Maximum education in the household	0.019	*0.038*	0.033	*0.038*
Ethnicity: Reference Category: Brahman \ Chhetri				
Dalit	-0.395**	*0.172*	0.004	*0.157*
Newar	-0.321*	*0.187*	-0.634***	*0.198*
Terai-Hill Janajatis	-0.223**	*0.101*	-0.160	*0.118*
Muslim \ Other Minorities	-0.364***	*0.132*	-0.154	*0.128*
Land holdings a year ago: Reference Category: No farm plot				
Farm plot < 0.5 ha	-0.082	*0.107*	0.046	*0.112*
Farm plot 0.5-1 ha	-0.375***	*0.144*	-0.144	*0.137*
Farm plot: 1-2 ha	-0.236	*0.157*	-0.042	*0.155*
Farm plot > 2 ha	-0.251	*0.191*	-0.264	*0.195*
Lagged durable asset index: Reference Category: No durables				
Asset poor (1 – 33th percentile)	0.085	*0.097*	-0.185*	*0.096*
(33th - 66th percentile)	-0.062	*0.104*	-0.185*	*0.105*
Asset rich (66th – 100th percentile)	-0.471***	*0.140*	-0.189	*0.125*
Total pensions per capita	-0.022	*0.019*	0.023**	*0.011*
Geography dummies: Reference Category: Katmandu				
Other urban areas	0.975***	*0.233*	0.805***	*0.234*
Rural west mount/hills	0.774**	*0.317*	1.476***	*0.341*
Rural eastern mount/hills	0.778***	*0.282*	0.676**	*0.302*
Rural western Terai	0.898***	*0.317*	1.050***	*0.328*
Rural eastern Terai	1.147***	*0.276*	1.196***	*0.287*
Log of distance to market center	-0.062	*0.044*	-0.023	*0.042*
Ward level variables				
% illiterate, among age 15+	-0.639	*0.571*	0.102	*0.600*
% literate or 1-4 years of education	-0.509	*0.839*	0.700	*0.772*
% completed 5-7 years of education	-0.293	*0.863*	0.637	*0.815*
% employed in wage job	-0.221	*0.556*	0.669	*0.632*
% self employed	0.783**	*0.364*	-0.045	*0.472*
Log of average household expenditure, 1995	0.102	*0.198*	0.194	*0.197*
Gini coefficient , 1995	-0.191	*0.841*	-1.302	*0.886*
Casualties from conflict, district level	-0.034	*0.084*	-0.041	*0.074*
Constant	-4.512**	*1.944*	-5.135***	*1.908*
Number of observations	3620			
Log-Likelihood	-2,705.20			

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table A4.1: OLS estimation of expenditure equations of the system (2-4)

	Domestic Migration		**International Migration**		**No Migration**	
	Coeff.	*Std.Err.*	Coeff.	*Std.Err.*	Coeff.	*Std.Err*
Household Demographics (before migration)						
Household size	-0.087***	*0.014*	-0.084***	*0.011*	-0.067***	*0.006*
Share of children 0-3: *Omitted variable*						
Share of children 4-7	0.255	*0.186*	0.153	*0.145*	0.168	*0.108*
Share of children 8-15	0.253*	*0.139*	0.606***	*0.126*	0.359***	*0.072*
Share of men 16-64	0.433***	*0.166*	0.520***	*0.172*	0.283***	*0.099*
Share of women 16-64	0.629***	*0.133*	0.702***	*0.140*	0.843***	*0.081*
Share of elderly	0.330**	*0.148*	0.460***	*0.170*	0.424***	*0.122*
Number of married couples	0.067*	*0.037*	0.052*	*0.031*	0.048***	*0.016*
Maximum education of women	0.034**	*0.016*	0.080***	*0.015*	0.087***	*0.007*
Ethnicity: Reference Category: Brahman \ Chhetri						
Dalit	-0.226***	*0.078*	-0.247***	*0.062*	-0.183***	*0.036*
Newar	-0.019	*0.062*	0.023	*0.071*	-0.009	*0.027*
Terai-Hill Janajatis	-0.127**	*0.050*	-0.142***	*0.044*	-0.224***	*0.026*
Muslim \ Other Minorities	-0.039	*0.060*	-0.178***	*0.050*	-0.143***	*0.030*
Land holdings a year ago: Reference Category: No farm plot						
Farm plot < 0.5 ha	-0.015	*0.051*	0.006	*0.053*	0.059**	*0.024*
Farm plot 0.5-1 ha	0.166***	*0.059*	0.028	*0.056*	0.132***	*0.030*
Farm plot: 1-2 ha	0.156**	*0.067*	0.110*	*0.066*	0.198***	*0.030*
Farm plot > 2 ha	0.239***	*0.078*	0.300***	*0.066*	0.323***	*0.040*
Lagged durable asset index: Reference Category: No durables						
Asset poor (1 – 33th percentile)	0.074	*0.048*	0.061	*0.046*	0.008	*0.020*
(33th - 66th percentile)	0.175***	*0.051*	0.173***	*0.049*	0.165***	*0.022*
Asset rich (66th – 100th percentile)	0.490***	*0.057*	0.484***	*0.063*	0.476***	*0.027*
Total pensions per capita	0.017**	*0.007*	0.022***	*0.005*	0.014***	*0.003*
Geography dummies: Reference Category: Katmandu						
Other urban areas	0.058	*0.093*	0.052	*0.129*	0.222***	*0.043*
Rural west mount/hills	0.048	*0.123*	-0.158	*0.150*	0.258***	*0.064*
Rural eastern mount/hills	0.012	*0.116*	-0.158	*0.149*	0.136**	*0.055*
Rural western Terai	0.168	*0.133*	-0.103	*0.158*	0.241***	*0.058*
Rural eastern Terai	0.105	*0.118*	0.113	*0.144*	0.331***	*0.055*
Log of distance to market center	-0.035	*0.022*	-0.020	*0.017*	-0.025***	*0.010*
Ward level variables						
% illiterate, among age 15+	-0.307	*0.233*	-0.251	*0.237*	-0.389***	*0.116*
% literate or 1-4 years of education	0.024	*0.346*	-0.312	*0.440*	-0.135	*0.180*
% completed 5-7 years of education	0.465	*0.400*	-0.279	*0.355*	-0.616***	*0.203*
% employed in wage job	0.011	*0.324*	-0.071	*0.211*	-0.127	*0.149*
% self employed	-0.235	*0.154*	-0.103	*0.144*	-0.197**	*0.093*
Log of average hh expenditure, 1995	0.183**	*0.084*	0.277***	*0.066*	0.323***	*0.041*
Gini coefficient, 1995	0.289	*0.322*	0.111	*0.282*	0.050	*0.212*
Casualties from conflict, district level	0.066*	*0.039*	0.015	*0.027*	-0.010	*0.022*
Constant	-1.515*	*0.823*	-2.227***	*0.640*	-2.827***	*0.380*
Number of observations	523		633		2,464	
Log-Likelihood	-236.85		-291.45		-1,037.61	

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table A3.2: FIML estimation of the migration choice part of the system (2-4) with amounts of remittances.

Base category: No Migration	**Domestic Migration**		**International Migration**	
	Coefficient	*Std. Error*	Coefficient	*Std. Error*
Share of domestic migrants in district, 1995	0.978***	*0.364*	-0.463	*0.443*
Share of international migrants in a ward, 2001	0.192	*0.245*	1.261***	*0.261*
Household Demographics (before migration)				
Household size	0.159***	*0.017*	0.127***	*0.017*
Share of children 0-3: *Omitted variable*				
Share of children 4-7	-0.174	*0.364*	0.172	*0.317*
Share of children 8-15	-0.020	*0.274*	-0.415	*0.256*
Share of men 16-64	1.222***	*0.350*	0.259	*0.350*
Share of women 16-64	1.990***	*0.300*	1.316***	*0.309*
Share of elderly	3.044***	*0.337*	1.004***	*0.368*
Number of married couples	-0.383***	*0.056*	-0.093*	*0.049*
Maximum education in the household	0.001	*0.027*	0.020	*0.027*
Ethnicity: Reference Category: Brahman \ Chhetri				
Dalit	-0.275**	*0.121*	0.002	*0.111*
Newar	-0.247*	*0.134*	-0.451***	*0.140*
Terai-Hill Janajatis	-0.159**	*0.072*	-0.112	*0.085*
Muslim \ Other Minorities	-0.271***	*0.097*	-0.108	*0.091*
Land holdings a year ago: Reference Category: No farm plot				
Farm plot < 0.5 ha	-0.061	*0.076*	0.034	*0.079*
Farm plot 0.5-1 ha	-0.255**	*0.102*	-0.102	*0.097*
Farm plot: 1-2 ha	-0.147	*0.114*	-0.025	*0.109*
Farm plot > 2 ha	-0.167	*0.135*	-0.186	*0.138*
Lagged durable asset index: Reference Category: No durables				
Asset poor (1 – 33th percentile)	0.057	*0.069*	-0.132*	*0.068*
(33th - 66th percentile)	-0.052	*0.073*	-0.133*	*0.074*
Asset rich (66th - 100th percentile)	-0.321***	*0.098*	-0.133	*0.089*
Total pensions per capita	-0.015	*0.013*	0.016**	*0.008*
Geography dummies: Reference Category: Katmandu				
Other urban areas	0.690***	*0.165*	0.565***	*0.165*
Rural west mount/hills	0.534**	*0.220*	1.033***	*0.241*
Rural eastern mount/hills	0.555***	*0.196*	0.473**	*0.213*
Rural western Terai	0.631***	*0.221*	0.735***	*0.231*
Rural eastern Terai	0.791***	*0.192*	0.834***	*0.203*
Log of distance to market center	-0.041	*0.031*	-0.015	*0.029*
Ward level variables				
% illiterate, among age 15+	-0.528	*0.396*	0.054	*0.425*
% literate or 1-4 years of education	-0.488	*0.589*	0.471	*0.550*
% completed 5-7 years of education	-0.206	*0.608*	0.453	*0.575*
% employed in wage job	-0.066	*0.393*	0.486	*0.446*
% self employed	0.555**	*0.251*	-0.025	*0.333*
Log of average hh expenditure, 1995	0.065	*0.135*	0.135	*0.138*
Gini coefficient, 1995	-0.033	*0.580*	-0.924	*0.621*
Casualties from conflict, district level	-0.024	*0.061*	-0.031	*0.053*
Constant	-3.188**	*1.327*	-3.615***	*1.344*
Number of observations	3620			
Log-Likelihood	-4,202.46			

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table A4.2: FIML estimation of expenditure equations of the system (2-4) with amounts.

	Domestic Migration		**International Migration**		**No Migration**	
	Coeff.	*Std.Err.*	Coeff.	*Std.Err.*	Coeff.	*Std.Err*
Log amount of remittances	0.061***	*0.011*	0.118***	*0.013*		
Household Demographics (before migration)						
Household size	-0.102***	*0.017*	-0.053***	*0.018*	-0.073***	*0.008*
Share of children 0-3: *Omitted variable*						
Share of children 4-7	0.244	*0.174*	0.102	*0.135*	0.174	*0.109*
Share of children 8-15	0.249*	*0.139*	0.536***	*0.125*	0.357***	*0.072*
Share of men 16-64	0.121	*0.182*	0.528**	*0.206*	0.228**	*0.104*
Share of women 16-64	0.307*	*0.161*	0.771***	*0.210*	0.753***	*0.106*
Share of elderly	-0.178	*0.209*	0.455*	*0.259*	0.264*	*0.153*
Number of married couples	0.121***	*0.047*	0.030	*0.039*	0.067***	*0.018*
Maximum education of women	0.025	*0.016*	0.071***	*0.013*	0.086***	*0.007*
Ethnicity: Reference Category: Brahman \ Chhetri						
Dalit	-0.142*	*0.084*	-0.200***	*0.063*	-0.170***	*0.038*
Newar	0.065	*0.068*	0.007	*0.091*	-0.002	*0.029*
Terai-Hill Janajatis	-0.075	*0.054*	-0.164***	*0.043*	-0.218***	*0.026*
Muslim \ Other Minorities	0.030	*0.067*	-0.141***	*0.052*	-0.133***	*0.031*
Land holdings a year ago: Reference Category: No farm plot						
Farm plot < 0.5 ha	-0.016	*0.051*	-0.036	*0.049*	0.062**	*0.024*
Farm plot 0.5-1 ha	0.187***	*0.064*	-0.026	*0.055*	0.143***	*0.030*
Farm plot: 1-2 ha	0.167**	*0.067*	0.053	*0.065*	0.206***	*0.031*
Farm plot > 2 ha	0.248***	*0.081*	0.220***	*0.065*	0.330***	*0.041*
Lagged durable asset index: Reference Category: No durables						
Asset poor (1 – 33th percentile)	0.054	*0.048*	0.041	*0.053*	0.004	*0.020*
(33th - 66th percentile)	0.161***	*0.050*	0.121***	*0.046*	0.166***	*0.022*
Asset rich (66th - 100th percentile)	0.518***	*0.064*	0.392***	*0.061*	0.490***	*0.028*
Total pensions per capita	0.020***	*0.007*	0.022***	*0.005*	0.015***	*0.003*
Geography dummies: Reference Category: Katmandu						
Other urban areas	-0.098	*0.106*	0.109	*0.133*	0.197***	*0.047*
Rural west mount/hills	-0.064	*0.132*	-0.008	*0.197*	0.243***	*0.074*
Rural eastern mount/hills	-0.063	*0.125*	-0.084	*0.134*	0.115**	*0.054*
Rural western Terai	0.037	*0.132*	-0.027	*0.155*	0.220***	*0.060*
Rural eastern Terai	-0.066	*0.135*	0.149	*0.149*	0.301***	*0.059*
Log of distance to market center	-0.025	*0.021*	-0.024*	*0.014*	-0.023**	*0.010*
Ward level variables						
% illiterate, among age 15+	-0.154	*0.214*	-0.158	*0.206*	-0.370***	*0.116*
% literate or 1-4 years of education	0.099	*0.298*	-0.150	*0.385*	-0.118	*0.182*
% completed 5-7 years of education	0.568	*0.369*	-0.167	*0.305*	-0.603***	*0.200*
% employed in wage job	0.077	*0.308*	0.027	*0.183*	-0.117	*0.147*
% self employed	-0.364**	*0.153*	-0.062	*0.133*	-0.222**	*0.093*
Log of average hh expenditure, 1995	0.136*	*0.072*	0.176***	*0.061*	0.320***	*0.041*
Gini coefficient, 1995	0.267	*0.267*	0.160	*0.251*	0.054	*0.213*
Casualties from conflict, district level	0.091**	*0.038*	0.016	*0.031*	-0.009	*0.021*
Constant	-0.535	*0.725*	-1.914**	*0.771*	-2.783***	*0.391*
Number of observations			3620			
Log-Likelihood			-4,202.46			

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table A3.3: FIML estimation of the migration choice part of the system (2-4) with amounts of remittances instrumented by age of the migrant.

Base category: No Migration	**Domestic Migration**		**International Migration**	
	Coefficient	*Std. Error*	Coefficient	*Std. Error*
Share of domestic migrants in district, 1995	1.051***	*0.345*	-0.421	*0.425*
Share of international migrants in a ward, 2001	0.174	*0.247*	1.273***	*0.264*
Household Demographics (before migration)				
Household size	0.158***	*0.017*	0.127***	*0.017*
Share of children 0-3: *Omitted variable*				
Share of children 4-7	-0.192	*0.365*	0.164	*0.318*
Share of children 8-15	-0.056	*0.277*	-0.416	*0.259*
Share of men 16-64	1.170***	*0.350*	0.243	*0.348*
Share of women 16-64	1.988***	*0.302*	1.310***	*0.307*
Share of elderly	2.969***	*0.353*	0.946***	*0.367*
Number of married couples	-0.379***	*0.056*	-0.089*	*0.049*
Maximum education in the household	0.004	*0.027*	0.023	*0.027*
Ethnicity: Reference Category: Brahman \ Chhetri				
Dalit	-0.269**	*0.120*	0.018	*0.115*
Newar	-0.245*	*0.133*	-0.452***	*0.140*
Terai-Hill Janajatis	-0.161**	*0.072*	-0.108	*0.087*
Muslim \ Other Minorities	-0.280***	*0.098*	-0.105	*0.094*
Land holdings a year ago: Reference Category: No farm plot				
Farm plot < 0.5 ha	-0.061	*0.076*	0.036	*0.079*
Farm plot 0.5-1 ha	-0.248**	*0.103*	-0.099	*0.098*
Farm plot: 1-2 ha	-0.144	*0.113*	-0.028	*0.111*
Farm plot > 2 ha	-0.157	*0.137*	-0.190	*0.142*
Lagged durable asset index: Reference Category: No durables				
Asset poor (1 – 33th percentile)	0.057	*0.069*	-0.134**	*0.068*
(33th - 66th percentile)	-0.056	*0.073*	-0.140*	*0.076*
Asset rich (66th - 100th percentile)	-0.324***	*0.097*	-0.138	*0.091*
Total pensions per capita	-0.015	*0.013*	0.016**	*0.008*
Geography dummies: Reference Category: Katmandu				
Other urban areas	0.700***	*0.167*	0.566***	*0.164*
Rural west mount/hills	0.557**	*0.228*	1.040***	*0.240*
Rural eastern mount/hills	0.570***	*0.198*	0.479**	*0.211*
Rural western Terai	0.651***	*0.225*	0.739***	*0.229*
Rural eastern Terai	0.804***	*0.195*	0.839***	*0.201*
Log of distance to market center	-0.041	*0.032*	-0.015	*0.029*
Ward level variables				
% illiterate, among age 15+	-0.544	*0.396*	0.030	*0.423*
% literate or 1-4 years of education	-0.550	*0.593*	0.417	*0.538*
% completed 5-7 years of education	-0.198	*0.610*	0.413	*0.578*
% employed in wage job	-0.053	*0.391*	0.484	*0.450*
% self employed	0.550**	*0.250*	-0.031	*0.332*
Log of average hh expenditure, 1995	0.063	*0.135*	0.131	*0.139*
Gini coefficient, 1995	0.014	*0.583*	-0.915	*0.623*
Casualties from conflict, district level	-0.024	*0.060*	-0.035	*0.056*
Constant	-3.165**	*1.324*	-3.561***	*1.344*
Number of observations		3620		
Log-Likelihood		-4,263.32		

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table A4.3: FIML estimation of expenditure equations of the system (2-4) with amounts of remittances instrumented by age of the migrant.

	Domestic Migration		**International Migration**		**No Migration**	
	Coeff.	*Std.Err.*	Coeff.	*Std.Err.*	Coeff.	*Std.Err*
Log amount of remittances	0.014	*0.037*	0.059	*0.057*		
Household Demographics (before migration)						
Household size	-0.117***	*0.018*	-0.085**	*0.035*	-0.074***	*0.008*
Share of children 0-3: *Omitted variable*						
Share of children 4-7	0.310	*0.191*	0.102	*0.143*	0.175	*0.109*
Share of children 8-15	0.276*	*0.145*	0.581***	*0.134*	0.358***	*0.072*
Share of men 16-64	0.150	*0.184*	0.399	*0.259*	0.228**	*0.103*
Share of women 16-64	0.278*	*0.154*	0.533	*0.355*	0.749***	*0.104*
Share of elderly	-0.189	*0.187*	0.243	*0.384*	0.261*	*0.149*
Number of married couples	0.147***	*0.045*	0.063	*0.052*	0.067***	*0.018*
Maximum education of women	0.032*	*0.018*	0.076***	*0.015*	0.086***	*0.007*
Ethnicity: Reference Category: Brahman \ Chhetri						
Dalit	-0.147*	*0.087*	-0.216***	*0.068*	-0.170***	*0.038*
Newar	0.053	*0.071*	0.073	*0.121*	-0.002	*0.029*
Terai-Hill Janajatis	-0.074	*0.055*	-0.136***	*0.051*	-0.218***	*0.026*
Muslim \ Other Minorities	0.026	*0.069*	-0.132**	*0.063*	-0.132***	*0.031*
Land holdings a year ago: Reference Category: No farm plot						
Farm plot < 0.5 ha	-0.005	*0.053*	-0.016	*0.055*	0.062**	*0.024*
Farm plot 0.5-1 ha	0.209***	*0.066*	0.025	*0.073*	0.143***	*0.030*
Farm plot: 1-2 ha	0.178***	*0.068*	0.089	*0.071*	0.206***	*0.031*
Farm plot > 2 ha	0.260***	*0.086*	0.281***	*0.084*	0.330***	*0.041*
Lagged durable asset index: Reference Category: No durables						
Asset poor (1 – 33th percentile)	0.052	*0.049*	0.065	*0.057*	0.004	*0.020*
(33th - 66th percentile)	0.172***	*0.053*	0.160**	*0.063*	0.167***	*0.022*
Asset rich (66th - 100th percentile)	0.550***	*0.068*	0.467***	*0.101*	0.491***	*0.028*
Total pensions per capita	0.020***	*0.008*	0.021***	*0.005*	0.015***	*0.003*
Geography dummies: Reference Category: Katmandu						
Other urban areas	-0.106	*0.105*	-0.026	*0.197*	0.195***	*0.047*
Rural west mount/hills	-0.063	*0.135*	-0.239	*0.291*	0.241***	*0.075*
Rural eastern mount/hills	-0.094	*0.124*	-0.198	*0.182*	0.114**	*0.054*
Rural western Terai	0.037	*0.136*	-0.177	*0.221*	0.218***	*0.060*
Rural eastern Terai	-0.072	*0.135*	0.008	*0.222*	0.300***	*0.059*
Log of distance to market center	-0.024	*0.022*	-0.020	*0.016*	-0.023**	*0.010*
Ward level variables						
% illiterate, among age 15+	-0.223	*0.241*	-0.210	*0.225*	-0.370***	*0.116*
% literate or 1-4 years of education	0.053	*0.325*	-0.302	*0.457*	-0.116	*0.182*
% completed 5-7 years of education	0.524	*0.394*	-0.279	*0.377*	-0.603***	*0.200*
% employed in wage job	0.097	*0.331*	-0.039	*0.212*	-0.117	*0.147*
% self employed	-0.342**	*0.157*	-0.113	*0.145*	-0.223**	*0.093*
Log of average hh expenditure, 1995	0.145*	*0.077*	0.208**	*0.086*	0.320***	*0.041*
Gini coefficient, 1995	0.325	*0.293*	0.246	*0.328*	0.052	*0.212*
Casualties from conflict, district level	0.084**	*0.039*	0.030	*0.034*	-0.010	*0.021*
Constant	-0.502	*0.743*	-1.510	*1.148*	-2.783***	*0.390*
Number of observations			3620			
Log-Likelihood			-4,263.32			

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table A3.4: Full sample FIML estimation of the migration choice in the system (2-4).

