KIER DISCUSSION PAPER SERIES

KYOTO INSTITUTE
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ECONOMIC RESEARCH

Discussion Paper No.898

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Remittances on Educational Expenditure:
Empirical Evidence from the Cambodian Socio-Economic Survey"

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August 2014

KYOTO UNIVERSITY

KYOTO, JAPAN

How Migrant Heterogeneity Influences the Effect of Remittances on Educational Expenditure: Empirical Evidence from the Cambodian Socio-Economic Survey*

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August 6, 2014

Abstract

This study explores the effects of remittances on child education that depend on three types of migration: parental, non-parental, and no migration. Measuring the effects of remittances is challenging and demands great caution because their theoretical positive impacts can be partly or fully offset by the adverse influences of family members' migration. The magnitude of this negative impact, furthermore, depends significantly on migrant characteristics. Specifically, given that parents play an irreplaceable role in their children's education, parental migration not only leads to a labor shortage in the household but also results in insufficient parental input. To overcome the difficulties of measuring the effects of remittances, we derive data from the Cambodian Socio-Economic Survey in 2009, which provides a sufficient sample size for the three self-selected migration types. Estimating each subsample enables us to disentangle the net impact of remittances from that of migration and measure the influence of remittances given the differences in migrant characteristics. Overall, the estimates suggest that the positive effects of remittances are partially canceled out for non-parental migration and completely eliminated when parental migration occurs.

JEL Codes: O15; I25; J13
Keywords: Remittance; Migrant heterogeneity; Educational expenditure

*We would like to thank Hisaki Kono for his continuous suggestions in this project and Katsunori Yamada for his valuable comments in the early stages. We are also indebted to Yoshihiko Nishiyama, Ryo Okui, Kohtaro Hitomi, Yoko Konishi, and Naoya Sueishi for their guidance and suggestions. We are grateful to Naohito Abe, Takeshi Aida, Samuel Amponsah, Yutaka Arimoto, Atsuyuki Asami, Shintaro Asaoka, Yoshihisa Godo, Jun Goto, Naoto Jinji, Tatsuya Kikutani, Yuka Kodama, Katsuo Kogure, Keisuke Kondo, Masahiro Kubo, Yuya Kudo, Takashi Kurosaki, Tomohiro Machikita, Yukichi Mano, Masahiro Okada, Yasuyuki Sawada, Aya Suzuki, Mizuhiro Suzuki, Kazushi Takahashi, Juro Teranishi, Kensuke Teshima, Yasuyuki Todo, Shuji Uchikawa, Hiromi Yamamoto, Takahide Yanagi, Go Yano, and the seminar participants at Hitotsubashi University, Institute of Developing Economies, Kyoto University, the Kyoto meeting of the Kansai Econometric Society, and Tokyo University for their useful comments. We thank Likanan Luch for his help with the data preparation. The authors acknowledge funding from a Grant-in-Aid for Japan Society for the Promotion of Science Fellows. This work was supported by JSPS KAKENHI Grant Numbers 25301025, 13J01709, 13J06130.

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1 Introduction

The large amount of remittance flows to developing countries and the increasing migration of all types (e.g., rural–urban, rural–rural, urban–urban, and cross-border) have both drawn significant scholarly attention to their role in influencing economic development. In particular, their effect on child education is a crucial research question because the socioeconomic environment in which a large proportion of the population has a low educational level can eventually limit future economic growth. This is also the case in Cambodia. While the net enrollment of primary school students reached 96% in 2010 according to UNESCO (2012) following the country's educational reforms in 1996 (Chhinh and Dy, 2009), educational attainment remains low: only approximately half (54%) of students finish primary school, while just one-third (35%) complete the lower secondary level. Thus, the role that remittances and migration play in the improvement of child education has received significant attention in Cambodia.

Economic theory expects remittances to have positive net effects on child education because they alleviate the credit constraints of the receiving households and encourage educational investment. By contrast, migration is expected to have negative net effects because it induces labor shortages in the household and results in children participating in the labor market instead of attending school.[1] Another possible channel through which migration affects child education arises from the characteristics of migrants. Because it has been shown that parents play a significant and irreplaceable role in their children's education (e.g., Becker and Tomes, 1979; Leibowitz, 1977), parental migration may not only lead to labor shortages in the household but also result in insufficient parental input in a child's education.[2]

Our interest in this study is driven by examining how migrant heterogeneity, that is, parental, non-parental, and no migration, differently mitigates the positive effects of remittances on the left-behind child's education. This question also relates to the concern of policymakers in developing countries that parental absence that is accompanied by increasing migration induces a negative impact on child education. It is important to understand that measuring the effects of remittances and migration is challenging and demands great caution because remittances are sent not only by migrants and migrants do not always remit. Since the effects of migration on child education depend on the heterogeneity of migrants, the effects of remittances on child education in a household with and without migrated members must be different. Thus, neglecting the migrant heterogeneity in the effects of remittances on child education can mislead the role of remittances and misguide migration policy.

[1] Other possible channels through which migration affects child education include "brain drain" and "brain gain": when the return to education in the migrant's destination is higher than that in the origin community, a child's expectation of future migration will stimulate educational achievement and vice versa. Chiquiar and Hanson (2002), Doquier and Rapoport (2009), and McKenzie and Rapoport (2011), for example, all emphasize the potential of this channel in the context of Mexican migration to the US. In this study, however, we exclude these factors from the potential migration impacts because we do not restrict the destinations of migrants to a particular country or city. In addition, the effect of this channel is derived from the past actions of migrants. Although the extent to which these effects spread out and how long they remain in the origin communities may be interesting research questions, we leave these topics to future research.