Base category: No Migration	**Domestic Migration**		**International Migration**	
	Coefficient	*Std. Error*	Coefficient	*Std. Error*
Share of domestic migrants in district, 1995	1.015***	*0.321*	-0.404	*0.412*
Share of international migrants in a ward, 2001	0.052	*0.235*	1.151***	*0.234*
Household Demographics (before migration)				
Household size	0.177***	*0.016*	0.142***	*0.017*
Share of children 0-3: *Omitted variable*				
Share of children 4-7	-0.292	*0.353*	0.095	*0.319*
Share of children 8-15	-0.128	*0.260*	-0.380	*0.250*
Share of men 16-64	1.181***	*0.299*	0.213	*0.328*
Share of women 16-64	1.953***	*0.285*	1.397***	*0.302*
Share of elderly	1.898***	*0.297*	0.184	*0.314*
Number of married couples	-0.398***	*0.055*	-0.096**	*0.047*
Maximum education in the household	0.001	*0.026*	0.031	*0.026*
Ethnicity: Reference Category: Brahman \ Chhetri				
Dalit	-0.325***	*0.114*	0.003	*0.104*
Newar	-0.208	*0.129*	-0.439***	*0.138*
Terai-Hill Janajatis	-0.181***	*0.070*	-0.091	*0.080*
Muslim \ Other Minorities	-0.290***	*0.091*	-0.090	*0.090*
Land holdings a year ago: Reference Category: No farm plot				
Farm plot < 0.5 ha	-0.060	*0.077*	0.023	*0.077*
Farm plot 0.5-1 ha	-0.226**	*0.102*	-0.108	*0.093*
Farm plot: 1-2 ha	-0.135	*0.111*	-0.042	*0.106*
Farm plot > 2 ha	-0.103	*0.131*	-0.203	*0.137*
Lagged durable asset index: Reference Category: No durables				
Asset poor (1 – 33th percentile)	0.055	*0.065*	-0.125*	*0.066*
(33th - 66th percentile)	-0.061	*0.069*	-0.157**	*0.073*
Asset rich (66th - 100th percentile)	-0.309***	*0.093*	-0.118	*0.086*
Total pensions per capita	-0.014	*0.010*	0.011*	*0.006*
Geography dummies: Reference Category: Katmandu				
Other urban areas	0.708***	*0.163*	0.546***	*0.161*
Rural west mount/hills	0.601***	*0.215*	1.010***	*0.228*
Rural eastern mount/hills	0.569***	*0.195*	0.447**	*0.203*
Rural western Terai	0.664***	*0.222*	0.715***	*0.220*
Rural eastern Terai	0.836***	*0.189*	0.814***	*0.194*
Log of distance to market center	-0.030	*0.030*	-0.017	*0.029*
Ward level variables				
% illiterate, among age 15+	-0.609	*0.386*	0.023	*0.402*
% literate or 1-4 years of education	-0.674	*0.571*	0.447	*0.500*
% completed 5-7 years of education	-0.045	*0.577*	0.425	*0.540*
% employed in wage job	-0.182	*0.390*	0.477	*0.441*
% self employed	0.423*	*0.251*	0.007	*0.325*
Log of average household expenditure, 1995	0.067	*0.132*	0.122	*0.133*
Gini coefficient, 1995	-0.070	*0.571*	-0.924	*0.604*
Casualties from conflict, district level	-0.014	*0.057*	-0.047	*0.048*
Constant	-3.105**	*1.296*	-3.547***	*1.283*
Number of observations	3874			
Log-Likelihood	-4,548.20			

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table A4.4: Full Sample FIML estimation of expenditure equations of the system (2-4)

	Domestic Migration		International Migration		No Migration	
	Coeff.	*Std.Err.*	Coeff.	*Std.Err.*	Coeff.	*Std.Err*
Household Demographics (before migration)						
Household size	-0.124***	*0.015*	-0.115***	*0.012*	-0.080***	*0.008*
Share of children 0-3: *Omitted variable*						
Share of children 4-7	0.354*	*0.185*	0.127	*0.154*	0.164	*0.101*
Share of children 8-15	0.305**	*0.142*	0.613***	*0.135*	0.374***	*0.069*
Share of men 16-64	0.200	*0.169*	0.301	*0.183*	0.324***	*0.096*
Share of women 16-64	0.295*	*0.157*	0.331**	*0.152*	0.745***	*0.102*
Share of elderly	-0.000	*0.168*	0.227	*0.192*	0.419***	*0.098*
Number of married couples	0.160***	*0.041*	0.098***	*0.030*	0.062***	*0.017*
Maximum education of women	0.034**	*0.016*	0.083***	*0.016*	0.084***	*0.007*
Ethnicity: Reference Category: Brahman \ Chhetri						
Dalit	-0.127	*0.087*	-0.220***	*0.067*	-0.175***	*0.036*
Newar	0.019	*0.066*	0.095	*0.082*	0.006	*0.028*
Terai-Hill Janajatis	-0.058	*0.052*	-0.117***	*0.045*	-0.198***	*0.026*
Muslim \ Other Minorities	0.027	*0.065*	-0.140***	*0.054*	-0.122***	*0.029*
Land holdings a year ago: Reference Category: No farm plot						
Farm plot < 0.5 ha	0.016	*0.053*	0.005	*0.053*	0.056**	*0.024*
Farm plot 0.5-1 ha	0.231***	*0.065*	0.073	*0.057*	0.131***	*0.029*
Farm plot: 1-2 ha	0.199***	*0.067*	0.119*	*0.067*	0.196***	*0.031*
Farm plot > 2 ha	0.257***	*0.081*	0.332***	*0.068*	0.326***	*0.041*
Lagged durable asset index: Reference Category: No durables						
Asset poor (1 – 33th percentile)	0.067	*0.047*	0.084*	*0.048*	0.025	*0.020*
(33th - 66th percentile)	0.195***	*0.049*	0.201***	*0.049*	0.182***	*0.022*
Asset rich (66th - 100th percentile)	0.567***	*0.063*	0.544***	*0.066*	0.501***	*0.027*
Total pensions per capita	0.017**	*0.007*	0.022***	*0.005*	0.014***	*0.002*
Geography dummies: Reference Category: Katmandu						
Other urban areas	-0.091	*0.105*	-0.119	*0.125*	0.210***	*0.048*
Rural west mount/hills	-0.082	*0.129*	-0.368**	*0.152*	0.221***	*0.076*
Rural eastern mount/hills	-0.126	*0.122*	-0.274*	*0.143*	0.125**	*0.057*
Rural western Terai	0.032	*0.132*	-0.268*	*0.150*	0.223***	*0.062*
Rural eastern Terai	-0.081	*0.132*	-0.075	*0.138*	0.312***	*0.061*
Log of distance to market center	-0.028	*0.021*	-0.018	*0.017*	-0.019**	*0.010*
Ward level variables						
% illiterate, among age 15+	-0.266	*0.217*	-0.215	*0.217*	-0.411***	*0.113*
% literate or 1-4 years of education	-0.033	*0.303*	-0.383	*0.407*	-0.182	*0.184*
% completed 5-7 years of education	0.453	*0.370*	-0.362	*0.344*	-0.666***	*0.199*
% employed in wage job	0.102	*0.324*	-0.080	*0.218*	-0.117	*0.152*
% self employed	-0.281*	*0.151*	-0.173	*0.143*	-0.197**	*0.091*
Log of average hh expenditure, 1995	0.162**	*0.072*	0.247***	*0.069*	0.314***	*0.040*
Gini coefficient , 1995	0.326	*0.272*	0.299	*0.310*	0.103	*0.204*
Casualties from conflict, district level	0.060	*0.037*	0.034	*0.025*	-0.004	*0.021*
Constant	-0.636	*0.710*	-1.390**	*0.703*	-2.730***	*0.388*
Number of observations			3874			
Log-Likelihood			-4,548.20			

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table A3.5: FIML estimation of the migration choice part of the system (2-4), where migration to India is treated as domestic migration.

Base category: No Migration	**Nepal + India Migration**		**Other abroad Migration**	
	Coefficient	*Std. Error*	Coefficient	*Std. Error*
Share of domestic migrants in district, 1995	0.620	*0.379*	-0.214	*0.719*
Share of international migrants in a ward, 2001	0.664***	*0.256*	1.323***	*0.308*
Household Demographics (before migration)				
Household size	0.157***	*0.015*	0.119***	*0.030*
Share of children 0-3: *Omitted variable*				
Share of children 4-7	-0.029	*0.299*	0.132	*0.428*
Share of children 8-15	-0.151	*0.233*	-0.668**	*0.335*
Share of men 16-64	0.919***	*0.316*	-0.141	*0.439*
Share of women 16-64	1.852***	*0.275*	1.276***	*0.367*
Share of elderly	2.402***	*0.330*	1.267***	*0.405*
Number of married couples	-0.265***	*0.050*	-0.145**	*0.058*
Maximum education in the household	-0.011	*0.025*	0.105***	*0.032*
Ethnicity: Reference Category: Brahman \ Chhetri				
Dalit	-0.152	*0.105*	0.157	*0.131*
Newar	-0.307**	*0.128*	-0.268*	*0.157*
Terai-Hill Janajatis	-0.253***	*0.069*	0.211**	*0.096*
Muslim \ Other Minorities	-0.202**	*0.082*	-0.126	*0.124*
Land holdings a year ago: Reference Category: No farm plot				
Farm plot < 0.5 ha	0.002	*0.070*	-0.022	*0.108*
Farm plot 0.5-1 ha	-0.203**	*0.087*	-0.045	*0.130*
Farm plot: 1-2 ha	-0.131	*0.100*	0.082	*0.141*
Farm plot > 2 ha	-0.239**	*0.122*	-0.010	*0.159*
Lagged durable asset index: Reference Category: No durables				
Asset poor (1 – 33th percentile)	-0.016	*0.060*	-0.201*	*0.112*
(33th - 66th percentile)	-0.123*	*0.067*	0.005	*0.096*
Asset rich (66th - 100th percentile)	-0.383***	*0.085*	0.080	*0.111*
Total pensions per capita	-0.026**	*0.012*	0.022***	*0.008*
Geography dummies: Reference Category: Katmandu				
Other urban areas	0.621***	*0.156*	0.721***	*0.185*
Rural west mount/hills	0.890***	*0.214*	0.808***	*0.281*
Rural eastern mount/hills	0.495***	*0.191*	0.794***	*0.255*
Rural western Terai	0.732***	*0.214*	0.632**	*0.282*
Rural eastern Terai	0.736***	*0.184*	1.181***	*0.236*
Log of distance to market center	-0.039	*0.029*	0.018	*0.036*
Ward level variables				
% illiterate, among age 15+	-0.124	*0.383*	-0.435	*0.610*
% literate or 1-4 years of education	0.009	*0.555*	0.441	*0.669*
% completed 5-7 years of education	0.099	*0.553*	0.267	*0.765*
% employed in wage job	0.205	*0.376*	0.274	*0.738*
% self employed	0.311	*0.260*	-0.179	*0.542*
Log of average hh expenditure, 1995	-0.064	*0.128*	0.626***	*0.157*
Gini coefficient, 1995	0.011	*0.578*	-2.035***	*0.763*
Casualties from conflict, district level	-0.055	*0.047*	0.031	*0.074*
Constant	-1.988	*1.263*	-8.040***	*1.588*
Number of observations	3,620			
Log-Likelihood	-4,061.94			

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table A4.5: FIML estimation of expenditure equations of the system (2-4), where India is treated as domestic destination

	Domestic Migration		**International Migration**		**No Migration**	
	Coeff.	*Std.Err.*	Coeff.	*Std.Err.*	Coeff.	*Std.Err*
Household Demographics (before migration)						
Household size	-0.109***	*0.015*	-0.084***	*0.019*	-0.071***	*0.012*
Share of children 0-3: *Omitted variable*						
Share of children 4-7	0.238*	*0.137*	0.059	*0.221*	0.167	*0.108*
Share of children 8-15	0.486***	*0.109*	0.465**	*0.211*	0.370***	*0.077*
Share of men 16-64	0.326**	*0.163*	0.469*	*0.246*	0.274***	*0.102*
Share of women 16-64	0.511***	*0.158*	0.506**	*0.207*	0.796***	*0.152*
Share of elderly	0.146	*0.187*	0.401*	*0.218*	0.371**	*0.186*
Number of married couples	0.102***	*0.032*	0.038	*0.050*	0.054**	*0.021*
Maximum education of women	0.061***	*0.014*	0.055**	*0.024*	0.085***	*0.010*
Ethnicity: Reference Category: Brahman \ Chhetri						
Dalit	-0.239***	*0.060*	-0.074	*0.105*	-0.183***	*0.037*
Newar	0.081	*0.071*	-0.068	*0.104*	-0.001	*0.034*
Terai-Hill Janajatis	-0.047	*0.052*	-0.166**	*0.075*	-0.224***	*0.029*
Muslim \ Other Minorities	-0.082	*0.053*	0.015	*0.076*	-0.137***	*0.032*
Land holdings a year ago: Reference Category: No farm plot						
Farm plot < 0.5 ha	-0.014	*0.044*	-0.061	*0.073*	0.059**	*0.024*
Farm plot 0.5-1 ha	0.135***	*0.050*	-0.174*	*0.089*	0.135***	*0.030*
Farm plot: 1-2 ha	0.147**	*0.059*	-0.003	*0.103*	0.198***	*0.032*
Farm plot > 2 ha	0.289***	*0.068*	0.118	*0.098*	0.326***	*0.040*
Lagged durable asset index: Reference Category: No durables						
Asset poor (1 – 33th percentile)	0.076**	*0.038*	0.104	*0.100*	0.010	*0.022*
(33th - 66th percentile)	0.186***	*0.039*	0.158**	*0.076*	0.166***	*0.022*
Asset rich (66th - 100th percentile)	0.588***	*0.062*	0.344***	*0.087*	0.478***	*0.030*
Total pensions per capita	0.025***	*0.007*	0.013***	*0.005*	0.013***	*0.005*
Geography dummies: Reference Category: Katmandu						
Other urban areas	0.019	*0.112*	-0.016	*0.141*	0.205***	*0.067*
Rural west mount/hills	-0.160	*0.145*	-0.177	*0.176*	0.230**	*0.101*
Rural eastern mount/hills	-0.048	*0.117*	-0.234	*0.161*	0.120*	*0.071*
Rural western Terai	-0.006	*0.135*	-0.104	*0.177*	0.224***	*0.072*
Rural eastern Terai	0.075	*0.132*	-0.069	*0.177*	0.307***	*0.089*
Log of distance to market center	-0.021	*0.016*	-0.035	*0.024*	-0.025***	*0.010*
Ward level variables						
% illiterate, among age 15+	-0.358*	*0.184*	0.044	*0.284*	-0.384***	*0.116*
% literate or 1-4 years of education	-0.287	*0.295*	-0.047	*0.520*	-0.143	*0.184*
% completed 5-7 years of education	0.156	*0.328*	-0.671	*0.437*	-0.629***	*0.204*
% employed in wage job	0.014	*0.209*	-0.148	*0.470*	-0.129	*0.147*
% self employed	-0.140	*0.128*	-0.177	*0.196*	-0.200**	*0.093*
Log of average hh expenditure, 1995	0.237***	*0.060*	0.189	*0.136*	0.314***	*0.053*
Gini coefficient , 1995	-0.020	*0.255*	1.034**	*0.487*	0.082	*0.248*
Casualties from conflict, district level	0.045*	*0.027*	0.001	*0.052*	-0.008	*0.022*
Constant	-1.421**	*0.640*	-1.030	*1.320*	-2.739***	*0.515*
Number of observations			3620			
Log-Likelihood			-4,061.94			

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table A3.6: FIML estimation of the migration choice part of the system (2-4), assuming equal returns in earning equations.

Base category: No Migration	**Domestic Migration**		**International Migration**	
	Coefficient	*Std. Error*	Coefficient	*Std. Error*
Share of domestic migrants in district, 1995	0.919**	*0.397*	-0.453	*0.444*
Share of international migrants in a ward, 2001	0.056	*0.238*	1.118***	*0.248*
Household Demographics (before migration)				
Household size	0.158***	*0.017*	0.131***	*0.016*
Share of children 0-3: *Omitted variable*				
Share of children 4-7	-0.217	*0.363*	0.149	*0.311*
Share of children 8-15	-0.063	*0.270*	-0.489*	*0.254*
Share of men 16-64	0.998***	*0.332*	0.101	*0.341*
Share of women 16-64	2.055***	*0.293*	1.303***	*0.306*
Share of elderly	2.961***	*0.341*	0.972***	*0.361*
Number of married couples	-0.380***	*0.056*	-0.097**	*0.048*
Maximum education in the household	0.009	*0.029*	0.022	*0.026*
Ethnicity: Reference Category: Brahman \ Chhetri				
Dalit	-0.289**	*0.125*	0.019	*0.107*
Newar	-0.241*	*0.135*	-0.442***	*0.139*
Terai-Hill Janajatis	-0.174**	*0.073*	-0.137*	*0.080*
Muslim \ Other Minorities	-0.281***	*0.098*	-0.087	*0.088*
Land holdings a year ago: Reference Category: No farm plot				
Farm plot < 0.5 ha	-0.059	*0.077*	0.047	*0.077*
Farm plot 0.5-1 ha	-0.241**	*0.103*	-0.071	*0.093*
Farm plot: 1-2 ha	-0.136	*0.113*	-0.001	*0.106*
Farm plot > 2 ha	-0.142	*0.137*	-0.170	*0.128*
Lagged durable asset index: Reference Category: No durables				
Asset poor (1 – 33th percentile)	0.061	*0.069*	-0.143**	*0.067*
(33th - 66th percentile)	-0.047	*0.073*	-0.127*	*0.075*
Asset rich (66th - 100th percentile)	-0.319***	*0.097*	-0.132	*0.085*
Total pensions per capita	-0.014	*0.012*	0.013*	*0.007*
Geography dummies: Reference Category: Katmandu				
Other urban areas	0.709***	*0.169*	0.578***	*0.158*
Rural west mount/hills	0.587***	*0.226*	1.117***	*0.231*
Rural eastern mount/hills	0.573***	*0.199*	0.526**	*0.207*
Rural western Terai	0.671***	*0.222*	0.797***	*0.224*
Rural eastern Terai	0.822***	*0.197*	0.857***	*0.195*
Log of distance to market center	-0.044	*0.032*	-0.017	*0.028*
Ward level variables				
% illiterate, among age 15+	-0.489	*0.400*	-0.003	*0.391*
% literate or 1-4 years of education	-0.416	*0.596*	0.545	*0.527*
% completed 5-7 years of education	-0.147	*0.637*	0.296	*0.575*
% employed in wage job	-0.083	*0.392*	0.418	*0.434*
% self employed	0.542**	*0.255*	-0.041	*0.310*
Log of average hh expenditure, 1995	0.075	*0.142*	0.150	*0.136*
Gini coefficient, 1995	0.030	*0.593*	-0.907	*0.620*
Casualties from conflict, district level	-0.022	*0.061*	-0.042	*0.052*
Constant	-3.289**	*1.383*	-3.688***	*1.301*
Number of observations	3,620			
Log-Likelihood	-4,319.62			

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table A4.6: FIML estimation of expenditure equations of the system (2-4), assuming equal returns in earning equations.

	Domestic Migration		**International Migration**		**No Migration**	
	Coeff.	*Std.Err.*	Coeff.	*Std.Err.*	Coeff.	*Std.Err*
Household Demographics (before migration)						
Household size	-0.081***	*0.007*	-0.081***	*0.007*	-0.081***	*0.007*
Share of children 0-3: *Omitted variable*						
Share of children 4-7	0.205**	*0.081*	0.205**	*0.081*	0.205**	*0.081*
Share of children 8-15	0.408***	*0.061*	0.408***	*0.061*	0.408***	*0.061*
Share of men 16-64	0.349***	*0.084*	0.349***	*0.084*	0.349***	*0.084*
Share of women 16-64	0.688***	*0.084*	0.688***	*0.084*	0.688***	*0.084*
Share of elderly	0.335***	*0.107*	0.335***	*0.107*	0.335***	*0.107*
Number of married couples	0.074***	*0.016*	0.074***	*0.016*	0.074***	*0.016*
Maximum education of women	0.077***	*0.006*	0.077***	*0.006*	0.077***	*0.006*
Ethnicity: Reference Category: Brahman \ Chhetri						
Dalit	-0.182***	*0.032*	-0.182***	*0.032*	-0.182***	*0.032*
Newar	0.003	*0.029*	0.003	*0.029*	0.003	*0.029*
Terai-Hill Janajatis	-0.186***	*0.025*	-0.186***	*0.025*	-0.186***	*0.025*
Muslim \ Other Minorities	-0.124***	*0.028*	-0.124***	*0.028*	-0.124***	*0.028*
Land holdings a year ago: Reference Category: No farm plot						
Farm plot < 0.5 ha	0.045**	*0.022*	0.045**	*0.022*	0.045**	*0.022*
Farm plot 0.5-1 ha	0.128***	*0.026*	0.128***	*0.026*	0.128***	*0.026*
Farm plot: 1-2 ha	0.184***	*0.028*	0.184***	*0.028*	0.184***	*0.028*
Farm plot > 2 ha	0.302***	*0.034*	0.302***	*0.034*	0.302***	*0.034*
Lagged durable asset index: Reference Category: No durables						
Asset poor (1 – 33th percentile)	0.019	*0.017*	0.019	*0.017*	0.019	*0.017*
(33th - 66th percentile)	0.168***	*0.019*	0.168***	*0.019*	0.168***	*0.019*
Asset rich (66th – 100th percentile)	0.503***	*0.025*	0.503***	*0.025*	0.503***	*0.025*
Total pensions per capita	0.017***	*0.003*	0.017***	*0.003*	0.017***	*0.003*
Geography dummies: Reference Category: Katmandu						
Other urban areas	0.155***	*0.047*	0.155***	*0.047*	0.155***	*0.047*
Rural west mount/hills	0.151**	*0.073*	0.151**	*0.073*	0.151**	*0.073*
Rural eastern mount/hills	0.064	*0.056*	0.064	*0.056*	0.064	*0.056*
Rural western Terai	0.164***	*0.063*	0.164***	*0.063*	0.164***	*0.063*
Rural eastern Terai	0.238***	*0.057*	0.238***	*0.057*	0.238***	*0.057*
Log of distance to market center	-0.024***	*0.009*	-0.024***	*0.009*	-0.024***	*0.009*
Ward level variables						
% illiterate, among age 15+	-0.331***	*0.106*	-0.331***	*0.106*	-0.331***	*0.106*
% literate or 1-4 years of education	-0.145	*0.180*	-0.145	*0.180*	-0.145	*0.180*
% completed 5-7 years of education	-0.409**	*0.190*	-0.409**	*0.190*	-0.409**	*0.190*
% employed in wage job	-0.080	*0.138*	-0.080	*0.138*	-0.080	*0.138*
% self employed	-0.214**	*0.083*	-0.214**	*0.083*	-0.214**	*0.083*
Log of average hh expenditure, 1995	0.291***	*0.036*	0.291***	*0.036*	0.291***	*0.036*
Gini coefficient , 1995	0.090	*0.174*	0.090	*0.174*	0.090	*0.174*
Casualties from conflict, district level	0.001	*0.021*	0.001	*0.021*	0.001	*0.021*
Constant	-2.311***	*0.382*	-2.687***	*0.396*	-2.555***	*0.348*
Number of observations			3620			
Log-Likelihood			-4,319.62			

Note: * is significant at 10% level; ** at 5% level; *** at 1% level; ♣ indicates joint significance of coefficients at 10% level. Standard errors are adjusted for clustering on a ward level.

Table A5: Simulated changes in expenditure, poverty and inequality rates for different migration scenarios (standard errors in parenthesis).

Migration scenarios	**Actual**	**No migration**	**Level of migration as in 1995-96**	**+10% point increase in domestic migration**	**+10% point increase in international migration**
Household types	*Poverty rate (changes in percentage points)*				
All Households	30.0	+3.6* *(2.1)*	+1.8* *(0.9)*	-2.4* *(1.3)*	-0.5 *(1.1)*
Households with no migrants	30.6	0	0	-3* *(1.4)*	-1.3 *(1.9)*
Households with migrants within Nepal	22.9	+23.4* *(9.4)*	+7.1* *(3.6)*	0	+2.6 (2.8)
Households with migrants abroad	32.8	+2.1 *(7.3)*	+4.4 *(4.2)*	-2.1 (2.5)	0
	Average expenditure, NRP 10,000's				
All Households	1.493	-0.088* *(0.046)*	-0.047* *(0.022)*	+0.068* *(0.041)*	+0.022 *(0.037)*
Households with no migrants	1.493	0	0	+0.092* *(0.050)*	+0.043 *(0.061)*
Households with migrants within Nepal	1.576	-0.489* *(0.188)*	-0.175* *(0.079)*	0	-0.049 *(0.060)*
Households with migrants abroad	1.441	-0.1 *(0.177)*	-0.113 *(0.100)*	+0.037 *(0.080)*	0
	Inequality rate (Gini)				
All Households	0.409	-0.004 *(0.004)*	-0.002 *(0.004)*	+0.003 *(0.005)*	+0.003 *(0.004)*

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Chapter 3

Work-related migration and its effect on educational attainment in Nepal

3.1 Introduction

In Nepal in 2004, about 1 million children (or 20% of all children aged 6 to 15) had fathers residing and working away from home, and often in foreign countries. What effect does this condition have on the well-being of these children and, in particular, on their educational attainment?

On the one hand, absence of a father can have a detrimental effect on the educational attainment of a child. For example, it has been consistently shown that children living without a father due to death or divorce in the family have lower progress in school (Antman, 2008). When the father is absent, children may have to spend more time helping with household chores and have less time to devote to school. A father present at home also serves as a role model to encourage schooling. On the other hand, the father's absence can be compensated by increased household income coming from remittances that the father sends home. In particular, my second essay showed that Nepali households with migrants have higher per capita consumption than they would have without migration (Bontch-Osmolovski and Lokshin, 2007). However, the findings of that essay are not directly applicable here, because spending on a child's education is more of an investment-type expenditure and is therefore not included in the calculation of household consumption aggregate.

Migration and remittances recently became a hot topic in literature on development and are actively promoted by international institutions as a cure for poverty.[1] However, if the short-term boost to household consumption has the long-term consequence of lower human capital of children, then the role of remittances in poverty reduction may need to be reconsidered.

Overall, there is no clear theoretical solution to the question formulated above and still no empirical answer. There have been very few attempts to estimate the effect of migration on education, and none so far in application to Nepal.

The main goal of this paper is to find out how the educational attainment of children responds to the migration of their parents or other relatives in the household. This essay uses the methodology and many of the results developed in my second essay, which studied the relationship between household migration and poverty.

3.2 Review of economic literature on educational attainment and its determinants

The economic research on the determinants of children's educational attainment (EA) is vast. However, there are few published papers that study the relationship between EA and migration of parents. I will start with an overview of the development of EA literature to summarize the

[1] e.g. "**With the number of migrants worldwide now reaching almost 200 million, their productivity and earnings are a powerful force for poverty reduction. ŞRemittances, in particular, are an important way out of extreme poverty for a large number of people. The challenge facing policymakers is to fully achieve the potential economic benefits of migration, while managing the associated social and political implications"**
Francois Bourguignon, Senior Vice President and Chief Economist, The World Bank

main findings for determinants of EA. I will pay special attention to the literature concerned with the impact of migration on EA.

Development of education attainment literature

This review relies largely on several extensive reviews of the literature available within the economics of education. A review of the literature up to 1995 can be found in a JEL article by Haveman and Wolfe (1995) and some later developments are discussed in the 2000 textbook by Belfield (2000). A discussion of the frontiers of the economics of education in developing countries is presented in a chapter of the Handbook of the Economics of Education, Glewwe and Kremer (2005). An early review of the human capital theory was given by Blaug (1976).

Before the arrival of the human capital theory developed by Becker (1964), economists were accustomed to view **education primarily as a consumption** item. Analysis of the determinants of EA based on this view would typically control for household income, family tastes and price of the education. A classic example of this consumption-based approach can be seen in a 1967 paper by Campbell and Siegel (1967).