[2] Interpretation of parental inputs is multifaceted. For example, when the outcome variable is educational expenditure, parental inputs can be understood as the expected monetary input on child education, which would not be spend when parents are absent from the households. On the other hand, when the outcome is school attendance or attainments, they can be parental monitoring on child education or parental time inputs, which would not be given by non-parents.

We introduce new concepts for the effects of remittances to shed more light on the object of interest.[3] Since remittance receipts correlate with the occurrence of migrated family members, remittances understandably affect child education both directly (hereinafter called the net effects of remittances) as well as through migration (hereinafter called the mixed effects of remittances). We also call the effects of remittances without taking account of the existence of migrants the aggregate effects, because they include both the net and the mixed effects of remittances.

Figure 1 explains the concept of these effects. The left circle illustrates the set of households who receive remittances and the right the set of households who have migrated household members. The effects of remittances in households who receive remittances but have no migrated members (the bright part of the left circle) are unaffected by the effects of migration. Thus, child educational outcomes in these households are affected by the net effects of remittances. The intersection of the circles (the dark part) illustrates the set of households who receive remittances *and* have migrated members. Since the effects of remittances in these households are influenced by the effects of migration, they enjoy the mixed effects of remittances. Then, the effects of remittances in all remittance-receiving households are the aggregated effects of remittances, which is the mixture of the net and the mixed effects.

Figure 1: The sets of households who receive remittances (left circle) and have migrated members (right circle).

Based on the foregoing, this study presents empirical evidence on the net and the mixed effects of remittances on child education. In particular, we introduce migrant heterogeneity into the mixed effects of remittances according to parental and non-parental migration. The significance of investigating the net and migrant-specific mixed effects is to provide greater insight into the role of remittances and migration in economic development, because they are comparable across studies and moreover can reveal the channels of the effects of migration, namely labor shortage and parental input, on child education by comparing them with each other. Since remittances are considered to affect child education such as school attendance and educational attainment by alleviating the credit constraints of households, the outcome variable is chosen to be educational expenditure for each child. To provide supplemental evidence on the channel of migration effects, we also examine the net and the migrant-specific mixed effects of remittances on the working activity of children. Finally, we also employ the schooling activity of children as our outcome.

The novelty of this study comes from introducing migrant heterogeneity into the mixed effects of remittances depending on whether migrants are parents of the observed children. In this vein, Giannelli and Mangiavacchi (2010) show empirical evidence for the negative impacts of parental migration on school attendance by employing a duration analysis in Albania. Nevertheless, the relative magnitude of these effects compared with, for example, the effects of non-parental migration remains an open question.

[3]For simplicity, we introduce them from the perspective of the remittances. However, they can be also defined from the perspective of migration in the same way.

As Table 1 shows, the literature in this field has largely focused on analyzing the aggregate effects of remittances and/or migration on child educational outcomes (see Edwards and Ureta, 2003; Calero, Bedi, and Sparrow. 2009; Acosta, 2011, and Alcaraz, Chiquiar, and Salcedo, 2012 on remittances and Hanson and Woodruff, 2003; Mansuri, 2006, and McKenzie and Rapoport, 2011 on migration).[4]

Table 1: Studies that investigate the effects of remittances and/or migration on child educational outcomes, classified into the three types of their effects.

Unlike the net and the mixed effects, the major problem with the investigation of the aggregate effects is that the results are not comparable across studies, since they directly depend on the characteristics of the data. Recall that the aggregate effects of remittances consist of the positive impacts of remittances, which are partly or fully offset by the adverse impact of migration. The magnitude of this negative impact depends significantly on the proportion of households with migrants in the full sample as well as on the characteristics of migrants. Consequently, it is uninteresting to compare the aggregate effects of remittances across studies because any difference in these effects may just reflect the quantitative tendency toward migration and the migrant characteristics in the cities or countries where the data are collected. In fact, empirical evidence on the direction of the aggregate effects of remittances on educational outcomes is inconsistent across studies.[5]

Some studies examine the migrant-specific aggregate effects of migration. Antman (2011, 2012) focuses on the aggregate effects of Mexican fathers migrating to the US, finding that paternal migration reduces study hours and increases work hours in the short-term, although it improves educational attainment for girls in the long run. Cortes (2013) investigates the aggregate effects of maternal migration compared with that of paternal migration on school performances measured by the probability of lagging behind.[6] The author concludes that maternal migration increases this probability relative to paternal migration. Nguyen and Purnamasari (2011) suggest that the gender of the migrant affects childhood activities. Specifically, female migration reduces child labor outside the home, but does not have a significant impact on school enrollment or attendance. It is worth re-emphasizing that previous studies introduce migrant heterogeneity into the aggregate effects rather than the mixed effects of migration. However, to provide more general policy proposals, insightful investigation into the existence of remittances is necessary, which can be performed by examining the mixed effects.

Bansak and Chezum (2009), Hu (2012), and Luch and Fukui (2012) investigate the net effects of remittances and migration on school attendance by using both remittances and migration as regressors

[4] When all remittances are sent by migrants, the set of households who receive remittances are the subset of households who have migrated household members. Then, as apparent from Figure 1, the aggregate effects are identical to the mixed effects. Thus, some of these studies may have actually identified the mixed effects that are equal to the aggregate effects. However, we cannot distinguish them when this is not clearly stated.