In contrast to the consumption-based approach, the human capital theory is based on a view of **education as an act of investment**. When education is viewed as an investment, demand for it must be determined by such factors as returns to education, borrowing constraints, opportunity costs of investment, risk aversion, and other typical investment model factors. The empirical literature that tried to estimate the role of these factors closely followed the development of theoretical models of human capital.

To begin with, a series of papers in the 1970s estimated the elasticity of demand for education in response to changes in salary for different occupations. In other words, they estimated a response of invested amount to future returns on that investment (see the review in Freeman, 1986). Further evidence for investment theory came with the estimation of the role of opportunity costs of education. In an important paper, Manski and Wise (1983) used local wage rates as a measure of foregone earnings and found that higher wage rates tend to diminish local enrollments in college. This provided further support for investment-type models of education.

Subsequently, in their seminal paper Becker and Tomes (1986) introduced the role of family background and family decision-making into the model. This model distinguished between genetic and acquired endowments of a child, modeled the role of parents in the decision-making process, and introduced endogenous fertility together with the educational choices. The goal of Becker and Tomes was to estimate mobility of earnings, wealth and ability between generations, so-called "intergenerational mobility".

Quite soon, the development of the theory and growing complexity of the models outpaced the development of the econometric methods used in the empirical work. In the late 1980s, quite a few papers were focused on particular determinants of EA, but downplayed the role of all the other potential aspects. Haveman and Wolfe (1995) present a meta-analysis of such groups of papers: papers on the effect of borrowing constraints, on the role of education and occupation of the parents, on the role of community level characteristics, etc.

One of the persistent econometric difficulties in the analysis of determinants of child EA was the presence of unobserved family background variables that are likely to be correlated with many other observed family covariates. Two solutions to this problem gradually emerged: the research on sibling data and use of longitudinal panel datasets.

In the sibling analysis, researchers would use between-sibling variation in outcome and covariates. For example, to estimate the effect of divorce in the family on child EA, one would interact the event of divorce with the age of the child and hold other family fixed effects constant. Of course, one would identify the effect only for the subsample of families with two or more children.

The longitudinal analysis makes it possible to control for family fixed effect by analyzing the variation in the timing of events during childhood. Furthermore, longitudinal data allow researchers to estimate life cycle models of human capital investment, taking into account self-selection of the agents into different occupations. An example of the frontiers in this type of analysis can be found in two papers by Keane and Wolpin (1997, 2001), which use 11 years of the NLSY data.

The human capital theory of education proved to be an excellent tool both in theoretical and empirical applications. Yet, it is not the only way that economists look at education, and I will briefly mention here the other alternatives.

First of all, the human capital investment theory of education was accompanied all along by a competing theory, which viewed **education as a signaling** or screening process. According to this theory, the primary goal of education is *not* to accumulate human capital, but to reveal the individual's inherent ability and skills to the prospective employer. While very different in theory, in practice it turned out to be difficult to distinguish empirically. Both predict a positive effect of education on earnings and self-selection of the individuals by enrollment decisions. Yet, the two models have quite different implications for the determinants of EA. In particular, if education is primarily a signaling tool and does not raise individual human capital, then persons with better prospects of self-employment would end up getting less education than those engaged in wage employment. Wolpin (1977) empirically confirmed the presence of such a phenomenon in his 1977 paper.

Another view of education recognizes it as an instrument to create social networks and produce so-called social capital. For example, one may consider the important role that fraternities and socializing play on college campuses in the US. The theory of social capital is a rather recent one and has not yet achieved full recognition by mainstream economic literature. A recent paper by Laibson et al. (2002) tries to build a framework for the accumulation of social capital and to distinguish it from human capital. Unlike human capital, social capital is not calculated on the individual level, but is defined for a network of people. In this regard the social capital theory of education would provide additional determinants of school enrollment. On the other hand, higher social capital of the neighborhood was shown to facilitate the supply of schooling by increasing the motivation for intergenerational loans from the older generation to the younger generation (Goldin and Katz, 1999).

Finally, education is sometimes modeled as a household-produced good, with one input being the time that children and parents devote to education, and other inputs being other market goods. This branch of the literature correlates closely with the literature on child quality. The papers treating education as household production are discussed in Gang and Zimmermann (2000). This literature is very important for the research on the effect of migration on EA, because it directly models the impact of parental time inputs (which has to change with migration of a parent) on the production of child EA. For example, a paper by Hanushek (1992) estimates the effect of absence of a father on the EA of the child (holding income constant). Surprisingly, Hanushek finds no significant effect, but some other studies do find such an effect (see page 5 in Antman, 2008)

Findings of the child labor literature

So far we have been considering the literature concerned primarily with the educational attainment of children. However, interesting results for EA may come from research on other topics, such as child labor. Indeed, in developing countries, child labor is often a primary substitute for education and the main opportunity cost of schooling is the foregone earnings from work (that a child could perform at home or on the market). The decision regarding child labor and education enrollment is probably made jointly and simultaneously in the household, so something that affects child labor would affect educational attainment as well.

One simple example of such analysis is a paper by Bonsang and Faye (2005). The authors estimate a multinomial logit model of a choice of child occupation among three options: work in the market, work at home or schooling. An important assumption of this paper is that schooling and child labor are mutually exclusive.

A paper by Beegle et al. (2005) reviews several studies of the child labor - schooling trade-off. The majority of these studies find a negative effect of child labor on child schooling. Some studies, however, argue that a child can do both activities at the same time if school hours are substantially short, in which case schooling and child labor are no longer mutually exclusive. In fact, Ravallion and Wodon (2000) find evidence just for that in Bangladesh; the increase in schooling was accompanied by a comparatively low reduction in child labor.

Another important question concerns the effect of household wealth on child labor. In an influential study Baland and Robinson (2000) model the relationship between parental income and child labor, and show that higher household income does not always lead to a decline in child labor. In fact, under certain conditions, an increase in parental income may lead to a decrease in expected transfers from the child back to his or her parents in the future; this would in turn lead to an increase in parental demand for child labor in the present. This interesting theoretical finding has been confirmed in the empirical literature (a meta-analysis of the results of 17 different papers is provided in a recent paper by Dammert (2005)).

Some authors, e.g. Basu and Van (1998), argue that one of the the primary factors for underinvestment in education is the fact that one can not have an enforceable contract with one's children, and that use of child labor is just a way for parents to get returns from their children as economic assets .

The determinants of educational attainment

In this subsection I summarize the possible determinants of educational attainment as suggested by the literature. Educational attainment viewed as investment would respond to the following factors:

- **returns to education**. Future monetary returns to education come from the increase in human capital productivity, signaling, and the acquisition of social networks. Returns to education are typically measured by future salaries or lifetime earnings. Studies typically estimate elasticity of the demand for education to be between 1 and 2. A meta-analysis of studies of elasticity of demand for education in returns to salaries is given by Freeman (1986).

What causes variation in returns to education? First of all, even though local returns to education are taken by households as given and can be considered exogenous, returns may vary between the local labor markets and especially between future migration destinations. Therefore, a new possibility of domestic or international migration may drastically change a household's perception of returns to education (McKenzie and Rapoport, 2003; de Brauw and Giles, 2005).

Returns to each additional year of education will vary by the level of education already achieved. While typical models of human capital formation involve negative second derivatives, there is also evidence of increasing returns to highly skilled human capital in developed countries, which partly explains the rise in inequality (Juhn et al., 1993).

On the individual level, returns to education are determined by child-specific abilities, which are usually unobserved by researchers. These abilities may be correlated with the abilities of parents and siblings. Depending on the model, we see two types of parental behavior with respect to child abilities: there is compensating behavior (if parents invest more in children with low abilities to equalize returns) or behavior which reinforces the differences (if parents invest more in children with high abilities and give monetary transfers to less able children) (Behrman, 1997). Returns to education may also vary by gender, and in most developing countries women in the same occupation with the same level of education earn considerably less than men (Lokshin and Mroz, 2003).

Finally, returns to education may be perceived differently by a child and his parents, depending on the contractual arrangement between the child and parents, and of parents' assessment of the value of the child's future utility. In non-altruistic models of parental behavior, parents may invest in a child's education primarily in the interest of future compensation (after they have retired) (Basu and Van, 1998). In such a case, it may matter for the parents whether the child is expected to stay nearby and support them in the future. In particular, since daughters are much more likely than sons to leave the household, perceived returns to parents from investment in daughters may be lower than for sons (Das Gupta et al., 2003). The possibility of outmigration of children may lower the link between parents and child as well.

- **opportunity costs of education**. First, there is an opportunity cost of time that a child spends on education, time which alternatively could be spent on work at home, work in the market or leisure. The opportunity cost for not-working at home is determined by a household home production function, and can be affected by such factors as household demographic composition, household productive assets (i.e. amount of agricultural land to harvest), and temporary income shocks. The opportunity cost for not-working on the wage market depends on the returns from the wage market (local or migrant), given the current level of education of the child. The maximum of those two costs would be the opportunity cost of studying.

  Second, an opportunity cost of monetary investment in a child's education lies in the possible income from investing that amount in the money market or elsewhere. For example, if returns on the money market are high, parents may choose to invest money in a bank rather than in the human capital of children, and compensate them with transfers later. A wealth model developed by Becker (reviewed in Behrman, 1997) predicts that parents will keep investing in their children's education until the returns from education and from the money market are equal.

- **household wealth, credit and liquidity constraints**. If a household faces high borrowing interest rates or borrowing constraints, then parents may choose a level of human capital investment below the optimal unconstrained level. In such cases, an increase in wealth of the household will shift the constrained choice of education higher, towards the unconstrained one. This can happen for two different reasons: wealthier households can borrow at lower interest rates than poorer, riskier households, or sometimes wealthier households may not need to borrow at all. When a household has reached the wealth threshold such that the borrowing constraint is no longer binding, the effect of an increase in wealth of the household on investment in education is expected to drop in magnitude (i.e. exhibit non-linear behavior) (McKenzie and Rapoport, 2003).

  While the theoretical effect of wealth and income on education is largely acknowledged, its identification remains a difficult task. In a 1999 article, Behrman and Knowles (1999) present an overview of the results of 21 papers which attempt to estimate the elasticity of various measures of educational attainment with respect to household long-term consumption. Many of the papers deliver significant positive elasticities, but interpretation of such estimates, including the ones derived in the Berhman paper, remains problematic because of the issues of measurement error and endogeneity of income variables.

- **other determinants of investment**. When it is not posible to borrow, investing in education involves a trade-off between current and future consumption. Such a trade-off will depend on the household discount rate and on the marginal utility of substitution between current and future household consumption. The lower the current level of consumption, the higher it is valued by the household relative to future consumption, and the less is invested in child education.

When education is treated as consumption, the quantity demanded depends on its price (i.e. tuition) relative to other goods, total household income (education is often claimed to be a normal good) and parents' taste. Parents' taste for education is likely to be affected by their own level of education and that of their parents and friends. Parents' marginal utility from the consumption of education can depend on such child characteristics as gender (particularly important in South Asian countries) and birth order (Das Gupta et al., 2003).

If education is viewed as screening or signaling, then it should create less incentive to acquire education for prospective self-employed individuals (Wolpin, 1977).

Finally, when education is modeled as a produced good, several groups of factors may influence the production process:

- **social factors** determine the available supply, cost and quality of education. This includes availability and proximity of schools, cost of tuition, teacher to pupil ratio, quality of teachers and educational institutions in general. A detailed review of the school quality literature and its effect on EA is provided in the Glewwe and Kremer (2005).

- **household factors** On the household level, the process of educating a child is considered to depend on the composition and number of adults in the household. Parents and other adults can serve as role models and help children to learn how to read and do homework. This effect depends, of course, on the educational level of adults. The number of other children in the household that share and split available resources and responsibilities can either lower or raise the educational attainment of a child.

Findings of the literature on migration and educational attainment.

Several effects of migration on educational attainment are identified in the literature. First, there can be a direct income effect from migration and remittances. The income effect can enter through an investment channel or consumption channel and is expected to be positive. On the other hand, if higher parental income is accompanied by an increase in child labor, as in Rogers and Swinnerton (2004), EA can actually be reduced. In addition, a household may suffer a period of economic setback immediately following the migrants' departure, before the remittances begin to arrive. During this time, the child may be forced to forgo schooling temporarily or even permanently.

Second, the absence due to migration of a member of the household will have its own effects on EA (Antman, 2008). The child's performance in school may deteriorate because of the absence of role models and decreased parental supervision. Another possibility is that a child may be forced to forgo schooling if the absence of a household member raises the child's productivity at home. This effect is probably going to be more significant for boys than for girls, as boys are better substitutes for an absent male. However, long-term effects of remittances may encourage a household to start up a new enterprise; this could in turn increase returns for the education of children working in that enterprise. [2]

Finally, the experience of migration in the household (and to some extent in the village) may change the perception of returns from education for the household members (McKenzie and Rapoport, 2003). If migrants' native education is not valued abroad, this would give a negative incentive for prospective migrants to study (even if they end up not migrating). On the other hand, if skilled labor is valued abroad (for instance, countries like Canada and Australia import only high-skilled workers), then the opposite effect would be observed.

To sum up: three different channels of how migration can effect educational attainment are established in the literature, while the total expected effect of migration on child EA remains undetermined. This is why it may be interesting to estimate it from the policy perspective. Theoretical models also predict potential variation of this effect between different age and gender groups. It is hard to decompose the total effect of migration through the three channels mentioned above, and most of the papers on migration and education either implicitly or explicitly treat the total effect as a a black box, failing to identify the contribution of each channel separately.

[2] On the other hand, as mentioned earlier, if education has a signaling effect only, then having an enterprise in the family may reduce the incentive for children to acquire education.

To further complicate matters, the research on migration and education is plagued by problems of endogeneity and selection. The same unobserved factors may affect both migration of the parent and school enrollment of the child (for example, a severe negative income shock may force both migration of a parent and withdrawal of a child from school to work in the market (Antman, 2008).

Overall, the literature on the effect of migration on educational attainment remains rather limited; as of December, 2008 it consists of one published paper and five working papers, which I review in greater detail below. In the earliest of those papers, Edwards and Ureta (2003) try to determine the effect of income from remittances on the educational attainment of children in El Salvador. They estimate that the impact of income from remittances is positive, i.e. that remittances significantly lower the hazard of dropping out of school, and that this effect is 3 to 10 times larger than the impact of income from other sources.[3]

To get these results, Edwards and Ureta used the cross-section data on 14,000 children aged 6 to 24 from the Annual Household Survey (EHPM) in 1997. The authors make the dependent variable the event of leaving school, conditional on being enrolled in the previous year. In other words, they apply the Cox proportional hazard model (CPH) to estimate the effect of the covariates on child educational attainment. They argue that the benefit of the CPH model in estimating total attainment is that it incorporates information on children currently enrolled in school (right censored). However, one shortcoming of this approach is that unenrolled children are assumed to have dropped out of school for good, whereas in reality some of them will return to school the next year. In the paper, such children are treated as if they will not re-enroll, and the estimate of total attainment for El Salvador may consequently be too low.

[3]In particular, receiving $100 in remittances is estimated to lower the hazard of leaving school by 25% in rural areas and by 54% in urban areas.

In the estimation, Edwards and Ureta control for gender of the child, access to basic services like water and electricity, parental education and two sources of family income: income from remittances and total income net of remittances. Two questions arise in this regard. First, they do not control for the age of child which is, of course, an important determinant of enrollment (despite the fact that hazard function estimates are conditional on the obtained grade by construction, obtained grade and age of child can be different in Nepal as I show in section 3.3). Second, there are problems with putting income variables on the right hand side. One problem, as the authors mention in the paper, is that current household income is used as a proxy for the permanent household income, and therefore it is measured with error by definition. In addition, both income from remittances and income net of remittances are potentially endogenous in respect to enrollment of the child. Edwards and Ereta argue that, since most of the migration in El Salvador occurred for political reasons in the 1980s, remittances income can be seen as exogenous.

Even if the migration decision was exogenous, however, the fact of sending remittances might not be; This would make income from remittances endogenous. Endogeneity of income net of remittances can stem from two sources. First, it can be affected by same unobservable factors that affect education of the child. Second, it can can be directly affected by child enrollment decision, since the child can work in the wage market instead of going to school. Overall, recent economic literature stresses the importance of using the household wealth rather than transitory income, and the need to control for endogeneity of the migration decision and remittances amounts (Haveman and Wolfe, 1995).

In the other working papers on education and migration, the problem of endogeneity is addressed in various ways. One of the commonly used instruments to account for the non-random selection of migrant households is the historical regional migration rates.

In a working paper written by Acosta (2006), the conclusions derived by EU are reexamined. Acosta uses the next round of EHPM data, the IV probit estimation rather than the

CPH estimation model used by Edwards and Ureta, and controls for the selection of migrants using village level networks as an instrument. Village level networks are measured by the proportion of the migrant families in the village. Acosta confirms the positive effect found by Edwards and Ureta, noting that it does not seem to apply to older boys (15-17 years old).

However, the instrument used by Acosta is subject to criticism for being influenced by current economic conditions in the village, and thus being correlated with the outcome of interest. In the papers described below, the authors use the *historic* level of migrant networks, which is a more refined version of the same instrument. Historic level networks with sufficient lag are argued to determine migration in the present but to be uncorrelated with current economic shocks.

In two very similar papers, Hanson and Woodruff (2003) and McKenzie and Rapoport (2003) study the effect of having a U.S migrant in the family on the educational attainment of children left at home in Mexico. Hanson and Woodruff use a 10% subsample of 10-15 year old children from the 2000 Mexico Census of Population and Housing, and McKenzie-Rapaport use the data from the 1997 ENADID survey, focusing on children 12 to 18 years old. Both of the papers use historic lagged state-level migration rates interacted with the household level variables to have a variation of instrument on the household level. It is argued that this instrument has an effect on the probability of migration, but does not affect education outcomes of the children. In regards to the estimation technique, both papers use the grade achieved at school as the dependent variable. Hanson and Woodruff use instrumental variable linear regression, but McKenzie and Rapaport go beyond the linear probability model, using iv-ordered probit and iv-censored ordered probit. Hanson and Woodruff find the positive effect of having a migrant in the household on grade achievement of girls of poorly-educated mothers (0-8 years) and an insignificant effect on boys. McKenzie and Rapaport actually report a negative effect of living in a migrant household (20 % lower chance of completing high school for boys and 14% for girls). Their explanation for this phenomenon is that children in migrant households are more likely to migrate themselves and, therefore, have lower expected returns to education.

However, as Antman (2008) points out in her paper, if networks reduce the cost of migration, then the presence of networks can affect the child's prospects of future migration and thus change the expected returns of education and the optimal level of educational attainment. This case would make the use of the instrument problematic.[4]

To take care of family-level fixed effects that may cause both migration and education, Antman follows an approach from the sibling research literature (see Haveman and Wolfe, 1995). The effect of migration on education is identified through the variation of its magnitude on children within the family, conditional on the age of the child when migration occurred. Antman uses a sample of siblings at least 25 years old from the Mexican Migration Project data (MMP107), and uses retrospective migration history to figure out the age of the child when the first migration happened. She concludes that migration of a father has a positive impact on education of the girls (about one additional year) and no impact on the boys. It turns out that the results of her analysis are the opposite of those found in McKenzie and Rapaport and Haveman and Wolfe studies. Of course, since the sibling method only estimates the effect on the sample of two-child households that have a migrant, additional assumptions are needed to generalize the results for the whole population.

A working paper by Mansuri (2006) tries to use both of the above-mentioned approaches separately. Her interest lies in the effect of migration on educational attainment and child labor in Pakistan. Mansuri takes the data from the Pakistan Rural Household Survey (PRHS) 2001-02 and examines the educational and labor outcomes of children aged 5-17. For the instrument, Mansuri uses the current proportion of households with a migrant in the village, interacted with the number of adult males in the household. At the same time, village-level

[4] de Brauw and Giles (2005) estimated that the village-level reduction in cost of migration in China resulted in a substantial drop in high-school enrollment, since the opportunity costs of education increased

fixed effects are used to take care of village-level unobservables that may determine both the migrant networks and educational attainment outcomes. Therefore, by interacting the village-level instrument with the household-level variable, Mansuri attempts to simultaneously use village-level instrument and control for village-level fixed effects. However, her assumption that the number of adult males in the household does not affect children's educational outcomes (conditional on other household level variables) remains questionable, especially given the extensive literature on the role of adults as role models for a child's educational performance (see Haveman and Wolfe, 1995).

In a separate exercise, Mansuri examines within-family variation of the age of a child at the time of migration and its effect on the educational outcomes. To take care of the endogeneity in the present level of village networks, Mansuri uses the interaction of village networks with the number of adult males in the household, and focuses on within-family variation of educational attainment between siblings. Mansuri finds a positive effect of migration of a household member on the educational outcomes of children using both ways of the estimation with a much larger effect for girls (50-65% increase in enrollment rates) than for boys (7-15% increase). However, enrollment rates of boys were already much larger to begin with.

Numerous other papers on the various effects of migration have used historical migration rates as the instruments for migration decision (See the discussion in Rapoport and Docquier, 2006, page 1186). Historical migrant networks are also occasionally used as instruments in the literature on the impact of immigration on the local labor markets (for example Card, 2001).

Some researchers used measures of regional variation in cost of migration as an instrument. Of course, one needs to show that such variation is uncorrelated with the determinants of the outcome of interest. An example of this is a working paper by de Brauw and Giles (2005) on the effect of an increase in migrant opportunities on enrollment in school. To migrate internally in China, one needs a national passport. In 1998, passports were not yet available to most rural residents; since then various rural locations started to issue passports to their residents at different times. deBrauw and Giles prove that this variation is exogenous and uncorrelated with local economic conditions. Using this instrument to control for the emergence of migrant networks, they find that enrollment in high school falls significantly with the rise of the opportunity to migrate.

Among the other approaches, a series of papers by Yang (2004) are notable for the use of exogenous fluctuations in the exchange rates as an instrument for the amount of migrant's earnings and the amount of remittances sent from abroad. Using the variation in migrants' destinations during the 1997-98 Asian exchange rate crisis, Yang is able to identify the effect of remittances on entrepreneurship and household consumption in Phillipines.

Table 3.1 summarizes the contributions and findings of existing migration literature.

Table 3.1: Summary of the literature on the effect of migration on education

	country	**age groups**	**method**	**control for endogeneity**	**effect on boys**	**girls**
Cox-Edwar.	El Salvador	6-24	(CPH)	no	$\succ 0$	assumed similar
Acosta	El Salvador	11-17	IV probit	present networks	$\succ 0$	$\succ 0$, stronger for girls
Hanson	Mexico	10-15	IV reg.	lagged networks	0	$\succ 0$, if low educated mothers
McKenzie	Mexico	12-18	Censored ordered IV probit	lagged networks	$\prec 0$	$\prec 0$, weaker for girls
Antman	Mexico	0-25	Sibling reg.	age of child at the migration	0	$\succ 0$
Mansuri	Pakistan	5-17	IV reg. and sibling. reg	current networks + age of child	$\succ 0$	$\succ 0$, stronger for girls
DeBrauw	China	high school	IV regression	issuance of national id	$\prec 0$	$\prec 0$, same

3.3 Data, descriptive analysis and introduction to the Nepalese Educational System

3.3.1 Data

This paper's analysis is based on the data from two rounds of the Nepal Living Standards Survey (NLSS) and data from the national census of households, 2001. The NLSS, a nationally representative survey of households and communities, was conducted between June 1995 and June 1996 (NLSS-I) and April 2003 and April 2004 (NLSS-II) by the Nepal Central Bureau of Statistics, with the assistance of the World Bank.[5] NLSS I and II data are comparable in terms of survey methodology, interviewing procedures, and questionnaire content. NLSS modules contain detailed information on household composition, individual activities of household members, their educational background and current or past school attendance. A special part of the questionnaire is devoted to the receipt of household remittances, providing information on the age and sex of sender, the relationship of sender to recipient, the amount of remittances and the location from which they were sent.

The NLSS-II sample includes both cross-sectional and panel components. The cross-sectional sample was constructed using a two-stage design based on the 2001 Nepal Census sample. The primary sampling units (PSUs) were identified using probability proportional to size sampling. Within each PSU, 12 households were selected using systematic sampling. Panel PSUs in NLSS-II were randomly selected with equal probability within each of the six strata as defined in NLSS-I (mountains, urban Kathmandu, urban hills, rural hills, urban Terai, and rural Terai). The survey's sample covers 73 districts of Nepal (excluding the Rasuwa and Mustang districts). The NLSS-II sample includes information on 326 cross-sectional and 95 panel PSUs enumerating 3,912 and 1,160 households respectively. To create a larger sample,

[5] NLSS questionnaires can be downloaded from http:\www.worldbank.org/lsms

I combine the cross-sectional and panel samples of NLSS II into one dataset [6]. The combined dataset includes 5,051 households with 7,182 children of school age (6-16) and 7,414 adult males (17-60).

3.3.2 Internal and international migration in Nepal

In this section I describe characteristics of internal and international migration in Nepal using information from Census 2001 data and NLSS surveys. According to (Central Bureau of Statistics, 2003) internal migration within Nepal steadily increased following the eradication of malaria in the Terai plains in the 1950s. In 2001, 22% of the population was living outside their district of birth and 3% of the population had changed district of residence in the last five years. The major stream of migrants (69% of all the migrants) moved from rural to rural areas. Rural to urban migrants constituted 26% and urban to urban just 3%. Geographically, the main direction of migration was and remains from the mountains and hills of the north to the Terai plains in the south.

International migration has two distinct destinations. First of all, India, bordering Nepal to the south, continues to attract a great deal of migrants from Nepal. Historically, citizens of Nepal did not need visa to enter or work in India. In this respect, migration to India can be seen as a natural extension of internal migration. According to NLSS, migration to India constituted 85% of all abroad destinations in 1993-94. However, migration to other foreign countries grew in importance after the 2001 reform simplified the procedure to get a travel passport. In 2003-04 18% of migrants went to Gulf countries, including Saudi Arabia, Qatar and UAE, and the share of migrants to India dropped to 65%.

Overall, according to NLSS 2004, 14% of households reported receiving remittances from

[6] In order to calculate country-level averages, population weights in the combined sample had to be adjusted accordingly.

Nepal and 18% from abroad. If receving remittances is used as an indicator of having a work-related migrant, this gives a total figure of 32% of households with work-related migrants. Accoridng to an alternate definition, a migration event in the household occurs when an adult male member of the household is absent from the household for more than six months. This definition gives an estimate of 29% of households with a working migrant.

Table 3.2 presents information on remittances in families with children grouped by the relation of sender to child.[7]

Table 3.2: Remittances patterns among children age 5 to 15

	Remittances sent from		
Relation of sender to child (%)	Nepal	Abroad	Total
Father	31	53	44
Brother	27	30	29
Uncle, father's side	13	11	12
Sister, aunt, mother	10	1	5
Other relative	19	4	10
Total	100	100	100
% of children, receiving remittances	13	18	30
% of children, receiving remittances from father	4	10	13
% of children, with father residing elsewhere			18

Table 3.2 reveals several important facts. First, the overall share of children receiving remittances is just about the same as the share of households receiving remittances in Table 1 of Bontch-Osmolovski and Lokshin (2007). Therefore, household with migrants have about the same number of children as no-migrant households. Second, 85% of all remittances are sent by either the father, brother or an uncle of the child (note that within one household a sender can simultaneously be the father of one child and an uncle of another). Third, a significant share of remittances sent from Nepal is sent by relatives outside the primary family,[8] who

[7] NLSS only considers the question of the relation of sender to the household head. I calculated the relation of sender to the child in the family by identifying relatives through information on their names, names of parents of their parents, relationship to household head and maternity history.

[8] A Nepalese household may consist of a household head, his parents, his wife, his sons and his daughters

usually reside in different households (for instance, relatives of the child's mother). These are in fact not remittances, but transfers between separate families. The share of fathers relative to brothers and uncles is lower among domestic senders than international senders. Finally, 5 % of children have fathers residing elsewhere but do not report that they receive remittances. Divorces are still extremely rare in Nepal; most likely in these cases, the father brings earnings from working elsewhere in person (or remittances were not reported for other reasons).

3.3.3 The Nepalese Educational System

Education in Nepal is structured between grade-school and higher education (college and above). Grade-school education includes a primary level of grades 1-5 (ages 6-10), lower secondary and secondary levels of grades 6-8 (ages 11-14) and 9-10 (ages 14-15). Pre-primary education is also available in certain areas. Secondary levels of education are usually taught in different locations than primary schools; these often require longer travel time or may not be available at all in the area.

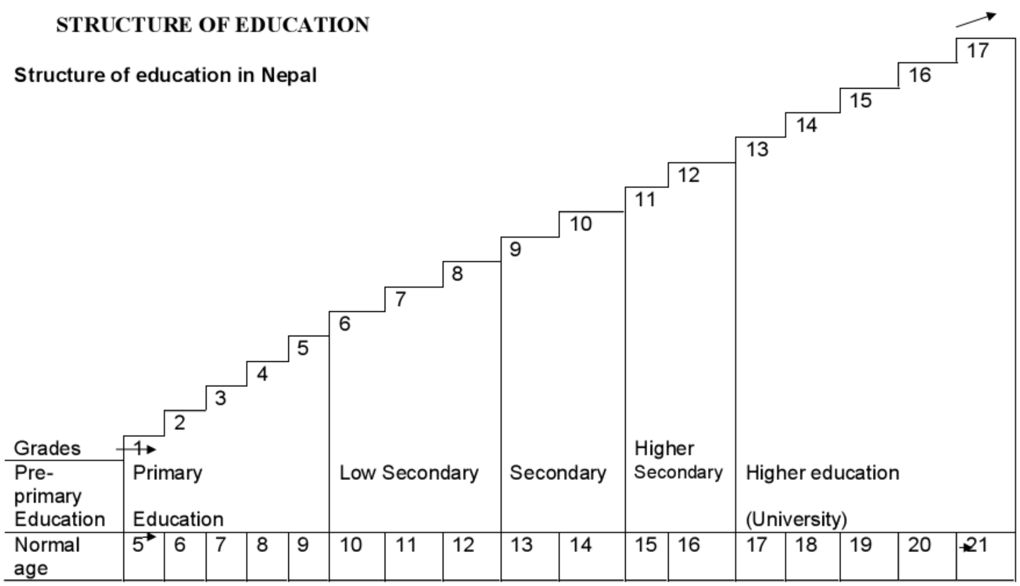
At grades 5, 8 and 10, students are required to pass a set of exams to complete the corresponding level of education and advance to the next one. To advance to higher education (college) a student has to pass a national exam after grade 10 and obtain a School Leaving Certificate (SLC examination). It usually takes an additional year to prepare for the SLC examination.

Education in primary school is compulsory by law, and six years of age is the prescribed age for admission into grade one. However, almost 50% of children enroll in first grade as young as the age of five. This results in some confusion regarding the official age of enrollment. Various authors use either five or six as the starting age of enrollment. Even the documents from the Nepali Ministry of Education and Sports are not consistent in this regard.

(if they are young), his brothers and sisters (if they are young) and his grandchildren. When women marry they usually leave the household. Consequently, relatives of the household head's wife do not typically reside in the household.

Figure 3.1 shows the official age-to-grade correspondence matrix, which begins at the age of five. However, other documents use a starting age of six (at this age enrollment becomes compulsory). In this analysis, I will use six as the prescribed age of enrollment into primary school, as many of the five-year-olds are either postponing their enrollment or repeating the 1st grade. The prescribed ages for low secondary and secondary schools are defined to be from 11 to 13 and from 14 to 15, respectively.

Figure 3.1: Age to grade official matrix, 2001



Source: Ministry of Education. www.moe.gov.np

Table 3.3 presents a snapshot of official educational statistics for 2001. This table shows several important characteristics of the Nepalese educational system. The enrollment rate in primary school is fairly high, but in low secondary and secondary schools we can observe a gender gap in enrollment and, consequentially, a sharp drop. One factor that explains this drop in enrollment is the availability of schools. In 2002, there were only half as many low secondary and secondary schools as there were primary schools.

Transition rates presented at the bottom of the table show that about 80% of children who

Table 3.3: Country level statistics, 2001

		Primary	Low secondary	Secondary	Total
Schools		24,943	7,340	4,113	25,194
Enrollments	Total	3,853,618	1,058,448	449,296	5,361,362
	Girls	1,726,253	446,382	186,092	2,358,727
	Girls %	44.8	42.2	41.4	44
	Boys	2,127,365	612,066	263,204	3,002,635
Teachers		96,659	26,678	18,846	142,183
Student/School		154.5	144.2	109.2	212.8
Teacher/School		3.9	3.6	4.6	5.6
Student/Teacher		39.9	39.7	23.8	37.7
Age group population		6-10	11-13	14-15	6-15
	Total	3,091,258	1,673,887	1,025,415	5,790,561
	Female	1,504,414	826,176	517,623	2,848,213
	Male	1,586,844	847,712	507,792	2,942,349
Gross enrollment rate					
	Total	124.7	63.2	43.8	92.6
	Girls	114.7	54	36	82.8
	Boys	134.1	72.2	51.8	102
Net enrollment rate					
	Total	81.1	39.4	25.5	59.2
	Girls	75.1	33.7	20.9	53.2
	Boys	86.9	45	30.2	65
Transition rate					
(primary to low secondary)	Total	82.1			
	Girls	81.8			
	Boys	82.3			

Source: Ministry of Education. www.moe.gov.np complete primary school enroll in secondary school. How is it possible that the enrollment rate in secondary school remains low, despite such a high transition rate? Several reasons explain this paradox: high incidence of grade repetition, problems of late enrollment in primary school and a low completion rate of 60%.

The incidence of grade repetition and late enrollment can be judged from the disparity between net enrollment rates and gross enrollment rates for all the school levels. The net enrollment rate is defined as the share of children of the relevant age that are enrolled in school among all children of that age group. The gross enrollment rate is defined as the share of children of all ages that are enrolled in school among all children of that age. The fact that gross enrollment is so high shows a particular problem in Nepalese education: that many older children are being enrolled in primary schools together with younger children, either because of a late start or because of grade repetition.

Indeed, other government reports show evidence of very high rates of repetition (percent of students that repeat a grade). Table 3.4 presents this data. Repetition rates are very high

Table 3.4: Internal efficiency of education, 2003

	Promotion rate			Repetition rate			Dropout rate		
Grade	Total	Girls	Boys	Total	Girls	Boys	Total	Girls	Boys
1	50.8	50.8	50.8	34.0	33.7	34.2	15.3	15.5	15
2	74.9	74.8	74.9	19.4	19.8	19.1	5.8	5.5	6.0
3	77.7	77.8	77.6	15.3	15.6	15.1	7.0	6.6	7.3
4	76.9	77.1	76.7	15.7	15.8	15.5	7.5	7.1	7.7
5	73.0	72.6	73.3	13.5	13.8	13.3	13.5	13.6	13.4
6	78.7	78.7	78.7	15.4	16.2	14.8	5.9	5.1	6.5
7	81.5	81.6	81.4	12.4	12.8	12.2	6.0	5.6	6.4
8	74.5	74.0	74.8	18.6	19.4	17.9	7.0	6.6	7.3
9	76.9	76.8	76.9	16.0	17.0	15.2	7.2	6.2	7.9
10	-		-	17.9	19.7	16.6	-	-	-

Source: Ministry of Education. www.moe.gov.np

especially for the first grade: one out of three students repeats the first grade. Likely, this high rate is driven by the underage enrolled children that stay for an extra year to catch up with the six-year-olds. Yet, even in the higher grades, repetition remains very high relative to other regions in South Asia. Drop out rates are also high in the first grade, but it is possible that some of the drop-outs reenroll in school next year.

Grade repetition leads to increased class sizes, lower teacher-to-student ratio and a mix of students of different ages in a class, making it harder for teachers to teach and students to learn. To generalize, while Nepal has made considerable progress in overall primary school enrollment and has seen drop-out rates plummet, the high repetition rate plagues the educational system and is a big problem for primary school students.

What are the reasons for the high repetition rates? Official reports from the Ministry of Education cite inadequate teacher training, a high level of absenteeism and low level of student commitment as primary factors. In other words, some children are enrolled formally, but have to contribute a lot of their time to household work and are unable to advance to the next grade.

Another acknowledged problem of education in Nepal is connected to the disparities between outcomes in regard to ethnicity and gender of the child. A recent descriptive paper by Stash and Hannum (2001) summarizes the role of caste and gender in long-term educational trends as of 1991, using DHS data. In the next section, I present the evidence on educational outcomes from the NLSSS data that I am using for this paper.

Evidence from the NLSS surveys of 1995-96 and 2003-04

It is evident that total enrollment rates calculated in NLSS for 2003-04 are lower than official enrollment rates reported in table 3.3 for 2001. Since there was an overall increasing trend in enrollment rates, this difference cannot be explained simply by difference between the years.

Table 3.10 on page 135 presents changes in net enrollment rate (NER) between 1996 and 2004.[9]

Table 3.10 shows that from 1995 to 2003 primary school NER increased by 10% points

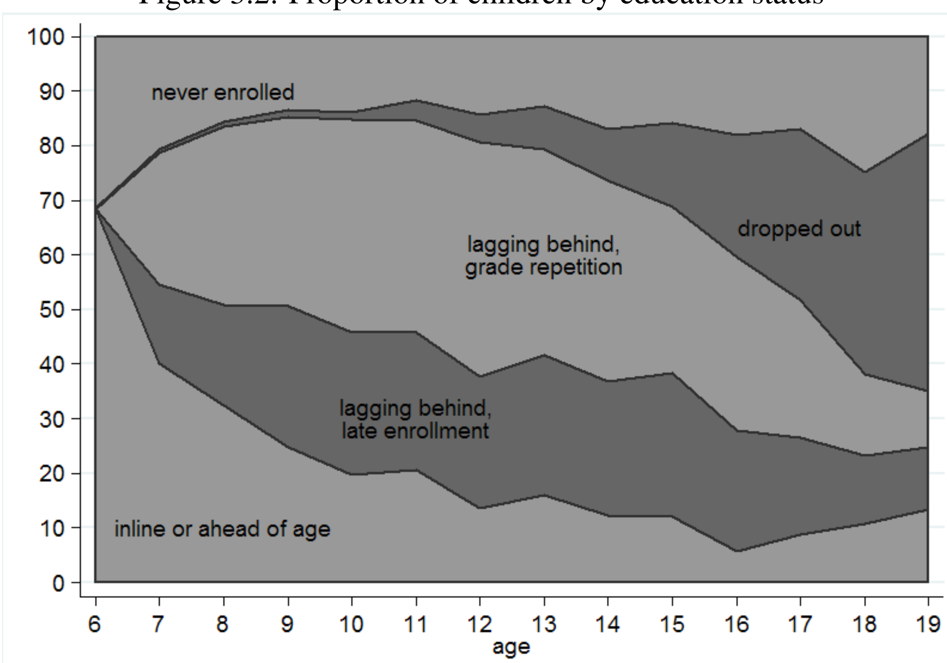
[9]The net enrollment rate (NER) is the share of children of primary school age that are enrolled in primary school.

(from 67% to 78 %) for boys and by 20% points (from 46% to 67%) for girls. Nepal has a compulsory education requirement only for the first 5 years of primary school, and not surprisingly, NER for secondary school drops dramatically at teh age of 11. On the other hand, secondary school enrollments also increased universally between the two periods for all the social divisions presented in the table.

Table 3.10 shows evidence of high variation in enrollment rates with respect to regional, ethnic and income groups. Enrollment rates are much higher in high-income groups, among advantaged ethnicities, and in urban areas. Gender disparity is almost negligible in urban areas and for high income groups, but has a very large presence in poor rural families and among Muslims. Overall, the lower the enrollment rate for boys, the bigger the gender gap between boys and girls.

Educational attainment by age

Figure 3.2: Proportion of children by education status



Source: author's calculation from NLSS.

Figure 3.2 (page 95) plots the proportion of children of certain age, categorized by their education status. The share of children who never went to school declines steadily from 5 to 11 years of age. The share of children who dropped out of school increases gradually from 11 to 18 years of age. Together this results in a U-shape function for the proportion of children who are not enrolled in school. In this paper I focus on the effect of migration on the probability of being enrolled in school only. Figure 3.2 shows that grade repetition is an important issue for the children of all ages, and needs to be studied separately.

3.4 Theoretical and empirical model of migration and enrollment

In this section I construct a theoretical and empirical framework for analyzing the effect of migration on enrollment. First, I start with a general discussion of how to define the effect of migration on enrollment in terms of conditional demand functions. Second, I calculate these effects in a simple theoretical model of household choice. Finally, I set up the empirical framework to estimate the effect of migration using Nepal survey data.

Effect of variable X on Y is usually defined as the change of Y variable, given the exogenous change in X, holding everything else constant. Since migration and schooling are both products of household's choice and endogenous in nature, the causality link between them is not obvious and demands closer examination.

I start with the assumption that a given household makes a joint simultaneous decision regarding an adult migration outcome M and a child enrollment outcome S. At this moment it is not necessary for me to specify the budget constraints and household utility function and solve explicitly for the optimal solutions (this is done in the later section). In general, as the result of a joint simultaneous choice, both migration and schooling enrollment outcomes will be some functions of exogenous parameters X.

$$
\begin{cases}
S^* = f^*(X) \\
M^* = g^*(X)
\end{cases}
\tag{3.1}
$$

(Stars * over the functions indicate that these are the optimal values). Despite the fact that the household simultaneously picks both M^* and S^*, this system can be rewritten as if maximization were a two step process. First, we solve for the optimal school enrollment choice, taking the migration outcome as given. Second, we pick the migration outcome that maximizes the utility function, given the optimal schooling choices. The optimal enrollment function then becomes a switching function of two conditional enrollment functions, depending on the value of optimal migration choice.

The system of equations, identical in solution to (3.1), becomes:

$$
\begin{cases}
S_0^* = f_0(X) \\
S_1^* = f_1(X) \\
M^* = g^*(X) \\
S^* = S_0^* I(M^* = 0) + S_1^* I(M^* = 1)
\end{cases}
\tag{3.2}
$$

The first two equations describe the optimal choice of schooling, conditional on migration, i.e. conditional demand functions. The third equation is unchanged. The fourth equation establishes identity with the system (3.1). Functions f_1 and f_0 are such that they are equal to the values of $f^*(X)$ on the corresponding subsets of X. i.e.

$$f_0(X) \equiv f^*(X), \text{where } X \text{ is such that: } g^*(X) = 0 \tag{3.3}$$

$$f_1(X) \equiv f^*(X), \text{where } X \text{ is such that: } g^*(X) = 1 \tag{3.4}$$

Under certain assumptions, conditional demand functions (if they are known or estimated) can provide an answer to the hypothetical question: "what would have happened if the household had made a different migration choice, while everything else that determines enrollment remained the same?" In this case, the difference between counterfactual outcomes S_0^* and S_1^* can be called the "effect" of the migration choice of the household on schooling enrollment. Formally:

$$D = S_1^* - S_0^* = f_1(X) - f_0(X)$$

Whether it makes sense to ask such a question and invest the time in getting an answer for it depends on the economic model adapted. There are several models which allow such a switch:

First of all, there could be a set of factors Z that influence migration decision, but not the enrollment decision. One example from the model solved later in the paper is the cost of migration and the income from migration; both of these factors, when there are no borrowing constraints, only influence the migration decision and not the enrollment decision. Then one may ask what would the enrollment be if the cost of migration dropped, for example.

Another example of Z is a sudden change in the preference for migration that a household may experience, e.g. a taste shift. If this change in taste is random we can say that the household changed its migration decision on a whim. If this change was influenced by some other factors, for instance, discovery of new information or an actual change in migration conditions, then we can say that household taste changed exogenously. In all of these examples, household switches to a different *optimal* state of migration and the corresponding level of enrollment will be set according to functions S_0^* and S_1^*.

One can also ask what would happen to a migrant household if the migration option was not on the table, if for example migration were banned for good. With such a question one must assume that such a policy has no general equilibrium effects, i.e. that other factors that determine schooling effort remain the same.

Finally, some models may allow households to make mistakes. In a non-deterministic world, governed by free will, we would ask what would happen if a household made a suboptimal migration choice by mistake. In a deterministic world, we would ask what would happen if there occurred an event that led the household to make a mistake regarding migration choice.

Each of these models results in the existence of counterfactual enrollment after the migration switch; we can call the difference in counterfactual enrollment the "effect" of migration. However, the particular cause of the switch in migration choice can be either more or less interesting. For example, free will and "whim choice" models are not so interesting, because it models an improbable situation when all or a large share of households make a sub-optimal choice. On the other hand, measuring "effect of change in migration on enrollment" is more interesting when there are policies that can influence migration outcome without simultaneously affecting enrollment, i.e. information campaigns or the lowering of travel costs or of sending remittances. In such cases, it may be preferable to avoid the "effect of migration" term altogether and focus on the effect of certain migration-changing policies on enrollment. Different migration stimulation policies will affect different households differently, and their resulting effect on enrollment will also be different. The "no-migration" question is interesting in its own way, because it quantifies the value of the option of migration itself, i.e. how much do we gain or lose in enrollment from having migration as an option.

An altogether different type of question concerns the effect on enrollment of some event that has a direct effect on both migration and enrollment decisions. For example, an increase in wages in the region simultaneously raises the opportunity cost of education and reduces incentive for migration. To study this effect it is not necessary to know the conditional demand functions in the system 3.2 and only necessary to know the solutions to the system 3.1.

The next section shows how to calculate effects of migration in a particular specification of a household model. My goal is to compare changes in the optimal schooling effort in the two scenarios: first, by comparing conditional demand of schooling effort between counterfactual migration choices, and second, by looking at the change of schooling effort as a result of change in migration, induced by increase in the returns from migration.

Theoretical model

The model is a standard two-period schooling investment model, modified to account for the potential effect of migration on human capital production. The household is assumed to select "schooling effort" of a child s (continuous) and migration dummy d in the first period, that will maximize a two period utility function of total household consumption C.

$$
\begin{aligned}
&\max_{d\in\{0,1\},s} U(C_1) + \delta U(C_2) \\
&C_1 = I_1 - ps + (R-Z)d - A \\
&C_2 = I_2 + \tilde{f}(H) + rA \\
&H = h(s,d) \text{ - human capital} \\
&A \geq 0, \quad \text{no borrowing}
\end{aligned}
\tag{3.5}
$$

Here, I_1 and I_2 are exogenously given incomes in each of the time periods, p is the price of schooling paid per unit of effort s (including the opportunity cost of schooling), $(R-Z)$ is the net reward of migration (remittances minus cost of migration) and A is the household savings that can be transferred to the second period. In the second period the household gets the return from investment in the child's human capital, according to the function $\tilde{f}(H(s,d)) \equiv f(s,d)$. One typically assumes that $\tilde{f}_h > 0, \tilde{f}_{hh} < 0, H_s > 0,\ H_{ss} < 0$.

This specification introduces several important restrictions having to do with how migration affects a household's budget constraint. The first restriction is that the production of human capital H depends only on the schooling effort and the migration dummy. This means, for example, that this model does not account for the possibility that malnourished children may perform worse in school, because household consumption does not enter the H function. Another restriction is that cost of schooling p is fixed and does not change with migration. Therefore, this model does not take into account changes in the opportunity cost of schooling, which may occur due to changes in the reallocation of labor because of migration.

Migration choice therefore enters the model in only two ways. First, it can have a purely monetary effect, adding net migration income $R - Z$ to household income in the first period. Second is the "absence" effect, since migration of a parent can change the level and the first derivative of the human capital of the child with respect to the schooling effort. In other words, it may change how much the child will learn and how much harder it is for him to learn more, *given* the schooling effort. The combination of monetary and absence effects will determine whether the total effect of migration will be positive or negative.

It is rather obvious to see that the monetary effect of migration on enrollment will be either positive or zero (this is shown formally below). The ambiguity of the effect of migration in this model comes from the absence effect, which theoretically can be either positive (if $f_{sd} > 0$) or negative (if $f_{sd} < 0$). f_{sd} measures by how much migration changes the marginal productivity of the child at school in terms of future returns. In the papers reviewed so far, it is speculated that the absence effect is likely to be negative because of the disruption of family life, the absence of a role model for the child, etc. (Antman, 2008; Hanson and Woodruff, 2003). At the same time, I can cite two examples where the opposite would hold. First, even if migration of the father indeed lowers the level of human capital (given the effort), i.e. $H_d < 0$, the marginal return from additional schooling effort may still rise, thus actually encouraging the exertion of more effort. Formally, $f_{sd} = \underset{-}{\tilde{f}_{hh}} \underset{+}{H_s} \underset{-}{H_d} + \underset{+}{\tilde{f}_h} \underset{?}{H_{sd}}$ and f_{sd} is undetermined. Second, it may be possible that out-migration of the father may improve the child's studying prospects, if the father was abusive, discouraged formal education, or otherwise impeded studying.

In summary, the sign of f_{sd} remains ambiguous. If $f_{sd} \geq 0$ then it can be shown straightforwardly that conditional demand for schooling effort will be same or higher in case of migration (non-negative income effect will be combined with non-negative absence effect). Keeping this in mind, throughout the rest of the section I examine the solution to the model for a more complicated and probably more plausible case: when migration of the father lowers child marginal productivity in school and the overall human capital, given the effort.

The solution to this optimization problem can be found in two stages. During the first stage we find the optimal schooling efforts $\hat{s}^0$ and $\hat{s}^1$ for each of the migration choices: d=0 and d=1. During the second stage we examine which pair of schooling effort and migration outcomes will bring the highest utility: $(\hat{s}^0, 0)$ or $(\hat{s}^1, 1)$.