[5] As Giannelli and Mangiavacchi (2010) suggest, empirical evidence on the direction of the effects of migration on child educational is also mixed.

[6] It also considers the net effect of maternal migration by controlling remittances in a single linear regression model. However, endogeneity in and multicollinearity between remittances and migration are not dealt with.

in a single linear regression model. Although the results of their IV estimation are compatible with the theoretical prediction, a degree of selection bias may prevent them from consistently estimating the effects of migration.[7] Similarly, Amuedo-Dorantes and Pozo (2010) identify the net effects of remittances by using a subsample of children that live in households without any migrated family members. However, while their results conform to the theoretical prediction of the positive net effects of remittances, the issue of sample selection remains and an insufficient sample size prevents them from investigating the mixed effects more in detail.

To overcome the difficulty of both estimating the net effects of remittances and investigating their migrant-specific mixed effects, this study uses the Cambodian Socio-Economic Survey (CSES) 2009 as our data source. An advantage of using data from Cambodia is that remittances are sent not only by migrated family members but also by relatives or friends.[8] Thus, we can follow the strategy of Amuedo-Dorantes and Pozo (2010) to identify the net effects of remittances. We also consider two more subsamples of children according to their parents' migration status in order to introduce migrant heterogeneity into the mixed effects of remittances: (i) at least one of the child's parents is absent from the household and (ii) non-parent household members are absent, both owing to migration.

Methodologically, this study addresses self-selection and the endogeneity of remittances by employing the sample selection bias correction method proposed by Dubin and McFadden (1984) in the two-stage least squares (2SLS) procedure as suggested by Wooldridge (2010). Two potential sources of endogeneity are omitted variables (e.g., the abilities of household members or labor market shocks) and simultaneity. We thus use geographic and weather variables as instruments in accordance with Adams and Cuecuecha (2010, 2013) and Acosta (2011).[9]

The presented estimation results support the theoretical prediction that remittances increase educational expenditure for children aged between 3 and 15 years. By contrast, migration decreases this expenditure and even offsets the positive impact of remittances when parents have migrated. In addition, we find that the migration of household members leads to labor shortages in the household, which increases child labor, and that the greater negative impact of parental migration is caused by less parental input in the education journey.

The remainder of this paper is organized as follows. Section 2 reviews the dataset and presents suggestive evidence that migrant heterogeneity influences the effects of remittances. Section 3 discusses the empirical strategy. Section 4 presents the estimation results from the 2SLS procedure with sample selection bias corrected, and their robustness is checked in Section 5. We conclude in Section 6.

[7] The amount of remittances depends on whether the receiving household has migrated family members, because some proportion of remittances are considered to be sent by migrants. Consequently, controlling for remittances can cause selection bias when the variable of interest is migration. For example, this is discussed as bad control in Angrist and Pischke (2009).

[8] Relatives include the parents, brothers, and sisters of the household head who are not considered to be household members. As Fukui and Miwa (2012) discuss, receiving unilateral donation is common in Cambodia.

[9] Another potential instrument was the employment rate in the migrant's destination, as used by McKenzie and Rapoport (2007), Amuedo-Dorantes and Pozo (2010), and Antman (2011); however, this instrument was inappropriate in our empirical strategy, particularly for the subsample of children whose household had no migrated members.

2 Data

The data used in this study come from CSES 2009, a nationwide survey conducted by the National Institute of Statistics of the Ministry of Planning in Cambodia. The 2009 survey includes 16,082 children aged between 3 and 15 years in 8,175 households. CSES 2009 contains information on a wide variety of village-, household-, and individual-level characteristics in Cambodia. It also contains information on migrated household members. In this study, we use a sample of children aged between 3 and 15 years in order to include sample subjects that have attended up to three years of pre-primary school education and nine years of compulsory education. Approximately 75% of all households have at least one member who is working in the primary sector (agriculture, forestry, or fishing).

The key variables of interest are migration, remittances, and educational expenditure. First, migrants are defined as former household members (spouse/children of the respondent, who is generally the head of the household or his/her spouse) who are 15 years or over that no longer live in the household on the grounds of taking or looking for a job or living with a spouse or relatives.[10] We include all types of migration, e.g. rural–urban, rural–rural, urban–urban, and cross-border. Second, remittances are defined as a received money transfer or gifts in cash sent by migrated household members, relatives, or friends in the past 12 months. Since more than half of remittances in CSES 2009 are sent by relatives or friends who may be parents, brothers, and sisters of the household head and his/her spouse, the effects of these remittances are not negligible.[11] Finally, educational expenditure includes those expenses spent on formal and non-formal education and private lessons during the past school year.[12] This category includes school fees, tuition fees, expenses for textbooks and other school supplies, transportation costs for each child, and gifts to teachers.

Notwithstanding that this survey provide separate household- and migrant-specific data, another key feature is that the common household ID codes assigned to both migrants and household members allow us to specify those households that include migrants. However, migrant data do not contain information about the migrants' familial relationships with their household members. Thus, the data do not directly reveal whether either or both of the parents of the sampled children have migrated. The identification of parental migration relies crucially on two unique variables in the household data: (i) person ID of each parent (when this variable is missing, we can conclude that the person is absent from the household) and

[10] Household members who are absent from household owing to study, missing, hospitalized, and detained are not treated as migrants. Since only 3% of all migrants left their communities in 2009, most of them here are considered to be long-term migrants.

[11] One may think that remittances from relatives or friends have different aims compared with those from migrants in their effects on child educational outcomes because the former may have reciprocal and bilateral characteristics for risk sharing. In fact, the effects of remittances from relatives or friends on educational expenditure for children inferred from our estimation strategy differ little from the estimated effects of remittances from migrants. In addition, even if remittances from relatives or friends have reciprocal bilateral characteristics for risk sharing, they do not always affect child educational outcomes. Indeed, those remittances may provide indirect revenue, thereby allowing household to save their own money to spend on their children's education.

[12] Although our focus lies on examining the effects of remittances on educational expenditure for children, a proportion of the remittances obtained in this survey can be received by households after they have paid for education. Therefore, we assume that households spend certain amounts of educational expenditure when they constantly receive the amounts of remittances in this survey.

(ii) marital status (i.e., married/living together, divorced/separated, widowed, and never married).

The following procedures enable us to identify single-parental migration. First, we confirm that one parent is absent from the household. Then, checking the marital status of the remaining parent leads us to exclude divorce, bereavement, and never married from the reasons for this absence. Although small in terms of the number of cases, reasons for absence also include the categories of missing, hospitalized, and detained besides migration.[13] For this reason, we verify that the corresponding candidates are on the list of migrants by referring to their gender and age. We carry out this procedure for each sample member to confirm the reliability of the dataset.

The identification procedures for parental migration become more difficult when both parents are absent from the household, because we cannot distinguish between children in one-parent households and those in two-parent households without knowing marital status. Thus, we cannot exclude the possibilities that the parent in a single-parent household is lost, missing, hospitalized, or detained besides migration or that both parents in two-parent households are lost, missing, hospitalized, or detained besides migration. For the sample of children ($n = 224$) whose both parents are absent, we address this issue by seeking persons who may be their parents in the migration data by referring to gender and age. Although this approach may be considered to be too arbitrary and likely to mislead the results of the study, we show the robustness of the estimation results by excluding the corresponding sample of children in Section 5.

Table 2: Descriptive statistics for children aged between 3 and 15 years.

Table 2 provides the descriptive statistics for our sample. The following three types of households can be distinguished: (i) those in which the mother or/and father have migrated, (ii) those in which non-parent household members have migrated, and (iii) households without any migrated members.[14] The sample sizes of each subsamples are 488, 2,859, and 12,735, respectively. Although received remittances are highest for children in households whose mother and/or father have migrated, the educational expenditure for children is lowest in those households. These findings corroborate that received remittances are less often invested in child education in households characterized by parental migration.

Figure 2: CDF of log educational expenditure in remittance-receiving and non-remittance-receiving households.

Figure 3: CDF of log educational expenditure by household migration type.

[13] According to the household questionnaire of CSES 2009, a person is counted as a household member if he/she lives in the household or has been absent for fewer than 12 months. Thus, only persons who are missing, hospitalized, or detained longer than 13 months are not counted as household members.

[14] Note that more than 30% of Cambodians in our sample live in multiple generation families (2,685 out of 8,175 households in our sample). Therefore, the sample size of children that live in a household characterized by non-parental migration is sufficient.

Figure 2 shows the cumulative distribution functions (CDFs) of log educational expenditure for each childr in households that receive remittances and that receive no remittances. This figure illustrates that the latter tend to invest more in child education because the CDF for remittance-receiving households lies entirely to the left of that for non-remittance-receiving households. Note, however, that this interpretation may be misleading because the heterogeneity of a household's migration types is not reflected in this figure and remittance-receiving households are more likely to have migrated members.[15] Figure 3 shows the CDFs of educational expenditure by the three migration types described above, providing suggestive evidence for the theoretical prediction that households that have absent migrated members invest less in child education. Furthermore, it also supports the theoretical prediction that child education is the least invested when parents of children are migrated. In following sections, we empirically examine the extent to which remittances influence educational expenditure after allowing for migrant heterogeneity and controlling for other covariates.

3 Empirical Strategy

To unravel how migrant heterogeneity influences the impact of remittances on educational expenditure, we begin by considering the following equation:

$$y_{i,h} = \beta_{0,s} + \beta_{1,s} R_h + \beta_s' X_{i,h} + u_{i,h}, \tag{1}$$

where the dependent variable $y_{i,h}$ represents educational expenditure for child i in household h. The inclusion of covariates $X_{i,h}$ controls for the variables related to the examined individual-, household-, and village-level characteristics.[16] We allow the coefficients to vary by household migration status, which is denoted by $s \in \{1, 2, 3\}$: $s = 1$ if at least one of the child's parents has migrated (i.e., parental migration), $s = 2$ for non-parental migration, and $s = 3$ for no migration.[17] We are interested in estimating $\beta_{1,s}$ for each s, which is the coefficient of the log of the total amount of remittances $R_{h,s}$ received by household h.

[15] Only around 7% of non-remittance-receiving households have migrated household members compared with approximately 61% of remittance-receiving households.