First stage of the solution

In each of the two migration choices, the optimal schooling effort will be different depending on whether the household is bound by the borrowing constraint. I use the notation $\bar{s}^{0,1}$ for the internal solution with positive saving ($A > 0$) in each of the migration cases 0 or 1, and $\dot{s}^{0,1}$ for the corner solution with zero saving ($A = 0$). Altogether, the first order conditions of the system (3.5) provide four equations that determine optimal s, and two inequalities that determine whether A is positive or zero:

$$\bar{s}^0 : RS^0 \equiv f_s(s,0) - rp = 0 \tag{3.6}$$

$$\bar{s}^1 : RS^1 \equiv f_s(s,1) - rp = 0 \tag{3.7}$$

$$\dot{s}^0 : DS^0 \equiv f_s(s,0) - \frac{U_c(I_1 - ps)}{\delta U_c(I_2 + f(s,0))} p = 0 \tag{3.8}$$

$$\dot{s}^1 : DS^1 \equiv f_s(s,1) - \frac{U_c(I_1 - ps + R - Z)}{\delta U_c(I_2 + f(s,1))} p = 0 \tag{3.9}$$

$$d = 0, A = 0 \text{ if } DA^0(\bar{s}^0) \equiv \frac{U_c(I_1 - p\bar{s}^0)}{\delta U_c(I_2 + f(\bar{s}^0, 0))} > r \tag{3.10}$$

$$d = 1, A = 0 \text{ if } DA^1(\bar{s}^1) \equiv \frac{U_c(I_1 - p\bar{s}^1 + R - Z)}{\delta U_c(I_2 + f(\bar{s}^1, 1))} > r \tag{3.11}$$

The first two equations, (3.6) and (3.7), determine the optimal schooling effort when the borrowing constraint is not binding. In this case, choice of s depends only on the price of schooling, the interest rate and the slope of the return-to-schooling-effort function. It does not depend on income levels or monetary returns from migration.

The second pair of equations, (3.8) and (3.9), characterize choice of s in the presence of borrowing constraints. In this case, s becomes a function of $I_1, I_2, R - Z$, in addition to r and p.

The two inequalities, (3.10) and (3.11), involve the ratio of marginal utilities of consumption in two periods. This ratio determines whether the household would want to save or borrow in an unconstrained solution. Two properties of $DA(s)$ will be useful later. First, the derivative of DA with respect to s is positive: since the numerator is increasing in s and the denominator is decreasing in s, $DA_s > 0$. Second, $DA^0(s) > DA^1(s) \; \forall \; s$.

Let us now compare the values of $\bar{s}^0, \bar{s}^1, \dot{s}^0, \dot{s}^1$ for the given household. Such a comparison will allow us to evaluate the effect of migration as the difference between the counterfactual outcomes.

First of all, compare $\bar{s}^0$ and $\bar{s}^1$. Assuming that $f_{sd} < 0$, i.e. that $f_s(s, 0) > f_s(s, 1)$, and from (3.6) and (3.7) it follows that

$$\bar{s}^0 > \bar{s}^1 \tag{3.12}$$

This means that *for a household that does not wish to borrow in either migration case, schooling effort will be lower in the state of migration*. Here, the only effect of migration is the "price" effect (it lowers the marginal productivity of schooling). Potential extra income from migration does not play any role.

Whether $\dot{s}^0$ or $\bar{s}^0$ will be greater depends on whether the borrowing constraint (3.10) is binding or not. Suppose that constraint is binding, so that $DA^0(\bar{s}^0) > r$. Then, we have

$$\begin{cases} DS^0(\dot{s}^0) = 0, \quad \text{by definition} \\ DS^0_s = \underset{-}{f_{ss}} - \underset{+}{DA^0_s} p < 0 \\ DS^0(\bar{s}^0) = f_s(\bar{s}^0, 0) - DA^0(\bar{s}^0)p = rp - DA^0(\bar{s}^0)p < 0 \end{cases} \tag{3.13}$$

$$\Rightarrow \dot{s}^0 < \bar{s}^0$$

Intuitively, effort is determined by equalizing the return from extra education with either the interest rate or the marginal utility of the foregone consumption. The comparison of $\dot{s}^1$ and $\bar{s}^1$ can be done similarly. Therefore, *in both migrant and non-migrant households, if the household is bound by the borrowing constraint and that constraint is relaxed (i.e. the household is suddenly allowed to borrow), then the schooling effort would increase.* On the other hand, if the household was initially saving and then forbidden to save, then the schooling effort would decrease.

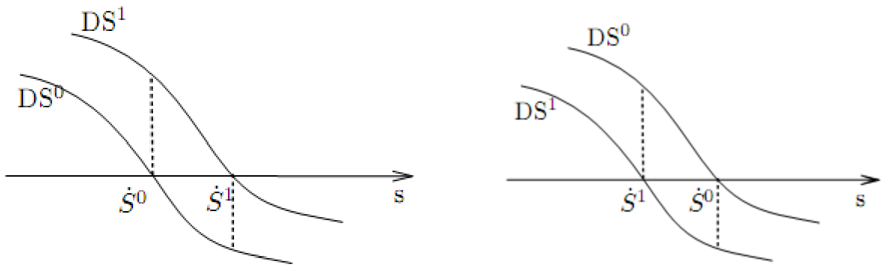
Now, let's turn to $\dot{s}^0$ and $\dot{s}^1$. They are determined as the roots of the equations $DS^0(s) = 0$ and $DS^1(s) = 0$. I already established above that $DS^0_s < 0$ and similarly one can show that $DS^1_s < 0$. The relation between $\dot{s}^0$ and $\dot{s}^1$ is then determined by the relation between DS^0 and DS^1, as seen from the following:

$$\begin{cases} DS^0(\dot{s}^0) = 0, \quad \text{by definition} \\ DS^1(\dot{s}^1) = 0, \quad \text{by definition} \\ DS^1_s < 0, \quad DS^0_s < 0 \end{cases} \tag{3.14}$$

$$\text{if } DS^1(\dot{s}^0) < DS^0(\dot{s}^0) = 0 \Rightarrow DS^1(\dot{s}^0) < 0 \quad \Rightarrow \quad \dot{s}^1 < \dot{s}^0 \tag{3.15}$$

$$\text{if } DS^1(\dot{s}^0) > DS^0(\dot{s}^0) = 0 \Rightarrow DS^1(\dot{s}^0) > 0 \quad \Rightarrow \quad \dot{s}^1 > \dot{s}^0 \tag{3.16}$$

Figure 3.3: Illustration of $DS^0(s)$ and $DS^1(s)$ functions



(a)
Case (3.15)

(b)
Case (3.16)

The interpretation is rather straightforward. DS is the difference between the marginal benefit of additional schooling effort, f_s, and the future value of the marginal cost of schooling p, where the time discount factor is the ratio of marginal utilities of consumption. The larger is the first-period marginal utility, the higher is the implicit price of schooling. Altogether DS is interpreted as the *net* marginal benefit of schooling effort, s. At the optimum, the marginal net benefit must be zero. Then the difference between DS^0 and DS^1, at either $\dot{s}^0$ or $\dot{s}^1$, shows whether migration raises or lowers the net benefit of schooling. In particular, if $DS^1(\dot{s}^0)$ is greater than zero, then migration raises the marginal net benefit of schooling and optimal effort must increase.

Consider the expression for the difference between DS^0 and DS^1 at $\dot{s}^0$:

$$DS^0(\dot{s}^0) - DS^1(\dot{s}^0) = \big(f_s(\dot{s}^0, 0) \underset{+}{-} f_s(\dot{s}^0, 1)\big) - \left(\frac{U_c(I_1 - p\dot{s}^0)}{\delta U_c(I_2 + f(\dot{s}^0, 0))} \underset{+}{-} \frac{U_c(I_1 - p\dot{s}^0 + R - Z)}{\delta U_c(I_2 + f(\dot{s}^0, 1))}\right) p \tag{3.17}$$

The sign of this difference is generally undetermined, as both the first and the second terms in brackets are positive. The first term measures the negative price effect of migration: how much migration hurts the productivity of schooling. This term is positive by the assumption of the model. The second term measures the combined income effect of migration. The second fraction has a lower numerator, because of the extra remittance income, and a larger denominator, because of the lower income return from schooling, than the first fraction. Both of these income effects lower the marginal utility in the first period relative to the marginal utility in the second period, so the implicit price of schooling becomes smaller (schooling becomes less costly in terms of giving up first period utility). The sign of total net effect depends on whether the price effect or income effect will be greater.

Finally, compare the values of $\bar{s}^1$ and $\dot{s}^0$. Consider the function $RS^1(s)$, which is defined in (3.7). We know that by definition $RS^1(\bar{s}^1) = 0$ and also that $RS^1_s = f_{ss} < 0$. Therefore, the relation between $\bar{s}^1$ and $\dot{s}^0$ can be determined by the sign of $RS^1(\dot{s}^0)$, or equivalently, by whether $f_s(\dot{s}^0, 1) > rp$.

$$\text{if } RS^1(\dot{s}^0) > 0 \Rightarrow f_s(\dot{s}^0, 1) > rp \quad \Rightarrow \dot{s}^0 < \bar{s}^1 \tag{3.18}$$

$$\text{if } RS^1(\dot{s}^0) < 0 \Rightarrow f_s(\dot{s}^0, 1) < rp \quad \Rightarrow \dot{s}^0 > \bar{s}^1 \tag{3.19}$$

The interpretation of these conditions is the following — they determine to what extent migration lowers the marginal return to schooling at the effort level $\dot{s}^0$. We know that if at no-migration regime the household faces a borrowing constraint, then $\bar{s}^0 > \dot{s}^0$ and $f_s(\dot{s}^0, 0) > f_s(\bar{s}^0, 0) = rp$. So at no-migration regime, marginal return to schooling is higher than rp. Migration lowers it down to the level of $f_s(\dot{s}^0, 1)$. In the case of (3.18), this lower level of marginal returns is still greater than rp, i.e. the negative effect of migration is not so strong and schooling effort in case of the migration will be higher. In the case of (3.19), the negative effect of migration is stronger, and the schooling effort in the case of migration will be lower than $\dot{s}^0$. It is important to note that neither monetary benefits from migration nor household exogenous income enter into the above inequality conditions.

Summary of the pairwise comparisons and empirical implications

In summary, assuming negative absence effect, the model gives one unambiguous prediction about the total effect of migration: for a household without borrowing constraint, the effect of father's migration will be negative. The magnitude of this effect is determined by the difference in the marginal return to schooling effort function f_s because of the migration. In terms of the empirical specification, effect of migration is interacted with age, gender and other possible determinants of $f(s, m)$, but there is no interaction with household's total income.

In contrast, for a household with restricted ability to borrow, effect of migration is ambiguous in sign, and depends in addition on the marginal utility of household consumption. If household current income is low and marginal utility of consumption is high, then effect of migration may become positive. Therefore, effect of migration needs to be interacted with exogenous measures of household wealth or credit ability (which do not depend on migration).

Second stage of the solution

A household will choose a pair of ($\hat{s}^d$, d) that maximizes utility. Consider the values of utility in each of the cases so far described. Once again, $\dot{U}$ denotes the corner solution of $A = 0$ and $\bar{U}$ — internal solution.

$$\dot{U}_0 = U(I_1 - p\dot{s}^0) + \delta U(I_2 + f(\dot{s}^0, 0)) \tag{3.20}$$

$$\dot{U}_1 = U(I_1 - p\dot{s}^1 + R - Z) + \delta U(I_2 + f(\dot{s}^1, 1)) \tag{3.21}$$

$$\bar{U}_0 = U(I_1 - p\bar{s}^0 - \hat{A}^0) + \delta U(I_2 + f(\bar{s}^0, 0) + r\hat{A}^0) \tag{3.22}$$

$$\bar{U}_1 = U(I_1 - p\bar{s}^1 + R - Z - \hat{A}^1) + \delta U(I_2 + f(\bar{s}^1, 1) + r\hat{A}^1) \tag{3.23}$$

I can now describe the behavior of different households in response to increases in R — the monetary benefits from migration. The change in household behavior can be twofold. First, there is a change in the optimal schooling effort $\frac{d\hat{s}}{dR}$ within a particular state $\hat{s}$. Second, there could be switches between the optimal states. There are four different cases to consider, depending on the initial optimal choice of the household.

- Initial state $\hat{s} = \bar{s}^1$ — a household that chose to send a migrant and had some positive savings.

$$\Rightarrow \bar{s}^1 \rightarrow \bar{s}^1; \quad \frac{d\bar{s}^1}{dR} = 0$$

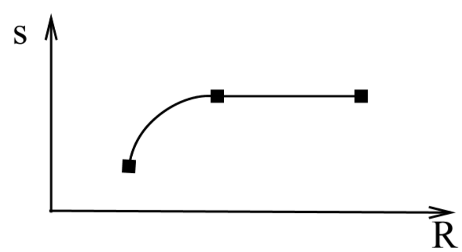
An increase in R will only make the migration state more attractive and the household won't switch between states. The schooling effort $\bar{s}^1$ does not depend on the level of remittances R.

- Initial state $\hat{s} = \dot{s}^1$ — a household that chose to send a migrant and was experiencing borrowing constraint.

$$\Rightarrow \dot{s}^1 \rightarrow \bar{s}^1; \quad \frac{d\dot{s}^1}{dR} > 0$$

An increase in R lowers the value of the corner condition, DA^1, and at some point $\bar{R}$: $DA^1(\bar{R} = 0)$ the borrowing constraint will cease to hold. It is easy to see that for the values of $R : R < \bar{R}$, the schooling effort would gradually rise to the unconstrained level $\bar{s}^1$ (see figure 3.4):

Figure 3.4:

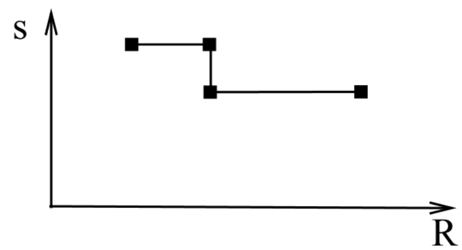


- Initial state $\hat{s} = \bar{s}^0$ — a household that chose not to send a migrant and had positive savings.

$$\Rightarrow \bar{s}^0 \rightarrow \bar{s}^1; \quad \frac{d\bar{s}^0}{dR} = 0$$

Rise in R increases the utility of the migration state, and at some point the household is going to make a switch into the unconstrained migration state. The schooling effort would drop from $\bar{s}^0$ to $\bar{s}^1$ (see figure 3.5):

Figure 3.5:



- Initial state $\hat{s} = \dot{s}^0$ — a household that chose not to send a migrant and was experiencing the borrowing constraint.

$$\Rightarrow \dot{s}^0 \rightarrow \dot{s}^1 \rightarrow \bar{s}^1;$$

$$\Rightarrow \dot{s}^0 \rightarrow \bar{s}^1;$$

$$\frac{d\dot{s}^0}{dR} = 0$$

There are two different possibilities here concerning the state transitions: the household can switch directly to the unconstrained migration case $\bar{s}^1$, or first switch to the constrained case $\dot{s}^1$ and then to $\bar{s}^1$. Increase in R makes both states $\bar{U}^1$ and $\dot{U}^1$ more attractive, but the unconstrained utility is always greater than the constrained one: $\dot{U}^1 > \bar{U}^1$ — so the level of remittances needed to encourage the switch to migration is lower in the case of the switch to the unconstrained case ($A > 0$) than the switch to the constrained case $(A = 0)$. Formally,

$$\bar{R}^{01} < \bar{R}^{01}, \text{ where}$$

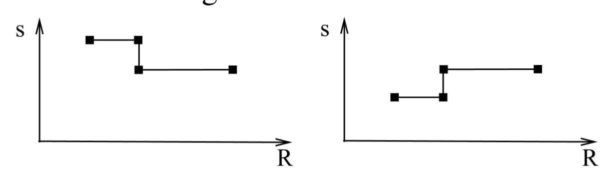
$$\bar{R}^{01} : \dot{U}^0 = \bar{U}^1$$

$$\dot{R}^{01} : \dot{U}^0 = \dot{U}^1$$

If it happens that $\bar{R} < \dot{R}^{01}$ — then the household would go $\dot{s}^0 \rightarrow \bar{s}^1$.

If it happens that $\bar{R} > \dot{R}^{01}$ — then the household would go $\dot{s}^0 \rightarrow \dot{s}^1 \rightarrow \bar{s}^1$ — i.e. the household would first switch to migration, but the borrowing constraint would still hold and only with the further increase in R would it relax. Depending on the possible relationships between $\dot{s}^0$, $\dot{s}^1$ and $\bar{s}^1$, there would be five distinct trajectories of household behavior (see figures 3.6 and 3.7):

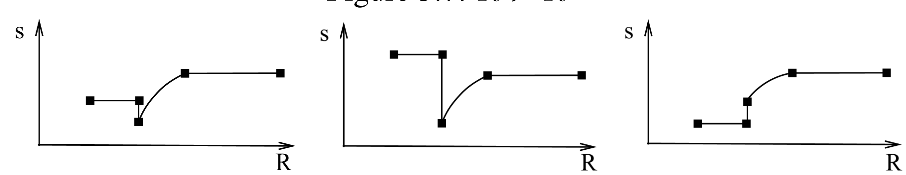
Figure 3.6: $\bar{R} < \dot{R}^{01}$



(a) Case 1

(b) Case 2

Figure 3.7: $\bar{R} > \dot{R}^{01}$



(a) Case 3

(b) Case 4

(c) Case 5

3.5 Empirical estimation

3.5.1 Econometric models specification

To estimate the relationship between conditional demand for school enrollment and migration in the household I use the NLSS survey data, described in greater detail in section 3.3.

Let S be the dummy variable for the event of child enrollment, $S = \left\{ \begin{smallmatrix} 1 & \text{-if enrolled} \\ 0 & \text{-if not enrolled} \end{smallmatrix} \right.$, and M be the dummy variable for the event of migration of an adult male, $M = \left\{ \begin{smallmatrix} 1 & \text{-if migrated} \\ 0 & \text{-if not migrated} \end{smallmatrix} \right.$, Z - the set of variables that determine migration but do not enter conditional demand functions (discussed in detail on page 117), and X - all other household variables that enter both migration and enrollment equations (discussed in detail on page 115).

I estimate the effect of migration on school enrollment, as defined in section 3.4, using several econometric specifications. These specifications vary according to the assumptions that are made about the model coefficients and distributions of unobservables. I examine the robustness of my estimates by comparing the estimates of more restrictive specifications against the less restrictive ones.

I use the probit model as the basic tool to model the probability of discrete outcomes $S = 1$ and $M = 1$, i.e. assuming that the probability of each event is a linear function of covariates X and that the unobservables have a multivariate normal distribution. The base specification is obtained by applying the probit model to the theoretical system (3.2) of conditional enrollment functions.

Switching probit model

$$\begin{cases} M^* = X\beta_m + \gamma Z + \epsilon_m \\ M = 1 \text{ if } M^* > 0, \\ S_0^* = X\beta_0 + \epsilon_0 \\ S_0 = 1 \text{ if } S_0^* > 0 \\ S_1^* = X\beta_1 + \epsilon_1 \\ S_1 = 1 \text{ if } S_1^* > 0 \\ S = S_0 I(M=0) + S_1 I(M=1) \\ \epsilon_m, \epsilon_1, \epsilon_2 \approx N(0, \Sigma_1) \end{cases} \tag{3.24}$$

The notation is the same as on page 97, i.e. S_0 and S_1 are the enrollment demand functions, conditional on no-migration and migration. Since this system models a joint household decision regarding enrollment and migration, and the migration equation is specified unconditional on enrollment, all the variables that enter enrollment equation have to be a part of the migration equation.

Switching probit specification features a full interaction of M with X in the enrollment functions, which results in two different sets of coefficients. All three error terms may be correlated and the error terms in the enrollment equations may have different expectations conditional on migration, $E(\epsilon_0|M) \neq E(\epsilon_1|M)$.

Expected effect of migration for a given household with observables X is calculated by the formula:

$$\widehat{E(D)} = E(S^1 - S^0) = P(S_1^* > 0) - P(S_0^* > 0) = \Phi(X\widehat{\beta}_1) - \Phi(X\widehat{\beta}_0) \tag{3.25}$$

The other estimated specifications are obtained by imposing additional restrictions on this base specification.

Independent probit Assumptions: $\beta_0 = \beta_1$ (except for constant), $(\epsilon_0, \epsilon_1) \perp \epsilon_m$. In this specification, enrollment functions S^0 and S^1 are different only by constant, M is independent with the error term and only one equation needs to be estimated.

$$\begin{cases} S^* = X\beta_0 + \alpha M + \epsilon_0 \\ \epsilon_0 \approx N(0, \Sigma_2) \end{cases} \tag{3.26}$$

Effect of migration is calculated by the formula:

$$\widehat{E(D)} = \Phi(X_i\widehat{\beta}_0 + \hat{\alpha}) - \Phi(X_i\widehat{\beta}_0) \tag{3.27}$$

Switching independent probit Assumptions: $(\epsilon_0, \epsilon_1) \perp \epsilon_m$. Migration effect is allowed to depend on other household observable covariates including child age and sex. The migration error is not correlated with either of the enrollment error terms. The effect of migration for a child in a given household is calculated by the same formula as in (3.25).

Bivariate Probit Assumptions: $\beta_0 = \beta_1$ (except for constant), $E(\epsilon_0|M) = E(\epsilon_1|M)$. Migration effect is additive, but independence of enrollment and migration error terms is not assumed. This would be the case when migration and enrollment choices are made jointly. Since the enrollment demand equation is estimated conditional on migration, but the migration equation is written down unconditional on enrollment, then all the variables from the enrollment equation (observable and unobservable) must enter the migration equation. This will cause the correlation between the error terms in the two equations.

This is the case when there are some common unobserved factors that affect both migration and conditional enrollment outcomes. For example, just as the observed X variables, all the factors that enter the enrollment equation and are unobserved in the data would enter into the migration equation too.

The assumption about equal expectations of errors ϵ_1 and ϵ_2 conditional on migration is needed to collapse two separate equations into one. Another more strict assumption is often used, that $\epsilon_0 = \epsilon_1$ (see Heckman et al. (1999)). The system of equations becomes:

$$\begin{cases} S^* = X\beta_0 + \alpha M + \epsilon_0 \\ M^* = X\beta_m + \gamma Z + \epsilon_m \\ \epsilon_0, \epsilon_m \approx N(0, \Sigma_3) \end{cases} \tag{3.28}$$

General effect of migration is calculated by the same formula as in the independent probit, i.e. (3.27).

Full interaction bivariate probit Assumptions: $E(\epsilon_0|M) = E(\epsilon_1|M)$. Migration effect is fully interacted with X. There is only one equation for enrollment, because the error terms in the enrollment functions are assumed to have the same distribution.

$$\begin{cases} S^* = X\beta_0 + XM\alpha + \epsilon_0 \\ M^* = X\beta_m + \gamma Z + \epsilon_m \\ \epsilon_0, \epsilon_m \approx N(0, \Sigma_4) \end{cases} \tag{3.29}$$

Effect of migration for a child in a given household with observables X is calculated by the formula:

$$\widehat{E(D)} = \Phi(X_i\widehat{\beta_0} + X\hat{\alpha}) - \Phi(X_i\widehat{\beta_0}) \tag{3.30}$$

3.5.2 Other econometric aspects:

Definition of the migration event

I construct the male migration dummy M using the information from the household roster. The dummy is constructed only for 17 to 60 years old males. M is equal to one if one of the following conditions hold true:

- a household member that is registered in the household roster is said to be absent from the household for more than 6 months.
- a 17-60 year old married woman is a household member, but her husband is absent and not in the household roster.
- a 0-16 year old child is a household member, father is alive, but absent from the household roster.

Right-hand side variables

The choice of right-hand side variables in enrollment equations is guided by both the theoretical model developed in section 3.4 and by the educational attainment literature reviewed in section 3.2. They suggest that enrollment outcome of a child in a given household depends on the factors that affect cost of enrollment, marginal benefits of an additional year at school and the returns to alternative investment (if a household is not credit-constrained). For credit-constrained households, enrollment would additionally be determined by any other factors determining household marginal utility of consumption.

Right-hand side covariates in the child enrollment equation include the following variables:

1. child age and sex (dummies)

2. number of other children in the household, number of adult women, number of elderly adults, pre-migration number of adult males, dummy for multiple family household, ethnic minority dummy.

3. dummies for educational levels of both parents of the child and level of maximum education of the other household members (pre-migration)

4. log of lagged agricultural land holdings and dummy for having no land plot

5. log of lagged durables asset index and dummy for having no durables in possession

6. regional level variables

   - Census 2000 ward level estimates for share of illiterate adults in ward and share of population employed in 4 different sectors of economy (the share out of labor force is ommited)
   - NLSS 1995 estimates for average log per capita consumption in the district

7. median interest rate in ward

8. median distance to primary school in ward in kilometers

It is important to note that all the right-hand side variables were constructed so as to be exogenous to migration. For example, to control for demographic composition, I use the pre-migration number of adult males which does not change with adult migration. Therefore, to estimate the effect of migration on enrollment, only the migration dummy M and its interactions with X variables needs to be adjusted.

Right-hand side variables in the migration equation include essentially all the covariates from the enrollment equations. Indeed, the two-step approach to estimation requires the inclusion of all the covariates from the main equation in the instrumented equation. Child-specific variables like age, sex and education level of the parents are aggregated on the household level to be a part of the household level migration equation.

Identification

In specifications with joint estimation of migration and enrollment outcomes, it is necessary to establish that the effect of migration (coefficients on M dummy and interactions of M and X) is identified. Indeed, if there were no instrumental variables Z that enter only the migration equation, then effect of migration would be identified only through the non-linearity of the normal probability function, and would not be identified if a linear probability model were used. However, all the specifications of the migration equations include variables Z, which are the levels of lagged migrant networks in wards and districts of household residence. Variable **%abroad_mig01** is a Census 2001 estimate of the share of working population in PSU that was working abroad in 2001. Variable **%intern_mig95** is a NLSS-I estimate of the share of households in the district that received remittances from migrants within Nepal in 1995. These variables turn out to be strong predictors of migration in all of the estimated models. The validity of these instruments rests on the assumption that lagged migrant networks are not correlated with the error terms in the enrollment equations. Let's examine more closely whether this assumption is plausible.