[16] Individual-level characteristics include child's gender and age. Household-level controls are as follows. Household income level (in quartiles; fourth quartile omitted), where household income is the sum of personal and real property income, agricultural income, non-agricultural income, and salary. Household asset variables include owned land in hectares ($(0, 0.5]$, $(0.5, 1.0]$, $(1.0, 2.0]$, $(2.0, 4.0]$, more than 4 hectares; 0 omitted); log value of electronics; log value of durable goods; log value of transport equipment; log value of owned livestock; log value of agricultural machinery; and number of rooms used by the household. Demographic and occupational variables comprise number of household members including migrant members by age group (1-5, 6-14, 15-64, over 65: 0 omitted); household head's gender and age (25-54, 55-65, over 65; under 25 omitted); ratio of household members that have achieved primary/secondary education; household head's occupation (not working, agriculture, mining and manufacturing; service omitted). Geographical characteristics include region (plain, Tonle Sap, coast, and plateau and mountain; Phnom Penh omitted) and an indicator of urban location. Village characteristics include percentage of households supplied with electricity, number of NGO activities, and number of large industrial and commercial enterprises within 10 km of the village.

[17] Note that some households that belong to $s = 1$ may also include non-parent migrated members, which could have led to downward bias in estimating $\beta_{1,s}$ if $s = 1$ households have a greater number of migrated members and thus receive a larger amount of remittances from them compared with the other two types of households. However, we confirmed that there are no significant differences in the number of migrated members among migration status.

The estimated result for the variable of interest by using a subsample of children with the household migration status $s = 1$ corresponds to the mixed effects of remittances for parental migration; $s = 2$ corresponds to the mixed effects of remittances for non-parental migration; and $s = 3$ corresponds to the net effects of remittances. Our empirical methodology follows that of Amuedo-Dorantes and Pozo (2010), who argue that the net effects of remittances can be investigated by examining how educational expenditure responds to the receipt of remittances in non-migrant households. This approach corresponds to the examination of the net effects of remittances by using the subsample of children that belong to $s = 3$. An additional empirical question, which Amuedo-Dorantes and Pozo (2010) also attempt to examine but are restricted by data limitations, is to explore educational expenditure in migrant households. This corresponds to the examination of the mixed effects of remittances by using the subsample of children that belong to $s = 1$ and $s = 2$. Indeed, we can argue that our attempt goes beyond their suggestion in the sense that we investigate the migrant-specific mixed effects of remittances.

One concern with estimating equation (1) is that OLS estimation methods will obtain biased estimates of $\beta_{1,s}$ because migration type is self-selected by each household. For example, Hoddinott's (1994) model accounts for migration decisions as being the outcome of a joint utility maximization by the prospective migrant and other household members. In this regard, migration selection patterns have been discussed based on migration costs (Borjas, 1987), wealth constraints (McKenzie and Rapoport, 2007), and migration networks (McKenzie and Rapoport, 2010). Moreover, Fernandez-Huertas Moraga (2013) finds that the influence of these three factors varies in different areas in Mexico.

To address this issue, we employ a variant of Dubin and McFadden's (1984) selection bias correction method with these factors taken into consideration. Bourguignon, Fournier, and Gurgand (2007) show that this variant of Dubin and McFadden's method outperforms those of Lee (1983) and Dahl (2002). We assume that $E[u_{i,h}|R_h, X_{i,h}, Z_h, s = k] = \gamma_k' \lambda_{i,h,k}$, where $Z_h \equiv (Z_{1,h}, Z_{2,h})$ denotes a vector of variables that is exogenous in equation (1). $\lambda_{i,h,s}$ depends on the choice probabilities which is estimated by using a multinomial logit model[18] and γ_s is a vector whose components are proportional to the correlation between $u_{i,h}$ and the error terms of the choice equation, where we do not impose the assumption that γ sums to zero. Sample selection can be corrected by adding a bias correction term $\hat{\lambda}_{i,h,s}$, namely, the estimates of $\lambda_{i,h,s}$, into equation (1) as follows:[19]

[18]The concern about whether the independence of irrelevant alternatives (IIA) assumption holds is dealt with in the robustness section.

[19]Specifically,

$$\hat{\lambda}_{i,h,s=1} \equiv \left(\hat{\lambda}_{1,i,h,s=1}, \hat{\lambda}_{2,i,h,s=1}, \hat{\lambda}_{3,i,h,s=1}\right)' = \left(\ln(P_{s=1}), \frac{P_{s=2}\ln(P_{s=2})}{1-P_{s=2}}, \frac{P_{s=3}\ln(P_{s=3})}{1-P_{s=3}}\right)',$$

$$\hat{\lambda}_{i,h,s=2} \equiv \left(\hat{\lambda}_{1,i,h,s=2}, \hat{\lambda}_{2,i,h,s=2}, \hat{\lambda}_{3,i,h,s=2}\right)' = \left(\frac{P_{s=1}\ln(P_{s=1})}{1-P_{s=1}}, \ln(P_{s=2}), \frac{P_{s=3}\ln(P_{s=3})}{1-P_{s=3}}\right)',$$

$$\hat{\lambda}_{i,h,s=3} \equiv \left(\hat{\lambda}_{1,i,h,s=3}, \hat{\lambda}_{2,i,h,s=3}, \hat{\lambda}_{3,i,h,s=3}\right)' = \left(\frac{P_{s=1}\ln(P_{s=1})}{1-P_{s=1}}, \frac{P_{s=2}\ln(P_{s=2})}{1-P_{s=2}}, \ln(P_{s=3})\right)',$$

where $P_{s=k},\ k \in 1, 2, 3$ denotes the estimated choice probability of migration status selected by household h.