First of all, lagged networks must not directly determine enrollment. There are two possible arguments for the idea that network do directly affect enrollment decisions. One of the argument asserts that if established networks make migration easier then that fact in turn can change a household's perception about the benefits of educating their children. For example, it is argued that in countries like Mexico, household's expectation of migration of the children in the future discourages formal education (Antman, 2008). However, this argument seems to be less relevant in the context of Nepal, where migration is predominantly short-term and migrants eventually return to their local labor markets. According to the second argument, if extensive migrant networks actually lead to a reduction of the cost of migration or to an increase in the returns of migration (e.g by making the choice set of the migrant larger), then the networks would affect the budget constraint of the household and would become one of the determinants of the enrollment decision.[10] In general, to get a definite answer on whether migrant networks have a monetary effect on the household budget, we must know precisely how migrant networks do help to encourage migration, and whether the net benefits of migration are higher or lower in the presence of migrant networks. Unfortunately, the information on the cost and benefits of migration is not available in the data. I argue that lagged networks are a proper instrument because they mainly have influence on the psychic costs of migration, and not on the monetary costs or benefits of migration. In terms of the costs of migration, especially travel costs, this assumption is quite plausible. In terms of the benefits of migration, this assumption may be violated if some of the migration destinations (e.g. foreign countries) have much higher net returns from migration than other destinations (e.g. internal destinations). In this case, it would be better to estimate the effect of migration separately by internal and foreign migration destinations, and to include the actual monetary costs and returns of migration. I follow this approach to some extent in my second essay, where I estimate the effect of migration on poverty separately for internal and international migration. However, this approach bears a high computational cost as well as the cost of much smaller sample sizes (once migration is broken down by destination). In this essay I choose not to distinguish between migration destinations but rather to estimate the average effect of migration for all destinations.

A separate case in which instrumental variables won't be valid can occur if migrant networks are correlated with location-specific variables that simultaneously determine both migration decision and enrollment decision. To eliminate the effect of time-variant location-specific shocks, I use the lagged level of networks in 2001 and 1994-95 so that the lagged level would not be correlated with the shocks of 2003-04. To control for potential time-persistent locational effects, I include local labor market and educational characteristics, including the

[10]In the context of the theoretical model, this example corresponds to equation 3.9, in which variable Z is the monetary cost of migration and enters the first-order condition for the optimal enrollment outcome $\dot{s}$

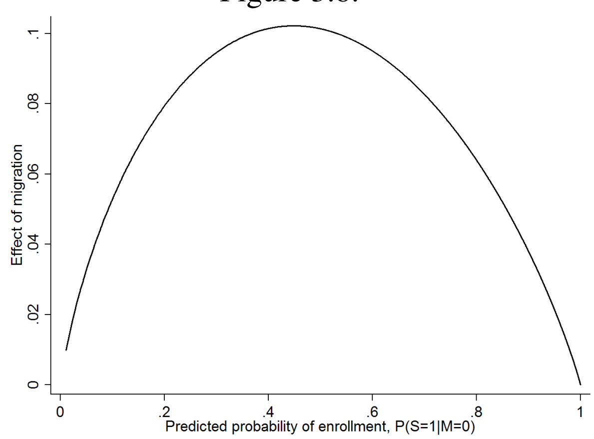
lagged level of share of illiterate in the district (calculated using 1995 NLSS-I data).

The actual performance of the instruments and tests for their validity are discussed on page 122.

Implicit interaction of effect of migration with X

Probit models have a feature which, although well-recognized, is important to mention in this context: the implicit interaction of the effect of migration with other covariates, because of the non-linearity of the probability function. Even in the model without explicit interaction of M and X, effect of migration will vary for different values of covariates X. Effect of migration will be lower (in absolute value) for values of X that give either very high or very low probability of enrollment. Graphically, the relationship between effect of migration and predicted probability of enrollment (without migration) is shown in figure 3.8

Figure 3.8:



Biased but consistent estimation of effect of migration

Let D_i be the effect of migration for particular child i in a family with covariates X. In the model with additive effect of migration, the *expected* value of the effect of migration D_i for a child with observable characteristics X_i is:

$$E(D_i) = E(S_i^1 - S_i^0) = P(X_i\beta_0 + \alpha + \epsilon_0 > 0) - P(X_i\beta_0 + \epsilon_0 > 0) = \Phi(X_i\beta_0 + \alpha) - \Phi(X_i\beta_0)$$

Expectation is taken over the distribution of unobserved error term ϵ_0. In practice, the true effect is calculated using the estimated coefficients β and α. In general, this will lead to a biased estimate of the expected effect of migration. Indeed, since Φ is a non-linear function, $E[\Phi(X\hat{\beta}_0] \neq \Phi(E[X\beta_0]) = \Phi(X\beta_0)$. Therefore, the expected value of $\widehat{E(D_i)}$ is not equal to the true value. The bias is larger in the regions where function Φ is more curved, i.e. for the high and low values of probability of enrollment. However, if β coefficients are estimated consistently, then $\widehat{E(D_i)}$ will also be consistent.

Family and ward level clustering

To account for the correlation of the error terms for observations within the household and within the PSU, I calculate all the standard errors using the robust estimator with clustering on the PSU level.

3.5.3 Estimation results

Table 3.5 shows the predicted average conditional enrollment rates and average effect of migration (D) for the five estimated models. These averages are taken over the whole sample using the sampling weights, i.e. these are the population averages. Estimated coefficients and details of the estimation are reported in the Tables R1-R5 in the appendix.

All of the estimations show a positive average effect of having a migrant in the family on child enrollment, estimated with relatively small standard error. Models which do not control for selection predict migration to increase enrollment by about 6-7 percentage points on average. However, models that control for selection of migrants show an increase of 26-27

Table 3.5: Estimated effect of migration, population average

	$E(S^1)$	$E(S^0)$	D	Min D	Max D	Std. Err(D)
	(1)	(2)	(1)-(2)			
Assuming independence:						
M1: Probit, additive	79	73	6	0	10	1.3
M2: Probit, full interaction	79	73	7	-47	66	1.5
Controlling for selection:						
M3: Bivariate probit	90	65	26	0	45	5.0
M4: Bivariate probit, full inter.	91	65	26	-7	78	3.3
M5: Switching probit	93	67	27	-6	82	3.0

Standard errors of D were calculated using parametric bootstrap with 500 replications

percentage points. This is a very large effect in magnitude. For comparison, Table R3 shows the 0.4 coefficient for the male dummy, which translates to a 10 percentage point increase in the probability of enrollment for being a boy vs a girl.

It is also apparent that controlling for selection leads to an important correction of the estimates. Tables R3-R5 show that the estimated correlation of the error terms between the enrollment and migration equations is negative and large in magnitude, ranging from -.5 to -0.9. This indicates that there are some unobserved household or regional factors that simultaneously increase the probability of migration while pushing down the likelihood of child enrollment. Ignoring such factors leads to underestimation of the effect of migration.

The specifications with full interaction of M and X give roughly the same prediction of the average effect, as do the specifications with additive effect only. However, there is a substantial difference in the range and variance of the effect of migration and in its value for particular households. Additive models always predict positive effect of migration, and the only source of variation is the predicted level of enrollment (as plotted on figure 3.8). On the other hand, interaction models predict migration effect to be negative for some households, and large and positive for other households. Figure 3.9 shows kernel density plots of the predicted effect of migration calculated by the five models. There is a noticeable difference between the two-peak densities of additive models and the single-peak densities estimated by interaction models.

Table 3.6: Wald test for model restrictions

H_0	Restriction	Prob $> \chi^2$	Result
Model 5 = Model 4	$\rho_{m0} = \rho_{m1}$	0.1548	Not-Rejected
Model 5 = Model 3	$\rho_{m0} = \rho_{m1}$, $MX = 0$	0.0000	Rejected
Model 5 = Model 2	$\rho_{m0} = \rho_{m1} = 0$	0.0075	Rejected
Model 5 = Model 1	$\rho_{m0} = \rho_{m1} = 0$, $MX = 0$	0.0000	Rejected
Model 4 = Model 3	$MX = 0$	0.0001	Rejected
Model 4 = Model 2	$\rho = 0$	0.0001	Rejected
Model 4 = Model 1	$\rho = 0$, $MX = 0$	0.0000	Rejected
Model 3 = Model 1	$\rho = 0$	0.0063	Rejected
Model 2 = Model 1	$MX = 0$	0.0000	Rejected

where,
Model 5: Switching probit
Model 4: Bivariate probit with full interaction
Model 3: Bivariate probit
Model 2: Independent probit with full interaction
Model 1: Independent probit

Table 3.6 reports a series of Wald tests on the restrictions applied to all the pairs of the nested models. Except for the switching probit and bivariate full-interaction pair, none of the other models could be reduced to their restricted counterparts.

Validity of the instruments

Using the estimates of the bivariate model (reported in table R3), I perform several tests to check whether my instrumental variables are valid and to see how they perform. First, I test whether instrumental variables belong to the model. The hypothesis that both of the coefficients are zero is rejected with $P(\chi^2(2) > 57.36) = 0.000)$. Second, I reestimate the same model when instruments are included in the outcome equation. If the exclusion restrictions are valid, the hypothesis that the instruments do not belong to the outcome equation won't be rejected. The results of the estimation are shown in table R3.3 in the Appendix, and one can not reject the null hypothesis that the coefficients on the excluded variables are zero at the 5% level ($\chi^2(2)$= 4.54, P = 0.1034).

3.5.4 Interaction of migration dummy with migrant's characteristics

One of the assumptions used in the theoretical model (3.5) was that the absence of a father because of migration may hurt the child's school performance and therefore discourage enrollment. It would be interesting to test this assumption empirically and see if effect of migration varies by whether the migrant is the father of the child, and by other migrant characteristics, such as age and education. However, since migrants are selected in the household, their characteristics become endogenous to the model. Therefore, interactions of migrants' characteristics with the migration dummy cannot be estimated with the models reviewed so far. To estimate such interactions, I need to estimate a selection of the migrants within the household.

Suppose that a household has N adult males who could potentially be migrants. Let X_i be the personal characteristics of male i, X_{-i} be a vector of the characteristics of all other males in the household and X_{hh} be the common household variables. The probability of migration for person i will be some function of X_i, X_{-i} and $X_h h$. Assuming linearity of this function in X, in a probit model it can be written down as:

$$M_i^* = C + X_i\beta_1 + X_{-i}\beta_2 + X_{hh}\beta_3 + \gamma Z + \epsilon_{mi} \tag{3.31}$$

In the actual estimation I use the following set of individual characteristics X_i: age, level of education, dummy for being married, education level of spouse (0 if not married), number of own children. Theoretically, I could use exactly the same variables to construct vector X_{-i} for the characteristics of other males. In practice, to keep the number of variables manageable, I use aggregates of those characteristics, e.g.: average age of other males, maximum education of other males, number of other married males and number of their children.

It must be noted that the NLSS questionnaire(like a typical Living Standard Monitoring Survey questionnaire) does not ask direct questions about characteristics of non-members of the household. In order to reconstruct the individual characteristics X_i of actual migrants, I had to do a complicated matching of information on the parents of the child with the information from remittances and maternity history section.

The set of outcomes for a household with N potential migrants will be estimated by N simultaneous equations:

$$\begin{cases} M_1^* = C + X_1\beta_1 + X_{-1}\beta_2 + X_{hh}\beta_3 + \gamma Z + \epsilon_{m1} \\ \dots \\ M_N^* = C + X_N\beta_1 + X_{-N}\beta_2 + X_{hh}\beta_3 + \gamma Z + \epsilon_{mN} \\ \epsilon_{m1}, \dots, \epsilon_{mN} = N(0, \Sigma_{NN}) \end{cases} \tag{3.32}$$

The next equation shows the general form of the enrollment equation for child c in a family with N potential migrants, which I can estimate jointly with the system (3.32).

$$S^* = X_c\beta_0 + \sum_1^N \alpha_1 M_i + \sum_1^N \alpha_2 M_i X_i + \epsilon_c \tag{3.33}$$

In contrast to the bivariate additive specification (3.28), this equation includes interaction of migrant-specific variables X_i with migration event variables M_i. For example, to estimate the effect of migration separately for father-migrants and other-migrants, migration dummy M_i is interacted with dummy for being the father of the child c.

$$S^* = X_c\beta_0 + \sum_1^N \alpha_1 M_i + \sum_1^N \alpha_2 M_i (M_i = \text{Father of } c) + \epsilon_c \tag{3.34}$$

In practice, I estimate this equation with just two migration dummy variables, for having a father-migrant or having at least one other-migrant. This is a more convenient specification, and it is practically equivalent to the one shown in (3.34), because only 0.1% of the children have more than two other-migrants in the family. Then, for a household with K childen and N migrants the joint system of equations becomes:

$$\begin{cases} S_1^* = X_{c1}\beta_0 + \alpha_1 \text{Father migr.} + \alpha_2 \text{Other migr.} + \epsilon_{c1,f} \\ \dots \\ S_K^* = X_{ck}\beta_0 + \alpha_1 \text{Father migr.} + \alpha_2 \text{Other migr.} + \epsilon_{cK,f} \\ M_1^* = C + X_1\beta_1 + X_{-1}\beta_2 + X_{hh}\beta_3 + \gamma Z + \epsilon_{m1,f} \\ \dots \\ M_N^* = C + X_N\beta_1 + X_{-N}\beta_2 + X_{hh}\beta_3 + \gamma Z + \epsilon_{mN,f} \end{cases} \tag{3.35}$$

Here subscript f indexes the families in the household. A household can have multiple families, and correlation of observations within a core family may be different that between the families. Error terms ϵ have a joint normal distribution.

Each particular household will have a different number of equations depending on the number of school-aged children and potential migrants in the household. For computational purposes I estimate a maximum of five enrollment equations and five migration equations in the household. Actually, out of 5051 total number of households there were only 23 households with more than five school-aged children and 10 households with more than five potential migrants. In such households I picked the five relevant outcomes using a random draw.

A 10 by 10 variance-covariance matrix of the error terms is estimated with several constraints. First, all the diagonal elements are constrained to one as in the typical probit normalization. Second, I restrict the following correlations to be the same: between ϵ_m's in the migration equations, between ϵ_c's in the child enrollment and ϵ_m in the father's migration equations, between ϵ_c's in the child enrollment and ϵ_m in the non-father's migration equations, between ϵ_c's of the children of the same parent, and between ϵ_c's of the children of different parents. It is convenient to reorder the equations in system (3.35) in the following way, so that these constraints on the correlations can be presented in the matrix form:

$$\begin{cases} \text{Father 1:} \\ M_1 = X_1\beta_1 + X_{-1}\beta_2 + X_{hh}\beta_3 + \gamma Z + \epsilon_{m1} \\ \text{Father 2:} \\ M_2 = X_2\beta_1 + X_{-2}\beta_2 + X_{hh}\beta_3 + \gamma Z + \epsilon_{m2} \\ \text{Up to three other males in the household:} \\ M_3 = X_3\beta_1 + X_{-3}\beta_2 + X_{hh}\beta_3 + \gamma Z + \epsilon_{m3} \\ M_4 = X_4\beta_1 + X_{-4}\beta_2 + X_{hh}\beta_3 + \gamma Z + \epsilon_{m4} \\ M_5 = X_5\beta_1 + X_{-5}\beta_2 + X_{hh}\beta_3 + \gamma Z + \epsilon_{m5} \\ \text{Up to four children of the Father 1:} \\ S_1 = X_{c1}\beta_0 + \alpha_1 F + \alpha_2 M + \epsilon_{c1} \\ \dots \\ S_4 = X_{c4}\beta_0 + \alpha_1 F + \alpha_2 M + \epsilon_{c4} \\ \text{A child of the Father 2:} \\ S_5 = X_{c5}\beta_0 + \alpha_1 F + \alpha_2 M + \epsilon_{c5} \end{cases} \tag{3.36}$$

Then, the variance-covariance matrix for this system has the following parametrization:[11]

$$\Sigma_{10} = \begin{pmatrix} 1 & a & a & a & a & b & b & b & b & c \\ a & 1 & a & a & a & c & c & c & c & b \\ a & a & 1 & a & a & c & c & c & c & c \\ a & a & a & 1 & a & c & c & c & c & c \\ a & a & a & a & 1 & c & c & c & c & c \\ b & c & c & c & c & 1 & d & d & d & e \\ b & c & c & c & c & d & 1 & d & d & e \\ b & c & c & c & c & d & d & 1 & d & e \\ b & c & c & c & c & d & d & d & 1 & e \\ c & b & c & c & c & e & e & e & e & 1 \end{pmatrix}$$

[11]This specification includes only one equation for the child from the second family, so some of the observations had to be excluded from the estimation. However, I always arrange equations in such a way that the largest group of children makes up the first group, and the smallest makes up the second one. Altogether there were only 36 households with more than one child in a second group. In these households I used a random draw to pick which of the children would be included in the estimation sample.

Here, a is the correlation between equations for potential migrants, b is the correlation between equations for father-migration and child enrollment, c is the correlation between equations for migration of non-father and child enrollment, d is the correlation between related children, and e is the correlation between unrelated children.

Estimation results This system is estimated by Simulated Maximum Likelihood, and involves the calculation of 10-variate normal probabilities. To estimate the model I use the Stata routine, **cmp**, developed by Roodman (2008). **cmp** uses the Geweke-Hajivassiliou-Keane algorithm to calculate multidimensional integrals. Estimates of the coefficients and correlations of the variance-covariance matrix are reported in Table R6 in the appendix.

In comparison to the bivariate probit estimates (reported in table R4), the coefficients are rather similar in value, and have expected sign; instruments continue to be a strong predictor of migration; standard errors in migration equations are smaller than in the bivariate probit estimates, reflecting perhaps an increase in efficiency due to the larger sample size and control for within-family correlation. The difference with the bivariate probit estimates is seen with the estimated correlation coefficients and effects of migration.

The correlation of error terms between children in the family is estimated to be about 0.6 and between adult males to be about 0.25, reflecting the role of unobserved family covariates. The correlation between father-migration and child-enrollment equations is -0.35; the correlation between other-male migration and child enrollment is -0.11 and not significantly different from zero (stand. err. = 0.10). In the bivariate probit model, however, the estimated correlation between the migration and enrollment equations was much higher (-0.6). This drop in correlation between unobserved error terms may be a result of a better specification in the migration equation. The new specification is done at the individual level, using the detailed information on the age, education, family history and children of each individual migrant, thus reducing unobserved error.

Table 3.7 reports the estimated average effect of migration of father and of other males on enrollment probability of a child.

Table 3.7: Estimated effect of migration, population average

	$E(S^1)$	$E(S^0)$	D	Min D	Max D	Std. err(D)
Father	87	71	17	0	31	3.6
Other M.	78	71	8	0	12	3.7

Note: Std. errors were calculated using parametric bootstrap with 500 replications

Father-migration on average increases probability of enrollment by 17 percentage points with the standard error of 3.6. This estimate is significantly less than in the bivariate probit model estimated earleir. Migration of another male relative increases probability of enrollment only by 8 percentage points on average. This finding seems to contradict the setup of the theoretical model 3.5 developed in section 3.4. There, I assumed that migration of a father might have an additional negative effect on enrollment (holding everything else, including remittances amount, equal), because of the loss of parental supervision of the child. The estimated model does not give any specific reasons as to why the effect of father's migration is larger than that of another male in the household. However, there are several possible explanations:

First of all, the difference in effect of migration can be explained by a difference in the characteristics of migrants with children and with no children. For example, migrants with children are on average 6 years younger than migrants with no children, and their remittances earnings could be lower. To see if this is the case, in the next section I estimate the model, interacting migration dummies with age and education of the migrant. The results in table R6.2 show that the difference between migration effect of father and other male remains even controlling for age and education of the migrant in the enrollment equation.

Second, this could be a sign that the collective household model of decision making is wrong. If individuals in the household maximize their own utility functions and migrants have a say in deciding how to spend remittances money, then migrant fathers may invest a greater share of that income in the education of their children.

Other aggregates of the effect of father's migration In addition to the population average effect of migration, I report other interesting aggregates in Table 3.8.

Table 3.8: Other aggregates of the effect of father's migration

	D	Std. Err(D)
Average D in the population	17	3.5
Average D, weighted by the P(M)	17	3.8
Average D, for landless rural households	21	4.0
LATE effect: $Z = Z_1 \vert P(M \vert Z_1) = +15\%$	17	3.6
Average $D \vert F_{\text{actual}} = 0$	14	2.7
Average $D \vert F_{\text{actual}} = 1$	20	5.9

Note: Std. errors were calculated using parametric bootstrap with 500 replications

The first line of the table shows the average effect in the population. The second line shows the average effect weighted by the predicted likelihood of migration, i.e. the effect for the subgroup of households most likely to migrate. It turns out to be equal to the average effect in the population.

The third line shows that the average of the effect of migration for rural landless households is higher than the average population effect, but not significantly different from it. In the specification reported below, I estimate the variation of the effect of migration by landlessness directly.

The fourth line shows the LATE effect of a particular policy that changes the probability of migration. This effect is calculated in two steps. First, I change the levels of instruments from Z_0 to Z_1 to get an overall 15% increase in the probability of migration. Then, effect of migration D is averaged with weights equal to the increase in predicted probaility of migration (i.e. those who are more affected by the change get the higher weight). The LATE effect in this instance coincides in value with the average effect.

The last two lines show the expected average effect of migration on enrollment probability, given the information on actual migration outcomes. For the individual child, this effect is calculated as the difference in expected probability of enrollment, conditional on X and actual migration outcomes.

$$[D|X, F_{\text{actual}} = 1] = P(S^1 = 1|X, F_{\text{actual}} = 1) - P(S^0 = 1|F_{\text{actual}} = 1)$$

To calculate this effect, I calculate the changes in probability of enrollment conditional on the migration event, using the estimated variance-covariance matrix of the error terms to compute the truncated probabilities. For instance, for a child living in a family with two potential migrants with actual migration outcomes $M_1 = 1$,$M_2 = 0$ I calculate the expression:

$$P(S_1 = 1|M_1 = 1, M_2 = 0) =$$
$$= P(\epsilon_{c1} > -X_{c1}\hat{\beta}_0 - \hat{\alpha}_1|\epsilon_{m1} > -X_1\hat{\beta}_m - \hat{\gamma}Z, \epsilon_{m2} > -X_2\hat{\beta}_m - \hat{\gamma}Z)$$

where:

$$\widehat{\text{corr}}(\epsilon_{c1}, \epsilon_{m1}) = -0.36$$
$$\widehat{\text{corr}}(\epsilon_{c1}, \epsilon_{m2}) = -0.11$$
$$\widehat{\text{corr}}(\epsilon_{m1}, \epsilon_{m2}) = -0.24$$

Probabilities of dimensions above 2 were calculated using the GHK algorithm. The results show that effect of migration is 6 percentage points higher for households with actual migrants than for non-migrant households, although the standard error in the last line of the table is also 6%.

3.5.5 Specifications with additional interactions

I estimate three additional specifications to see if the migration effect varies across the subgroups (other than implicit probit-induced variation). The first one includes the interaction of the migration dummy with age and education of the migrant, to see if this could help explain the difference in effect of father and non-father migration. The second specification includes the interaction of the migration dummy with age and sex of the child. Finally, I interact the migration dummy with a dummy for a landless rural household. Model 3.5 predicts that the effect of migration will be larger for poor, credit-constrained households. I use landlessness as a sign that a household is in the poorest group of households, assuming that migration would not change the landlessness status. In other words, landlessness can be treated as an exogenous variable.

The results of the estimation of the coefficients are reported in Tables R6.2, R6.3 and R6.4 in the appendix. Table R6.2 shows that age and education of the migrant are not important for the effect of migration on enrollment. While age and age square coefficients are jointly significant on the 5% level, their magnitude is too small to make any difference in probability of enrollment. The difference in effect by relationship to the child remains even after controlling for age and education of the migrant.

Table R6.3 shows that there is no difference in the average effect of migration by gender of the child, i.e girls benefit from it as much as boys. There is a slight difference relating to the age of a child: the coefficient in age and migration interaction is 0.02. The interaction effect is not large; it results in an additional 0.5% point increase in probability of enrollment due to migration for each additional year of the child's age, adding up for the 5% difference in the effect of migration between ages 6 and 16.

Table R6.4 reports the estimated coefficients for the model in which migration is interacted with a dummy for landless rural households. As shown in the Table 3.9, average effect of father's migration for landless households increases enrollment probability by 28 points (from 53% to 81%), in contrast to the 15 point increase for other household types. This estimate is consistent with the theoretical result, that effect of migration on enrollment should be larger for poorer, credit-constrained households.

Table 3.9: Estimated effect of migration, interacted with land ownership

	$E(S^1)$	$E(S^0)$	D
Landless Rural hh.	53	81	28
Other households	76	91	15

3.6 Conclusions

This paper investigates the effect of work-related migration of adults in Nepal on the enrollment outcomes of their children who remain at home. The importance of this question stems from the fact that work-migration is very common in Nepal and there are concerns that, despite the increase in income from remittances and per capita consumption that comes with migration, absence of a parent may hurt children's educational outcomes.

I find that the opposite is the case: migration of a father increases the probability of enrollment by about 16% points on average, and migration of a brother or uncle increases enrollment probability by 7% points. I find that this effect is similar in value regardless the gender and age of the child. I also find that positive effect of migration is greater for poor households. Among landless rural households, migration of a father raises the probability of the child's enrollment by 28%.

This paper contributes something new to the existing migration literature by treating the migration event at the individual level rather than on the household level, commonly used in the previous literature. Most of the literature models migration at the household level, because of the lack of information available in a typical household survey concerning the migrant. I demonstrate that it is possible to recover information concerning the migrant's age, education, marital status and relationship to other household members, using the information from a typical LSMS survey. This in turn allows me to use migrant characteristics as explanatory variables in the enrollment equation, and treat the endogenous nature of these variables by modeling the selection of migrants within households at the individual level.

Appendix

Figure 3.9: Kernel density of estimated effect of migration

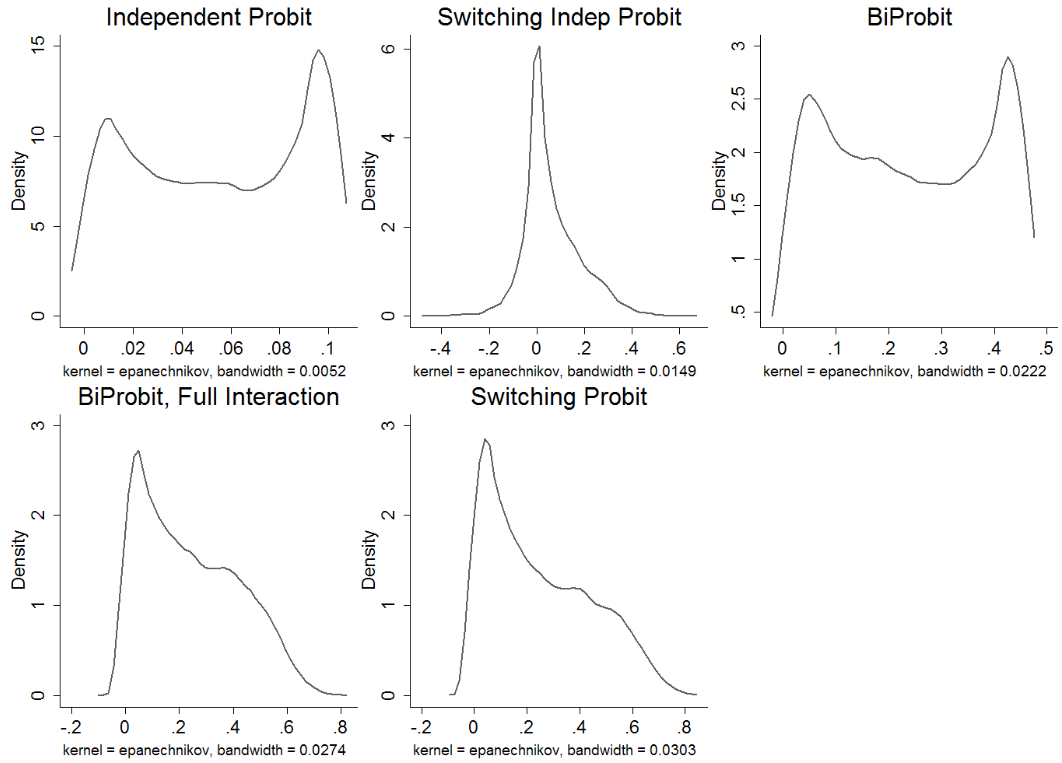


Table S1: Enrollment equation: variables and sample means

Notation:	Enrolled	Not-enrolled	Description	Comment
child level				
hasmigrant	0.28	0.24	migrant in the family	
age6	0.07	0.16	6 years old	ommited dummy
age7	0.09	0.10	7 y.o	
age8	0.10	0.08	8 y.o	
age9	0.10	0.06	9 y.o	
age10	0.11	0.07	10 y.o	
age11	0.09	0.05	11 y.o	
age12	0.12	0.09	12 y.o	
age13	0.09	0.06	13 y.o	
age14	0.09	0.10	14 y.o	
age15	0.08	0.11	15 y.o	
age16	0.06	0.10	16 y.o	
male	0.56	0.37	male dummy	
ethnic	0.37	0.63	ethnic minority dummy	
father_illiterate	0.42	0.73	father's educ: illiterate	ommited dummy
father_primary	0.24	0.15	primary or less	
father_second	0.15	0.07	secondary	
father_college	0.19	0.04	above secondary	
mother_illiterate	0.81	0.95	mother's educ: illiterate	ommited dummy
mother_primary	0.08	0.03	primary or less	
mother_second	0.05	0.02	secondary	
mother_college	0.05	0.01	above secondary	
maxedadults	1.54	0.84	max educ. of other adult males	Calc. before migration
fatherdeceased	0.04	0.06	father deceased dummy	
nothkids1316	0.62	0.44	# of other children 13-16	
nothkids612	1.16	1.35	# of other children 6-12	
household level				
nkids05	0.75	1.12	# of children 0-5	
multifamily	0.16	0.19	multiple family household dummy	
nmen0	0.04	0.04	zero adult males	Calc. before migration
nmen1	0.57	0.55	one adult male	ommited dummy
nmen2	0.25	0.28	two adult males	
nmen3	0.09	0.09	three adult males	
nmen4	0.05	0.04	four and more adult males	
nwomen	1.58	1.42	# of adult women	
nelderly	0.31	0.28	# of elderly	
no_durables	0.35	0.56	no durable assets	
ln_durables	4.32	2.42	ln(durable assets)	
no_land_ur	0.06	0.03	no owned land, urban	
ln_land_ur	-0.05	-0.04	ln(owned land), urban	
no_land_ru	0.14	0.25	no owned land, rural	
ln_land_ru	-0.43	-0.63	ln(owned land), rural	
ward level				
prc_illit01	0.57	0.68	ward % of illiterate (15+ y.o)	
prc_wage_agr01	0.04	0.08	ward % of empl. in wage labor, agriculture	
prc_wage_nag01	0.08	0.06	ward % of empl. in wage labor, nonagriculture	
prc_selfe_agr01	0.47	0.43	ward % of self empl. in agriculture	
prc_selfe_nag01	0.05	0.05	ward % of self empl. in non-agricult.	
ln_exp1995	8.71	8.64	district ln(mean expenditure), 1995	
interest_rate	0.30	0.37	ward median interest rate	
km2school	1.72	1.96	ward distance to primary school, km	
Number of obs	5516 obs	1666 obs		

Table 3.10: Net enrollment rates in 1995-2003

	primary NER				low secondary NER				secondary NER			
	NLSS1:		NLSS2:		NLSS1:		NLSS2:		NLSS1:		NLSS2:	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Regions												
Kathmandu	78	72	85	86	46	40	66	61	38	36	35	32
Other urb. areas	65	77	83	81	33	34	41	40	18	7	40	27
Rural west hills	70	50	88	82	22	16	28	20	10	2	11	11
Rural east hills	72	55	76	67	25	11	32	27	9	10	10	9
Rural west terai	68	47	82	70	15	5	26	31	6	0	17	7
Rural east terai	59	31	69	49	24	16	28	18	18	8	17	15
Urban												
Urban	69	76	84	82	37	36	47	47	26	19	38	29
Rural	67	45	77	65	22	13	29	23	12	5	13	11
Quintile												
Poorest	51	27	65	47	7	3	8	8	2	2	2	1
Second	60	36	76	62	15	6	17	13	9	1	10	2
Third	71	52	84	77	28	8	35	26	11	3	11	6
Fourth	76	63	84	79	29	25	43	42	12	9	23	21
Richest	82	69	86	83	36	33	54	53	28	13	35	32
Ethnicity												
Brahman/Chhetri	78	63	85	85	30	21	43	43	17	10	26	23
Terai Middle Caste	62	27	75	50	24	13	27	11	5	11	28	22
Dalits	69	43	85	84	11	3	17	14	4	0	2	3
Newar	74	64	93	86	28	22	56	37	19	15	16	24
Hill Janajatis	65	47	75	66	16	11	29	19	6	1	12	7
Terai Janajatis	59	34	84	65	13	9	15	30	13	4	15	5
Muslim	46	32	58	38	8	0	11	1	0	0	0	0
Other Minorities	60	36	73	51	29	14	28	18	17	2	18	15
Total	67	46	78	67	23	14	31	26	13	6	17	13

Table S2: Migration equation household level variables and sample means

Notation:	Migrant hh	Non-migrant hh	Description	Comment
household level				
nkids612	1.90	1.89	# of children 6-12	
nkids1316	0.95	0.93	# of children 13-16	
maxedu_illiter	0.29	0.33	maximum educ of adult males: illiterate	ommited dummy
maxedu_primary	0.17	0.22	primary or less	Calc. before migration
maxedu_seconda	0.39	0.28	secondary	
maxedu_college	0.16	0.17	above secondary	
medageofmales	33	35	median age of adult males	Calc. before migration
ethnic	0.45	0.43	ethnic minority dummy	
nkids05	1.0	0.78	# of children 0-5	
multifamily	0.3	0.12	multiple family household dummy	
nmen0	0	0.05	zero adult males	
nmen1	0.4	0.64	one adult male	
nmen2	0.4	0.21	two adult males	
nmen3	0.2	0.06	three adult males	
nmen4	0.1	0.03	four and more adult males	
nwomen	1.8	1.45	# of adult women	
nelderly	0.3	0.30	# of elderly	
no_durables	0.4	0.41	no durable assets	
ln_durables	4.0	3.82	ln(durable assets)	
no_land_ur	0.0	0.06	no owned land, urban	
ln_land_ur	0.0	-0.06	ln(owned land), urban	
no_land_ru	0.2	0.17	no owned land, rural	
ln_land_ru	-0.5	-0.46	ln(owned land), rural	
ward level				
prc_illit01	0.6	0.59	ward % of illiterate (15+ y.o)	
prc_wage_agr01	0.1	0.05	ward % of empl. in wage labor, agricult.	
prc_wage_nag01	0.1	0.07	ward % of empl. in wage labor, nonagri.	
prc_selfe_agr01	0.5	0.46	ward % of self empl. in agriculture	
prc_selfe_nag01	0.0	0.05	ward % of self empl. in non-agriculture	
ln_exp1995	8.7	8.70	district ln(mean expenditure), 1995	
interest_rate	0.3	0.31	ward median interest rate	
km2school	1.8	1.78	ward distance to primary school, km	
instruments				
%_abroad_mig01	0.15	0.10	ward % of adult males living abroad,01	
%_intern_mig95	0.14	0.12	district % of households with internal migrants, 95	
Number of obs	1798 obs	5384 obs		

Table R1:Independent probit

	P(S=1)	
	coef	**se**
HasMigrant	**0.256*****	0.06
Age7	0.638***	0.09
Age8	0.895***	0.08
Age9	1.070***	0.09
Age10	1.054***	0.08
Age11	1.013***	0.10
Age12	0.874***	0.09
Age13	0.700***	0.10
Age14	0.489***	0.09
Age15	0.291***	0.09
Age16	0.011	0.09
Male	0.450***	0.04
Ethnic	-0.332***	0.06
Father_Primary	0.375***	0.06
Father_Second	0.552***	0.07
Father_College	0.606***	0.09
Mother_Primary	0.075	0.10
Mother_Second	0.082	0.14
Mother_College	0.166	0.17
MaxEdAdults	0.070***	0.02
FatherDeceased	-0.458***	0.12
Nothkids1316	0.068*	0.04
Nothkids612	-0.087***	0.02
Nkids05	-0.168***	0.03
MultiFamily	0.057	0.10
Nmen0	0.255*	0.15
Nmen2	-0.315***	0.07
Nmen3	-0.482***	0.12
Nmen4	-0.524***	0.16
Nwomen	0.198***	0.04
Nelderly	-0.093**	0.04
No_durables	0.039	0.18
Ln_durables	0.045**	0.02
No_land_UR	-0.244**	0.10
Ln_land_UR	0.129**	0.05
No_land_RU	-0.358***	0.08
Ln_land_RU	0.100***	0.03
Prc_illit01	-1.125***	0.18
Prc_wage_agr01	-0.311	0.35
Prc_wage_nag01	-0.080	0.54
Prc_selfe_agr01	0.282	0.20
Prc_selfe_nag01	-0.612	0.59
Ln_exp1995	0.055	0.08
Interest_rate	-0.871***	0.24
Km2school	-0.079***	0.02
Constant	0.274	0.73
NOBS	7,182	

note: *** p<.01, ** p<.05 * p<.10

Table R2: Switching independent probit

	P(S^0=1)		P(S^1=1)		beta1-beta0	
	coef	**se**	**coef**	**se**	**diff**	**se**
Age7	0.674***	0.09	0.549***	0.171	-0.125	0.192
Age8	0.874***	0.09	0.984***	0.172	0.110	0.200
Age9	1.097***	0.10	1.052***	0.173	-0.044	0.204
Age10	1.099***	0.10	0.878***	0.160	-0.222	0.181
Age11	1.049***	0.11	0.970***	0.180	-0.079	0.208
Age12	0.903***	0.10	0.773***	0.181	-0.130	0.206
Age13	0.671***	0.11	0.726***	0.200	0.054	0.219
Age14	0.447***	0.11	0.515***	0.175	0.068	0.207
Age15	0.291***	0.11	0.178	0.176	-0.112	0.202
Age16	-0.068	0.11	0.163	0.191	0.231	0.211
Male	0.473***	0.05	0.413***	0.089	-0.060	0.103
Ethnic	-0.383***	0.06	-0.134	0.107	0.249**	0.119
Father_Primary	0.455***	0.07	0.020	0.119	-0.435***	0.143
Father_Second	0.619***	0.09	0.379***	0.144	-0.240	0.175
Father_College	0.643***	0.11	0.412**	0.183	-0.231	0.223
Mother_Primary	0.098	0.11	0.026	0.188	-0.072	0.219
Mother_Second	0.192	0.16	-0.329	0.282	-0.521	0.318
Mother_College	0.442**	0.22	-0.493*	0.300	-0.935**	0.369
MaxEdAdults	0.059***	0.02	0.116***	0.030	0.056	0.037
FatherDeceased	-0.481***	0.12	-0.367	0.272	0.114	0.300
Nothkids1316	0.021	0.04	0.209***	0.075	0.189**	0.087
Nothkids612	-0.107***	0.03	0.001	0.042	0.108**	0.049
Nkids05	-0.195***	0.03	-0.125**	0.051	0.069	0.058
MultiFamily	-0.151	0.12	0.336**	0.150	0.487**	0.191
Nmen0	0.257*	0.15				
Nmen2	-0.298***	0.09	-0.361***	0.121	-0.063	0.152
Nmen3	-0.425***	0.16	-0.561***	0.172	-0.136	0.237
Nmen4	-0.370**	0.18	-0.583**	0.259	-0.213	0.317
Nwomen	0.298***	0.05	-0.006	0.072	-0.303***	0.084
Nelderly	-0.059	0.05	-0.201***	0.073	-0.142	0.090
No_durables	0.031	0.20	-0.062	0.373	-0.093	0.428
Ln_durables	0.046*	0.03	0.031	0.044	-0.015	0.052
No_land_UR	-0.290***	0.11	0.051	0.267	0.341	0.292
Ln_land_UR	0.144**	0.06	0.091	0.125	-0.053	0.141
No_land_RU	-0.393***	0.08	-0.291*	0.151	0.102	0.166
Ln_land_RU	0.096***	0.03	0.124**	0.052	0.028	0.059
Prc_illit01	-1.145***	0.21	-1.115***	0.291	0.029	0.335
Prc_wage_agr01	-0.137	0.39	-0.767	0.477	-0.630	0.522
Prc_wage_nag01	-0.510	0.59	1.625	0.994	2.135**	1.074
Prc_selfe_agr01	0.221	0.22	0.732**	0.320	0.510	0.345
Prc_selfe_nag01	-0.382	0.61	-0.662	1.152	-0.280	1.167
Ln_exp1995	0.032	0.09	0.155	0.158	0.123	0.179
Interest_rate	-0.912***	0.28	-0.829**	0.388	0.083	0.451
Km2school	-0.074***	0.02	-0.123***	0.030	-0.049	0.035
Constant	0.471	0.81	-0.339	1.448	-0.810	1.645

note: *** p<.01, ** p<.05 * p<.10 NOBS: 7,182

Table R3: Bivariate probit

	P(S=1)			P(M=1)	
	coef	**se**		**coef**	**se**
HasMigrant	1.206***	0.242	**Ethnic**	-0.032	0.071
Age7	0.580***	0.083	**MultiFamily**	0.222**	0.101
Age8	0.811***	0.086	**Nkids05**	-0.015	0.035
Age9	0.973***	0.095	**Nkids612**	-0.040	0.029
Age10	0.954***	0.096	**Nkids1316**	-0.108***	0.042
Age11	0.916***	0.100	**MaxEdu_Primary**	-0.030	0.083
Age12	0.790***	0.090	**MaxEdu_Seconda**	0.197**	0.080
Age13	0.660***	0.096	**MaxEdu_College**	-0.035	0.101
Age14	0.460***	0.087	**MedAgeofMales**	-0.000	0.002
Age15	0.284***	0.087	**Nmen2**	0.712***	0.069
Age16	0.041	0.087 `	**Nmen3**	0.960***	0.123
Male	0.406***	0.049	**Nmen4**	1.075***	0.168
Ethnic	-0.290***	0.058	**Nwomen**	-0.007	0.043
Father_Primary	0.330***	0.057	**Nelderly**	-0.025	0.051
Father_Second	0.446***	0.079	**No_durables**	0.065	0.196
Father_College	0.533***	0.097	**Ln_durables**	0.002	0.024
Mother_Primary	0.061	0.088	**No_land_UR**	-0.258*	0.155
Mother_Second	0.058	0.125	**Ln_land_UR**	0.105*	0.062
Mother_College	0.165	0.157	**No_land_RU**	0.021	0.099
MaxEdAdult	0.061***	0.016	**Ln_land_RU**	-0.082***	0.031
FatherDeceased	-0.428***	0.108	**Km2school**	-0.007	0.015
Nothkids1316	0.091***	0.035	**%_illit01**	-0.119	0.229
Nothkids612	-0.066***	0.025	**%_wage_agr01**	-0.143	0.349
Nkids05	-0.144***	0.029	**%_wage_nag01**	0.457	0.640
MultiFamily	-0.040	0.091	**%_selfe_agr01**	-0.131	0.227
Nmen0	0.222	0.135	**%_selfe_nag01**	-1.854**	0.755
Nmen2	-0.509***	0.081	**Ln_exp1995**	0.092	0.082
Nmen3	-0.750***	0.129	**Interest_rate**	1.021***	0.300
Nmen4	-0.799***	0.170	**%_abroad_mig01**	1.277***	0.169
Nwomen	0.174***	0.040	**%_intern_mig95**	0.808**	0.384
Nelderly	-0.074*	0.040	**Constant**	-2.096***	0.761
No_durables	0.049	0.165			
Ln_durables	0.044**	0.020			
No_land_UR	-0.115	0.117			
Ln_land_UR	0.080	0.053	**/athrho**	-0.703***	0.254
No_land_RU	-0.327***	0.077	**rho:**	-0.606	
Ln_land_RU	0.121***	0.026			
%_illit01	-0.931***	0.200			
%_wage_agr01	-0.223	0.333			
%_wage_nag01	-0.175	0.531			
%_selfe_agr01	0.259	0.187			
%_selfe_nag01	-0.071	0.566			
Ln_exp1995	0.013	0.078			
Interest_rate	-1.119***	0.231			
Km2school	-0.068***	0.020			
Constant	0.421	0.676	NOBS:	7,182	

note: *** p<.01, ** p<.05 * p<.10

Table R4: Bivariate probit with full interaction of M and X

	P(S=1)		P(S=1)			P(M=1)	
	coef	se	M*coef	se		coef	se
Age7	0.616***	0.088	-0.133	0.169	**Ethnic**	-0.035	0.070
Age8	0.798***	0.089	0.048	0.179	**MultiFamily**	0.226**	0.102
Age9	1.010***	0.097	-0.098	0.182	**Nkids05**	-0.017	0.035
Age10	1.006***	0.093	-0.246	0.160	**Nkids612**	-0.042	0.029
Age11	0.957***	0.102	-0.110	0.184	**Nkids1316**	-0.113***	0.042
Age12	0.825***	0.094	-0.157	0.182	**MaxEdu_Primary**	-0.022	0.083
Age13	0.650***	0.103	-0.021	0.196	**MaxEdu_Seconda**	0.201**	0.079
Age14	0.427***	0.101	0.028	0.184	**MaxEdu_College**	-0.030	0.100
Age15	0.285***	0.099	-0.107	0.178	**MedAgeofMales**	-0.000	0.002
Age16	-0.029	0.099	0.187	0.188	**Nmen2**	0.712***	0.069
Male	0.429***	0.052	-0.060	0.091	**Nmen3**	0.956***	0.122
Ethnic	-0.339***	0.063	0.235**	0.105	**Nmen4**	1.071***	0.167
Father_Primary	0.407***	0.066	-0.395***	0.129	**Nwomen**	-0.005	0.042
Father_Second	0.515***	0.087	-0.250	0.156	**Nelderly**	-0.023	0.051
Father_College	0.568***	0.107	-0.204	0.197	**No_durables**	0.066	0.196
Mother_Primary	0.086	0.103	-0.078	0.193	**Ln_durables**	0.002	0.024
Mother_Second	0.159	0.143	-0.495*	0.284	**No_land_UR**	-0.268*	0.157
Mother_College	0.430**	0.194	-0.866***	0.327	**Ln_land_UR**	0.108*	0.062
MaxEdAdult	0.051***	0.020	0.052	0.033	**No_land_RU**	0.017	0.100
FatherDeceased	-0.433***	0.114	0.064	0.259	**Ln_land_RU**	-0.083***	0.031
Nothkids1316	0.049	0.041	0.167**	0.076	**Km2school**	-0.006	0.015
Nothkids612	-0.084***	0.028	0.103**	0.044	**%_illit01**	-0.129	0.228
Nkids05	-0.168***	0.032	0.063	0.052	**%_wage_agr01**	-0.113	0.351
MultiFamily	-0.202*	0.106	0.374**	0.171	**%_wage_nag01**	0.415	0.646
Nmen0	0.225	0.139			**%_selfe_agr01**	-0.144	0.227
Nmen2	-0.474***	0.089	-0.146	0.132	**%_selfe_nag01**	-1.841**	0.752
Nmen3	-0.670***	0.162	-0.216	0.209	**Ln_exp1995**	0.094	0.083
Nmen4	-0.641***	0.171	-0.283	0.274	**Interest_rate**	1.022***	0.304
Nwomen	0.260***	0.048	-0.263***	0.078	**%_abroad_mig01**	1.267***	0.168
Nelderly	-0.048	0.048	-0.118	0.079	**%_intern_mig95**	0.797**	0.374
No_durables	0.033	0.186	-0.074	0.371	**Constant**	-2.117***	0.765
Ln_durables	0.043*	0.024	-0.012	0.045			
No_land_UR	-0.165	0.118	0.352	0.265			
Ln_land_UR	0.095*	0.056	-0.064	0.121			
No_land_RU	-0.365***	0.081	0.118	0.148	**/athrho**	-0.713***	0.183
Ln_land_RU	0.116***	0.028	0.034	0.051	**rho:**	-0.612	
%_illit01	-0.954***	0.208	0.065	0.290			
%_wage_agr01	-0.082	0.363	-0.484	0.463			
%_wage_nag01	-0.562	0.551	1.931*	1.000			
%_selfe_agr01	0.218	0.198	0.420	0.307			
%_selfe_nag01	0.146	0.579	-0.099	0.999			
Ln_exp1995	-0.003	0.086	0.077	0.158			
Interest_rate	-1.130***	0.255	-0.002	0.412			
Km2school	-0.065***	0.022	-0.041	0.030			
Constant	0.537	0.756	0.602	1.436	NOBS:	7,182	