$$y_{i,h} = \beta_{0,s} + \beta_{1,s} R_h + \beta_s' X_{i,h} + \gamma_s' \hat{\lambda}_{i,h,s} + v_{i,h}, \tag{2}$$

where γ_s is a parameter to be estimated in equation (2). The identification of the effects of remittances relies crucially on the existence of the vector of exogenous variables $Z_{1,h}$ that primarily affects selection. This is because multicollinearity arises when $\lambda_{i,h,s}$ is estimated by using only $X_{i,h}$.[20] $Z_{1,h}$ includes three variables: ratio of the number of migrants to the total population in the village, an indicator of whether the village has access to a motorable road, and a dummy of whether the household head is an immigrant in the village. The first variable above can be interpreted as a measure of the size of the community migration network, which can reduce the cost of and thus encourage migration. Second, if the village has access to a motorable road, inhabitants can easily move to the migration destination, and therefore this increases migration. Finally, past migration by the household head may facilitate migration by reducing the migration cost for other household members.[21]

The main threat here is the possible endogeneity of the impact of remittances on educational expenditure caused by omitted variable and simultaneity. 2SLS methods are employed to address these issues where we consider the following first-stage regression:[22]

$$R_h = \alpha_{0,s} + \alpha_{1,s}' Z_{2,h} + \alpha_{2,s}' X_{i,h} + \alpha_{3,s}' \hat{\lambda}_{i,h,s} + \epsilon_{i,h}, \tag{3}$$

where $Z_{2,h}$ denotes a vector of instrumental variables for remittance amount that consists of a dummy variable of whether the village suffers from a rainfall shock and distance from the village to the provincial headquarters in kilometers.

Our rationale for using these instrumental variables is as follows. First, a rainfall shock indicates whether the amount of rainfall was higher than normal.[23] Since higher or lower rainfall may induce a negative shock on household resources, it may motivate remittance senders to remit regardless of actual events. In this regard, Lucas and Stark (1985) show empirical evidence from Botswana that ongoing drought motivates more remittances from urban migrants. However, this finding does not correlate with the unobserved pattern of a household's educational expenditure because a rainfall shock is a natural phenomenon. One threat to this first instrumental variable is that a rainfall shock could cause an income shock for some households, thereby affecting educational expenditure directly. To allow for this possibility,

[20] As suggested by Wooldridge (2010), Z_h is used to estimate the choice probabilities.

[21] Past migration does not include only rural–urban migration but also rural–rural migration. For example, when household heads come from rural agricultural districts, this could reduce the job search cost by intermediating between the workforce needs and labor supply for the harvest season.

[22] This three-step estimation method is an application of the standard estimation approach explained by Wooldridge (2010, pp. 809–813) when one tackles endogenous variables and sample selection. One difference between our approach and that of Wooldridge is that we employ a multinomial choice model instead of a binary choice model to obtain the choice probability of the three migration statuses examined herein.

[23] Note that the state "higher than normal" does not indicate a specific amount of rainfall, since this was a subjective reply by respondents. While it may indicate an extreme case that can cause flooding or drought in some villages, it may simply refer to slightly above or below average rainfall in others.

we control for household income.[24]

Furthermore, a rainfall shock may be directly correlated with educational expenditure, when school classes are closed by flooding or when drought improves school attendance by reducing the opportunity cost to work in fields (e.g. Shah and Steinberg, 2013). In particular, our concern lies on the former case because some regions in Cambodia were damaged by flooding in 2009. Since we do not observe whether school classes are closed, we use a proxy that indicates the possible areas where classes could be closed: a rainfall shock that closes school classes is considered to be strong enough to damage crops and reduce crop yields. Accordingly, in the robustness section, we exclude observations of all children living in a village where at least one household suffered from crop damage and yield reductions caused by a rainfall shock to check the validity of the instrument.

Second, according to the CSES questionnaire, 63% of migrants stay in the same province and 96% of remittances are carried out in person. Remittances and the distance to the provincial headquarters may be negatively correlated because distance affects the frequency of handing over remittances to family members.[25] However, there is little evidence of a systematic relationship between educational expenditure and distance to the provincial headquarters, because educational opportunities in rural Cambodia have been extended and improved.[26] A potential violation of the second instrumental variable might be that agriculture in suburban areas is more profitable than that in other areas, as suburban households may use modern agricultural machinery and have better market access. In addition, because skilled workers tend to live close to cities in which a relatively large labor market exists, distance to the provincial headquarters is systematically correlated to the outcome variable through household income. However, we control for household income, assets, and the urban–rural indicator.[27] Further, since we have observations of children who come from the same family, we cluster the standard errors at the household level to allow for arbitrary correlations within families. In addition, the standard errors are corrected for the generated regressors problem by using the bootstrap technique.

[24] Income is typically considered to be an endogenous variable because it correlates with the unobserved variables as ability, which might be a determinant of the outcome variable. However, our interest does not lie in investigating how income influences educational expenditure.

[25] A less plausible concern is that migrants might be commuters. According to CSES 2009, only 3% of migrants left their communities in 2009; most migrants began moving before 2009.

[26] Increasing equitable access to the first nine years of basic education has been a fundamental objective for the Cambodian government in recent decades (Royal Government of Cambodia, 2003). Indeed, as mentioned in the introduction, net enrollment at the primary school level has significantly improved.