note: *** p<.01, ** p<.05 * p<.10

Table R5: Switching probit

	P(S^0=1)		P(S^1=1)			P(M=1)	
	coef	se	coef	se		coef	se
Age7	0.634***	0.091	0.401***	0.141	**Ethnic**	-0.034	0.070
Age8	0.824***	0.094	0.692***	0.181	**MultiFamily**	0.222**	0.102
Age9	1.039***	0.100	0.748***	0.188	**Nkids05**	-0.018	0.034
Age10	1.037***	0.096	0.614***	0.167	**Nkids612**	-0.043	0.029
Age11	0.987***	0.105	0.687***	0.190	**Nkids1316**	-0.114***	0.041
Age12	0.850***	0.098	0.553***	0.163	**MaxEdu_Primary**	-0.025	0.080
Age13	0.658***	0.106	0.511***	0.163	**MaxEdu_Seconda**	0.196**	0.078
Age14	0.434***	0.104	0.363**	0.154	**MaxEdu_College**	-0.033	0.099
Age15	0.286***	0.102	0.147	0.137	**MedAgeofMales**	0.000	0.002
Age16	-0.042	0.102	0.127	0.146	**Nmen2**	0.713***	0.068
Male	0.445***	0.054	0.326***	0.070	**Nmen3**	0.965***	0.123
Ethnic	-0.353***	0.064	-0.080	0.089	**Nmen4**	1.077***	0.167
Father_Primary	0.424***	0.068	0.020	0.093	**Nwomen**	-0.005	0.042
Father_Second	0.547***	0.090	0.199*	0.116	**Nelderly**	-0.022	0.050
Father_College	0.595***	0.111	0.314**	0.145	**No_durables**	0.072	0.195
Mother_Primary	0.089	0.107	0.002	0.142	**Ln_durables**	0.003	0.024
Mother_Second	0.169	0.148	-0.315	0.218	**No_land_UR**	-0.274*	0.156
Mother_College	0.436**	0.202	-0.389*	0.236	**Ln_land_UR**	0.110*	0.062
MaxEdAdult	0.054***	0.020	0.092***	0.023	**No_land_RU**	0.018	0.099
FatherDeceased	-0.450***	0.118	-0.340*	0.202	**Ln_land_RU**	-0.084***	0.031
Nothkids1316	0.044	0.042	0.204***	0.060	**Km2school**	-0.007	0.015
Nothkids612	-0.090***	0.029	0.023	0.034	**%_illit01**	-0.136	0.226
Nkids05	-0.176***	0.032	-0.086*	0.046	**%_wage_agr01**	-0.106	0.347
MultiFamily	-0.195*	0.109	0.086	0.133	**%_wage_nag01**	0.425	0.645
Nmen0	0.240*	0.144			**%_selfe_agr01**	-0.143	0.226
Nmen2	-0.446***	0.096	-0.691***	0.105	**%_selfe_nag01**	-1.863**	0.747
Nmen3	-0.632***	0.170	-0.963***	0.146	**Ln_exp1995**	0.095	0.082
Nmen4	-0.597***	0.178	-1.017***	0.233	**Interest_rate**	1.025***	0.303
Nwomen	0.272***	0.049	-0.006	0.057	**%_abroad_mig01**	1.246***	0.172
Nelderly	-0.051	0.049	-0.140**	0.059	**%_intern_mig95**	0.760**	0.383
No_durables	0.033	0.191	0.010	0.299	**Constant**	-2.132***	0.760
Ln_durables	0.044*	0.024	0.034	0.036			
No_land_UR	-0.195	0.120	0.203	0.250			
Ln_land_UR	0.108*	0.058	0.004	0.094			
No_land_RU	-0.376***	0.082	-0.205	0.128	**/atanhrho_m0**	-0.557***	0.211
Ln_land_RU	0.113***	0.029	0.147***	0.041	**/atanhrho_m1**	-1.319**	0.553
%_illit01	-1.008***	0.214	-0.715***	0.262			
%_wage_agr01	-0.096	0.373	-0.393	0.431	**rho_m0:**	-0.55	
%_wage_nag01	-0.558	0.561	1.126	0.940	**rho_m1:**	-0.88	
%_selfe_agr01	0.223	0.203	0.542*	0.279			
%_selfe_nag01	0.037	0.593	0.331	0.844			
Ln_exp1995	0.005	0.089	0.041	0.130			
Interest_rate	-1.104***	0.268	-1.152***	0.377			
Km2school	-0.068***	0.022	-0.089***	0.023			
Constant	0.523	0.775	1.620	1.175	NOBS:	7,182	

note: *** p<.01, ** p<.05 * p<.10

Table R3.2: Bivariate probit, no instruments

	P(S=1)			P(M=1)	
	coef	se		coef	se
HasMigrant	0.782	0.560	**Ethnic**	-0.023	0.073
Age7	0.622***	0.091	**MultiFamily**	0.268**	0.105
Age8	0.874***	0.089	**Nkids05**	-0.018	0.036
Age9	1.043***	0.100	**Nkids612**	-0.038	0.029
Age10	1.027***	0.103	**Nkids1316**	-0.101**	0.045
Age11	0.987***	0.105	**MaxEdu_Primary**	-0.048	0.085
Age12	0.851***	0.095	**MaxEdu_Seconda**	0.185**	0.092
Age13	0.694***	0.102	**MaxEdu_College**	-0.062	0.110
Age14	0.487***	0.091	**MedAgeofMales**	-0.000	0.002
Age15	0.293***	0.093	**Nmen2**	0.694***	0.069
Age16	0.024	0.093 `	**Nmen3**	0.937***	0.124
Male	0.438***	0.050	**Nmen4**	1.019***	0.168
Ethnic	-0.318***	0.059	**Nwomen**	-0.010	0.043
Father_Primary	0.365***	0.060	**Nelderly**	-0.011	0.052
Father_Second	0.516***	0.094	**No_durables**	0.024	0.195
Father_College	0.590***	0.103	**Ln_durables**	-0.001	0.024
Mother_Primary	0.071	0.095	**No_land_UR**	-0.335**	0.160
Mother_Second	0.073	0.136	**Ln_land_UR**	0.132**	0.065
Mother_College	0.166	0.169	**No_land_RU**	-0.006	0.097
MaxEdAdult	0.068***	0.018	**Ln_land_RU**	-0.097***	0.032
FatherDeceased	-0.447***	0.114	**Km2school**	-0.013	0.016
Nothkids1316	0.083**	0.037	**%_illit01**	-0.234	0.234
Nothkids612	-0.079***	0.028	**%_wage_agr01**	-0.140	0.373
Nkids05	-0.160***	0.030	**%_wage_nag01**	0.175	0.714
MultiFamily	0.007	0.110	**%_selfe_agr01**	0.002	0.235
Nmen0	0.243*	0.144	**%_selfe_nag01**	-1.664**	0.785
Nmen2	-0.425***	0.127	**Ln_exp1995**	0.160*	0.088
Nmen3	-0.639***	0.190	**Interest_rate**	1.021***	0.310
Nmen4	-0.686***	0.211	**Constant**	-2.384***	0.803
Nwomen	0.191***	0.041			
Nelderly	-0.084**	0.042			
No_durables	0.043	0.171			
Ln_durables	0.045**	0.021			
No_land_UR	-0.185	0.130			
Ln_land_UR	0.108*	0.059	**/athrho**	-0.331	0.388
No_land_RU	-0.349***	0.079	**rho:**	-0.3194	
Ln_land_RU	0.113***	0.029			
%_illit01	-1.053***	0.215			
%_wage_agr01	-0.275	0.351			
%_wage_nag01	-0.111	0.538			
%_selfe_agr01	0.277	0.194			
%_selfe_nag01	-0.337	0.610			
Ln_exp1995	0.032	0.087			
Interest_rate	-1.021***	0.283			
Km2school	-0.075***	0.021			
Constant	0.367	0.721	NOBS:	7,182	

note: *** p<.01, ** p<.05 * p<.10

Table R3.3: Bivariate probit with instruments in the enrollment equation

	P(S=1)			P(M=1)	
	coef	se		coef	se
HasMigrant	0.677**	0.339	**Ethnic**	-0.035	0.072
%_abroad_mig01	0.447	0.262	**MultiFamily**	0.223**	0.102
%_intern_mig95	-0.438	0.318	**Nkids05**	-0.017	0.035
Age7	0.629***	0.085	**Nkids612**	-0.041	0.030
Age8	0.874***	0.081	**Nkids1316**	-0.112***	0.042
Age9	1.059***	0.091	**MaxEdu_Primary**	-0.035	0.086
Age10	1.036***	0.088	**MaxEdu_Seconda**	0.175**	0.086
Age11	0.999***	0.096	**MaxEdu_College**	-0.063	0.105
Age12	0.860***	0.087	**MedAgeofMales**	-0.001	0.002
Age13	0.703***	0.101	**Nmen2**	0.717***	0.069
Age14	0.476***	0.092 `	**Nmen3**	0.959***	0.123
Age15	0.288***	0.094	**Nmen4**	1.067***	0.167
Age16	0.013	0.093	**Nwomen**	-0.003	0.043
Male	0.442***	0.045	**Nelderly**	-0.026	0.051
Ethnic	-0.325***	0.056	**No_durables**	0.073	0.197
Father_Primary	0.360***	0.058	**Ln_durables**	0.004	0.024
Father_Second	0.533***	0.079	**No_land_UR**	-0.265*	0.157
Father_College	0.604***	0.099	**Ln_land_UR**	0.113*	0.064
Mother_Primary	0.050	0.097	**No_land_RU**	0.012	0.101
Mother_Second	0.049	0.137	**Ln_land_RU**	-0.081***	0.031
Mother_College	0.152	0.173	**Km2school**	-0.008	0.015
MaxEdAdult	0.070***	0.017	**%_illit01**	-0.152	0.233
FatherDeceased	-0.459***	0.113	**%_wage_agr01**	-0.162	0.353
Nothkids1316	0.074**	0.037	**%_wage_nag01**	0.439	0.649
Nothkids612	-0.080***	0.025	**%_selfe_agr01**	-0.118	0.229
Nkids05	-0.166***	0.028	**%_selfe_nag01**	-1.877**	0.761
MultiFamily	0.010	0.097	**Ln_exp1995**	0.096	0.084
Nmen0	0.243*	0.145	**Interest_rate**	0.998***	0.305
Nmen2	-0.400***	0.096	**%_abroad_mig01**	1.225***	0.179
Nmen3	-0.607***	0.151	**%_intern_mig95**	1.004***	0.371
Nmen4	-0.632***	0.182	**Constant**	-2.109***	0.769
Nwomen	0.198***	0.039			
Nelderly	-0.088**	0.041			
No_durables	0.029	0.173			
Ln_durables	0.044**	0.021	**/athrho**	-0.278	0.221
No_land_UR	-0.195*	0.108	**rho:**	-0.271	
Ln_land_UR	0.109**	0.053			
No_land_RU	-0.342***	0.076			
Ln_land_RU	0.118***	0.026			
%_illit01	-0.982***	0.191			
%_wage_agr01	-0.210	0.337			
%_wage_nag01	-0.028	0.547			
%_selfe_agr01	0.193	0.192			
%_selfe_nag01	-0.522	0.559			
Ln_exp1995	0.051	0.082			
Interest_rate	-0.946***	0.250			
Km2school	-0.075***	0.020			
Constant	0.212	0.704	NOBS:	7,182	

note: *** p<.01, ** p<.05 * p<.10

Table R6: Effect of migration of father

Equations 1-5:	**P(Enr=1)**	
	coef	**se**
Father_migrant	0.797***	0.195
Other_migrant	0.315*	0.165
Age7	0.633***	0.078
Age8	0.821***	0.072
Age9	0.978***	0.082
Age10	0.987***	0.079
Age11	0.967***	0.089
Age12	0.848***	0.082
Age13	0.706***	0.096
Age14	0.478***	0.085
Age15	0.285***	0.091
Age16	0.016	0.093
Male	0.453***	0.043
Ethnic	-0.327***	0.058
Father_Primary	0.345***	0.060
Father_Second	0.428***	0.078
Father_College	0.603***	0.091
Mother_Primary	0.076	0.095
Mother_Second	0.011	0.140
Mother_College	0.053	0.171
MaxEdAdult	0.074***	0.017
FatherDeceased	-0.394***	0.115
Nothkids1316	-0.073***	0.023
Nothkids612	0.082**	0.037
Nkids05	0.067	0.093
MultiFamily	-0.149***	0.026
Nmen0	0.345**	0.144
Nmen2	-0.337***	0.077
Nmen3	-0.556***	0.124
Nmen4	-0.632***	0.180
Nwomen	0.171***	0.038
Nelderly	-0.121***	0.039
No_durables	-0.021	0.174
Ln_durables	0.038*	0.022
No_land_UR	-0.165	0.104
Ln_land_UR	0.110**	0.054
No_land_RU	-0.342***	0.075
Ln_land_RU	0.103***	0.026
%_illit01	-1.012***	0.179
%_wage_agr01	-0.215	0.323
%_wage_nag01	-0.064	0.532
%_selfe_agr01	0.225	0.190
%_selfe_nag01	-0.502	0.577
Ln_exp1995	0.034	0.080
Interest_rate	-1.027***	0.231
Km2school	-0.070***	0.018
Constant	0.433	0.704

Equations 6-10:	**P(Mig=1)**	
	coef	**se**
Age	0.095***	0.014
Age_sq	-0.156***	0.019
Ethnic	0.017	0.050
Ed<=Primary	-0.016	0.056
Ed_Second	0.223***	0.060
Ed_College	-0.411***	0.076
Spouse_Primary	0.154**	0.069
Spouse_Second	0.337***	0.080
Spouse_College	0.364***	0.091
Married	0.073	0.066
Nownchild05	-0.076***	0.027
Nownchild612	-0.076***	0.024
Nownchild1316	-0.095**	0.043
Notherchildr016	0.037**	0.016
AgeotherMales	0.006**	0.002
MaxEdotherMales	0.002	0.013
NotherMarried	-0.113**	0.053
Nmen2	-0.050	0.100
Nmen3	-0.008	0.116
Nmen4	0.170	0.126
Nwomen	0.019	0.028
Nelderly	0.029	0.034
No_durables	0.128	0.128
Ln_durables	0.002	0.016
No_land_UR	-0.363***	0.091
Ln_land_UR	0.045	0.042
No_land_RU	-0.027	0.067
Ln_land_RU	-0.049**	0.022
%_illit01	-0.397**	0.175
%_wage_agr01	-0.201	0.254
%_wage_nag01	0.265	0.419
%_selfe_agr01	0.009	0.167
%_selfe_nag01	-1.373**	0.604
Ln_exp1995	-0.005	0.061
Interest_rate	1.071***	0.206
Km2school	-0.021	0.015
%_abroad_mig01	1.102***	0.160
%_intern_mig95	0.653**	0.262
Constant	-2.395***	0.589

	correlations	**coef**	**se**
d	**related children**	0.57	0.03
e	**unrelated children**	0.25	0.12
b	**child - father migr**	-0.36	0.11
c	**child - other migr**	-0.11	0.10
a	**migration equation**	0.24	0.04
	NOBS:	14,568	

note: *** p<.01, ** p<.05 * p<.10

note: standard errors adjusted for clustering on PSU level

Table R6.2: Effect varying by migrant age and education

Equations 1-5:	P(Enr=1)		Equations 6-10:	P(Mig=1)	
	coef	**se**		**coef**	**se**
Father_migrant	0.630***	0.226	**Age**	0.091***	0.014
Other_migrant	0.233	0.183	**Age_sq**	-0.151***	0.019
Migrant's_age	0.001	0.012	**Ethnic**	0.011	0.050
Migrant's_age2/100	0.025	0.023	**Ed<=Primary**	-0.026	0.058
Migrant's_educlev	-0.004	0.023	**Ed_Second**	0.210***	0.061
Age7	0.631***	0.078	**Ed_College**	-0.393***	0.077
Age8	0.836***	0.075	**Spouse_Primary**	0.175**	0.071
Age9	0.983***	0.083	**Spouse_Second**	0.343***	0.082
Age10	0.960***	0.079	**Spouse_College**	0.369***	0.093
Age11	0.951***	0.092	**Married**	0.043	0.068
Age12	0.836***	0.084	**Nownchild05**	-0.075***	0.027
Age13	0.690***	0.096	**Nownchild612**	-0.069***	0.024
Age14	0.479***	0.086	**Nownchild1316**	-0.092**	0.043
Age15	0.272***	0.088	**Notherchildr016**	0.041**	0.017
Age16	0.027	0.090	**AgeotherMales**	0.005**	0.002
Male	0.432***	0.043	**MaxEdotherMales**	0.002	0.013
Ethnic	-0.306***	0.058	**NotherMarried**	-0.097*	0.055
Father_Primary	0.343***	0.063	**Nmen2**	-0.045	0.098
Father_Second	0.400***	0.077	**Nmen3**	-0.003	0.113
Father_College	0.614***	0.089	**Nmen4**	0.148	0.130
Mother_Primary	0.072	0.093	**Nwomen**	0.017	0.028
Mother_Second	-0.023	0.136	**Nelderly**	0.020	0.034
Mother_College	0.012	0.166	**No_durables**	0.111	0.131
MaxEdAdult	0.069***	0.017	**Ln_durables**	-0.002	0.017
FatherDeceased	-0.374***	0.113	**No_land_UR**	-0.352***	0.092
Nothkids1316	-0.080***	0.023	**Ln_land_UR**	0.039	0.041
Nothkids612	0.070*	0.037	**No_land_RU**	-0.011	0.069
Nkids05	0.058	0.090	**Ln_land_RU**	-0.052**	0.023
MultiFamily	-0.150***	0.026	**%_illit01**	-0.368**	0.174
Nmen0	0.374***	0.144	**%_wage_agr01**	-0.211	0.266
Nmen2	-0.329***	0.077	**%_wage_nag01**	0.167	0.421
Nmen3	-0.541***	0.127	**%_selfe_agr01**	-0.009	0.168
Nmen4	-0.613***	0.176	**%_selfe_nag01**	-1.387**	0.606
Nwomen	0.160***	0.038	**Ln_exp1995**	0.005	0.062
Nelderly	-0.105***	0.038	**Interest_rate**	1.030***	0.206
No_durables	-0.039	0.176	**Km2school**	-0.02	0.016
Ln_durables	0.035	0.022	**%_abroad_mig01**	1.133***	0.157
No_land_UR	-0.141	0.104	**%_intern_mig95**	0.643**	0.267
Ln_land_UR	0.109**	0.054	**Constant**	-2.383***	0.599
No_land_RU	-0.360***	0.074			
Ln_land_RU	0.112***	0.026	**correlations**	**coef**	**se**
%_illit01	-0.934***	0.176	d **related children**	0.58	0.04
%_wage_agr01	-0.191	0.309	e **unrelated children**	0.29	0.11
%_wage_nag01	0.020	0.525	b **child - father migr**	-0.48	0.10
%_selfe_agr01	0.219	0.185	c **child - other migr**	-0.15	0.10
%_selfe_nag01	-0.383	0.566	a **migration equation**	0.21	0.04
Ln_exp1995	0.041	0.079			
Interest_rate	-1.099***	0.227			
Km2school	-0.067***	0.017			
Constant	0.334	0.696	NOBS:	14,568	

note: *** p<.01, ** p<.05 * p<.10

note: standard errors adjusted for clustering on PSU level

Table R6.3: Effect varying by child age and sex

Equations 1-5:	P(Enr=1)	
	coef	se
Father_migrant	0.629***	0.203
Other_migrant	0.082	0.182
ChildAge_migrant	0.027**	0.011
Boy_migrant	0.006	0.095
Age7	0.636***	0.079
Age8	0.838***	0.076
Age9	0.986***	0.084
Age10	0.954***	0.081
Age11	0.939***	0.094
Age12	0.815***	0.086
Age13	0.662***	0.099
Age14	0.439***	0.091
Age15	0.223**	0.092
Age16	-0.025	0.096
Male	0.436***	0.048
Ethnic	-0.315***	0.058
Father_Primary	0.347***	0.062
Father_Second	0.416***	0.076
Father_College	0.597***	0.089
Mother_Primary	0.075	0.094
Mother_Second	-0.006	0.138
Mother_College	0.032	0.169
MaxEdAdult	0.073***	0.016
FatherDeceased	-0.401***	0.113
Nothkids1316	-0.078***	0.023
Nothkids612	0.074**	0.037
Nkids05	0.065	0.091
MultiFamily	-0.152***	0.026
Nmen0	0.380***	0.145
Nmen2	-0.334***	0.077
Nmen3	-0.560***	0.126
Nmen4	-0.622***	0.174
Nwomen	0.165***	0.038
Nelderly	-0.108***	0.039
No_durables	-0.030	0.177
Ln_durables	0.036	0.022
No_land_UR	-0.157	0.106
Ln_land_UR	0.109**	0.055
No_land_RU	-0.363***	0.075
Ln_land_RU	0.112***	0.026
%_illit01	-0.961***	0.177
%_wage_agr01	-0.193	0.317
%_wage_nag01	0.024	0.530
%_selfe_agr01	0.222	0.188
%_selfe_nag01	-0.391	0.568
Ln_exp1995	0.043	0.080
Interest_rate	-1.078***	0.229
Km2school	-0.068***	0.018
Constant	0.350	0.706

Equations 6-10:	P(Mig=1)	
	coef	se
Age	0.091***	0.015
Age_sq	-0.150***	0.019
Ethnic	0.011	0.051
Ed<=Primary	-0.023	0.057
Ed_Second	0.212***	0.061
Ed_College	-0.391***	0.077
Spouse_Primary	0.174**	0.071
Spouse_Second	0.342***	0.082
Spouse_College	0.371***	0.093
Married	0.042	0.068
Nownchild05	-0.073***	0.027
Nownchild612	-0.069***	0.024
Nownchild1316	-0.094**	0.043
Notherchildr016	0.040**	0.017
AgeotherMales	0.006**	0.002
MaxEdotherMales	0.001	0.013
NotherMarried	-0.096*	0.056
Nmen2	-0.043	0.099
Nmen3	-0.001	0.114
Nmen4	0.150	0.131
Nwomen	0.017	0.028
Nelderly	0.022	0.034
No_durables	0.109	0.131
Ln_durables	-0.002	0.017
No_land_UR	-0.352***	0.092
Ln_land_UR	0.040	0.041
No_land_RU	-0.012	0.069
Ln_land_RU	-0.052**	0.023
%_illit01	-0.375**	0.174
%_wage_agr01	-0.208	0.267
%_wage_nag01	0.164	0.422
%_selfe_agr01	-0.008	0.168
%_selfe_nag01	-1.378**	0.605
Ln_exp1995	0.005	0.062
Interest_rate	1.021***	0.206
Km2school	0.015	0.020
%_abroad_mig01	1.133***	0.160
%_intern_mig95	0.668**	0.265
Constant	-2.386***	0.601

	correlations	coef	se
d	**related children**	0.57	0.04
e	**unrelated children**	0.29	0.12
b	**child - father migr**	-0.41	0.10
c	**child - other migr**	-0.15	0.10
a	**migration equation**	0.21	0.04

NOBS: 14,568

note: *** p<.01, ** p<.05 * p<.10

note: standard errors adjusted for clustering on PSU level

Table R6.4: Effect varying by landlessness for rural households

Equations 1-5:	P(Enr=1)	
	coef	**se**
Father_migrant	0.807***	0.189
Other_migrant	0.299*	0.162
LandlessRur_migrant	0.254*	0.138
Age7	0.638***	0.080
Age8	0.847***	0.076
Age9	1.001***	0.084
Age10	0.975***	0.080
Age11	0.968***	0.093
Age12	0.851***	0.085
Age13	0.705***	0.098
Age14	0.488***	0.088
Age15	0.279***	0.090
Age16	0.029	0.093
Male	0.437***	0.043
Ethnic	-0.311***	0.058
Father_Primary	0.347***	0.062
Father_Second	0.417***	0.077
Father_College	0.594***	0.089
Mother_Primary	0.076	0.095
Mother_Second	-0.005	0.138
Mother_College	0.034	0.170
MaxEdAdult	0.076***	0.017
FatherDeceased	-0.387***	0.114
Nothkids1316	-0.078***	0.023
Nothkids612	0.073*	0.037
Nkids05	0.067	0.092
MultiFamily	-0.153***	0.026
Nmen0	0.348**	0.145
Nmen2	-0.341***	0.078
Nmen3	-0.564***	0.128
Nmen4	-0.644***	0.181
Nwomen	0.165***	0.038
Nelderly	-0.107***	0.039
No_durables	-0.015	0.177
Ln_durables	0.038*	0.022
No_land_UR	-0.174	0.106
Ln_land_UR	0.111**	0.055
No_land_RU	-0.425***	0.080
Ln_land_RU	0.110***	0.026
%_illit01	-0.968***	0.178
%_wage_agr01	-0.215	0.319
%_wage_nag01	0.031	0.525
%_selfe_agr01	0.223	0.188
%_selfe_nag01	-0.395	0.572
Ln_exp1995	0.040	0.081
Interest_rate	-1.071***	0.230
Km2school	-0.068***	0.018
Constant	0.364	0.710

Equations 6-10:	P(Mig=1)	
	coef	**se**
Age	0.091***	0.015
Age_sq	-0.150***	0.019
Ethnic	0.010	0.051
Ed<=Primary	-0.023	0.057
Ed_Second	0.211***	0.061
Ed_College	-0.392***	0.077
Spouse_Primary	0.174**	0.071
Spouse_Second	0.340***	0.082
Spouse_College	0.371***	0.093
Married	0.044	0.068
Nownchild05	-0.073***	0.027
Nownchild612	-0.070***	0.024
Nownchild1316	-0.092**	0.043
Notherchildr016	0.041**	0.017
AgeotherMales	0.006**	0.002
MaxEdotherMales	0.001	0.013
NotherMarried	-0.095*	0.056
Nmen2	-0.048	0.100
Nmen3	-0.007	0.115
Nmen4	0.144	0.131
Nwomen	0.017	0.028
Nelderly	0.022	0.034
No_durables	0.110	0.131
Ln_durables	-0.002	0.017
No_land_UR	-0.352***	0.092
Ln_land_UR	0.040	0.041
No_land_RU	-0.018	0.069
Ln_land_RU	-0.052**	0.023
%_illit01	-0.377**	0.175
%_wage_agr01	-0.209	0.268
%_wage_nag01	0.157	0.422
%_selfe_agr01	-0.007	0.168
%_selfe_nag01	-1.375**	0.604
Ln_exp1995	0.005	0.062
Interest_rate	1.023***	0.206
Km2school	0.012	0.030
%_abroad_mig01	1.131***	0.160
%_intern_mig95	0.671**	0.267
Constant	-2.382***	0.600

correlations	**coef**	**se**
d **related children**	0.57	0.04
e **unrelated children**	0.28	0.11
b **child - father migr**	-0.40	0.11
c **child - other migr**	0.12	0.10
a **migration equation**	0.21	0.04

NOBS: 14,568

note: *** p<.01, ** p<.05 * p<.10

note: standard errors adjusted for clustering on PSU level

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