[27] Another potential concern is that the quality of education is systematically different in urban and rural areas. For example, well-qualified teachers may tend to be concentrated in urban areas. However, the quality of schools can be a bad control because receiving remittances may be the determinant of the school choice. Accordingly, this is a remaining problem to be studied.

4 Results

4.1 Multinomial logit results

We begin by explaining the estimates of the multinomial logit model by migration status. The most interesting results in Table 3 are the coefficients of $Z_{1,h,s}$. All exogenous variables are significant at a reasonable statistical level except for the results of the immigrant dummy in column (1). The Hausman test statistic (Hausman and McFadden, 1984) that checks the validity of the IIA assumption is shown at the bottom of Table 3. The null hypothesis is that the exclusion of any migration status does not change the odds ratio of the other two types of migration. Following the suggestion of Cameron and Trivedi (2005), we calculate the robust Hausman statistic by bootstrapping with 1,000 repetitions. According to Table 3, the null hypothesis is not rejected, even at the 10% level.

Table 3: Multinomial logit estimates of migration status.

All results are consistent with the aforementioned theoretical prediction. First, the ratio of the number of migrants in the village shows the expected sign: if the size of the community migration network grows, it encourages household members to migrate. Second, the sign for access to a motorable road is also as expected: if household members live in a village that has a motorable road, they are more likely to migrate. Lastly, the past migration of the household head also has the expected sign: if the household head has past migration experiences, household members are more likely to relocate in order to find a better job.

4.2 Main results

Table 4: First- and second-stage results of the log educational expenditure by migration status.

The left panel of Table 4 presents the results from the first-stage estimation. This table shows that the instrumental variables are statistically significant for each migration status except distance to the provincial headquarters for $s = 1$. The point estimates show that a rainfall shock increases remittance amount by 123.8 ($s = 1$), 113.2 ($s = 2$), and 37.8 ($s = 3$) percentage points, respectively, while each additional kilometer away from the provincial headquarters decreases remittance amount by 2.4 ($s = 2$) and 0.7 ($s = 3$) percentage points, respectively. Overall, these results are consistent with the discussion of the rationale for using these instrumental variables. The results of the first-stage F-statistics for checking weak instruments are 3.07, 11.84, and 12.61 for each migration type, respectively. These tests thus show that our instruments are sufficiently correlated with the endogenous regressors for $s = 2$ and $s = 3$ (Staiger and Stock, 1997; Stock and Yogo, 2002).[28]

[28] Although we cannot conclude that our instruments are valid for $s = 1$, we retain it in the analysis in order to compare our results.

The right panel of Table 4 presents the results of the second-stage estimation on educational expenditure by household migration status. Column (6) shows that the coefficient of remittances is 0.504 and is significant at the 1% level, when no migrants exist in the households. This finding implies that a one percentage point increase in remittances enhances educational expenditure by 50.4 percentage points (the net effects of remittances). Column (5) also shows that the coefficient of remittances is 0.332 and is significant at the 5% level, implying that a one percentage point increase in remittances raises educational expenditure by 33.2 percentage points (the migrant-specific mixed effects of remittances). In comparison with the result in column (6), the effect of remittances here seems to be partially canceled out by the disruptive effects of non-parental migration, which are likely to be caused by the labor shortage in the household.

Column (4) shows that the coefficient of remittances is -0.043 (the migrant-specific mixed effects of remittances). Although this is not significant, the sign is negative and therefore consistent with the theoretical prediction that the effects of remittances are completely canceled out by the disruptive effects of parental migration. Compared with the result in column (5), the countervailing effects of migration for $s = 1$ may be caused by the labor shortage in the household as well as insufficient parental input into child education. The results of Sargan's statistic for the validity of the instrumental variables are 1.74, 0.03, and 0.02 for each migration type, respectively. Hence, we cannot reject the null hypothesis that the instruments are uncorrelated with the error term even at the 10% level. Finally, no selection correction terms in the right panel of Table 4 are significant, suggesting that selectivity in unobservable factors does not matter in the migration decision.

4.3 Labor shortage, schooling, and insufficient parental input

Table 5: Second-stage results of children's work and schooling by migration status.

Columns (1)–(3) in Table 5 investigate whether labor shortages in the household exist, by using a dummy that indicates whether work was the main activity for children over the past 12 months as the dependent variable. Columns (2) and (3) show that the coefficients of remittances are -0.033 and -0.075, respectively, and are both significant at the 1% level. This finding implies that a one percentage point increase in remittances reduces the probability of children participating in the labor force by 3.3 and 7.5 percentage points, respectively. Compared with the result in column (3), the effects of remittances in column (2) seem to be partially canceled out by the disruptive effects of non-parental migration, implying that such migration causes a labor shortage in the household, which subsequently increases child participation in the workforce. Column (1) shows that the coefficient of remittances is 0.037, which is positive but not significant. This result suggests that parental migration wipes out the effects of remittances. By comparing this result with that in column (2), we can see that the countervailing effects

of migration on childhood working for $s = 1$ may be caused by both the labor shortages in the household and the lack of parental input into children's work.

Columns (4)–(6) in Table 5 investigate whether children are switching to attending school from working, by using a dummy that indicates whether schooling was the main activity for children over the past 12 months as the dependent variable. Columns (5) and (6) show that the coefficients are 0.041 and 0.113, respectively, and are both significant at the 1% level. This finding implies that a one percentage point increase in remittances raises the probability of attending school by 4.1 and 11.3 percentage points, respectively. Compared with the result in column (6), column (5) shows that the effects of remittances are partially cancelled out by the disruptive effects of non-parental migration. Column (4) shows that the coefficient of remittances is -0.036. Although this result is not significant, the sign is negative, suggesting that parental migration decreases the probability of attending school. By comparing the result with that in column (5), the countervailing effects of migration on children's schooling activity for $s = 1$ are caused by both a labor shortage in the household and a lack of parental input into the school decision for children.

Overall, the net effects of remittances seem to decrease children's focus on working and increase their focus on attending school. These effects are negated by the disruptive effects of non-parental migration. Furthermore, the effects of remittances are eliminated when their parents have migrated. Finally, the selection correction terms $\hat{\lambda}_1$ of columns (3) and (6) as well as $\hat{\lambda}_2$ of columns (3), (4), and (6) in Table 5 are both significant, suggesting that selectivity in unobservable factors matters in the migration decision.

Next, we provide supportive evidence for the statement that parental inputs are crucial. A possible counterargument against the existence of parental input is that the additional negative effect for children with migration status $s = 1$ compared with that with $s = 2$ may be caused by a lack of adult support rather than parental input when the children have no adult household members to take care of them.[29] However, we are not concerned with this argument because approximately 90% of the sampled children with migration status $s = 1$ live with household members aged over 20 years old who are able to care for them.

5 Robustness

5.1 Migration type assignments

As discussed in Section 2, one challenge with identifying migrated parents is that we cannot exclude bereavement being the reason behind the absence of both parents. In this case, these children would have been assigned to migration type $s = 3$ rather than $s = 1$. Then, the estimated coefficient of log

[29] Another possible counterargument is that the differences in the results between $s = 1$ and $s = 2$ may be led by extreme poverty in $s = 1$ households because parental migration is the last resort to make a living. However, we control for household income as well as the related property characteristics.

remittances for children with migration status $s = 1$ households in Table 4 would not suggest the impact of remittances which is offset only by the adverse impact of parental migration. Although measuring the bias is infeasible, we have ascertained that parental migration dilutes the impact of sending remittances in both cases.[30]

Table 6: Robustness to migration type assignments. 2SLS with selection bias correction, excluding the sample of children whose parents are both absent from household.

Hence, we restrict the $s = 1$ migration status to households in which one parent has migrated, because the identification of one case of parental migration is reliable. Table 6 presents the re-estimation results for the coefficients of log remittances excluding the sample of children whose parents are both absent from the household. Here, the dependent variables used are log educational expenditure and the dummy variables of whether work or school was the main activity over the past 12 months. We find that all the results are identical in terms of signs and significance levels except that the result for the log amount of remittances on the log educational expenditure is significant at the 1% level for the non-parental migration status.[31] As a result, we conclude that the previously used migration status assignments to $s = 1$ do not affect the interpretation of our results even though they may be somewhat arbitrary.

5.2 Validity of the instrument: rainfall shock

The second concern arises from the violation of the exclusion restriction for the instrumental variable rainfall shock. Above all, a problem arises when school classes are closed by higher than average rainfall. Then, the variable is no longer a valid instrument because it can affect educational expenditure directly. For example, when Typhoon Ketsana hit Cambodia in September 2009, some northern provinces were submerged by flash flooding, which could have led school classes to close.[32]

Table 7: Robustness to the instrument, rainfall. 2SLS with selection bias correction, excluding the sample of children whose households suffered worse rainfall and smaller crop yields compared with normal years.

Table 7 presents the re-estimated impacts of log remittances on log educational expenditure excluding the 550 observations of children in 289 households who are living in the 22 villages where a rainfall shock damaged crops and reduced crop yields compared with normal years. The F-statistics for the excluded instruments from the first-stage regression remain over 10 for $s = 2$ and $s = 3$ households and at an undesirable level for $s = 1$ households. In addition, the results of the overidentification test also hold.

[30] As discussed in Section 1, parents play a significant and irreplaceable role in their children's education. Thus, regardless of its reason, parental absence is expected to affect educational expenditure negatively to varying degrees.

[31] Slight differences can be found in the magnitude of the coefficient for $s = 1$ households on log educational expenditure and the school dummy variable. However, these do not change the interpretation of our results as long as the negative signs are retained.

[32] According to the report by the Royal Government of Cambodia (2010), some parts of the following provinces were submerged: Ratanak Kiri, Mondul Kiri, Kratie, Oddar Meanchey, Banteay Meanchey, Battambang, Kampong Cham, Kampong Chhnang, Preah Sihanouk, and Kampot. Since our data include observations from these provinces, we must ascertain the validity of this instrument.

This finding implies that including households that suffer both higher rainfall and smaller crop yields does not compromise the strength of the instrument. The results for the coefficients of log remittances are also the same in terms of signs and significance except that the significance for $s = 3$ households reduces to the 5% level.[33]

5.3 IIA assumption

To estimate the choice probability of migration status for the selection bias correction term, we employed a multinomial logit model under the IIA assumption. The violation of this assumption leads to the wrong prediction about the choice of migration status and thus the sample selection bias correction would be invalid. IIA assumes that the relative odds between two choices are unaffected by the existence of another choice. The two possible sources for the violation of this assumption come from the observations of children whose households have no opportunity to choose the migration statuses $s = 1$ or $s = 2$.[34] For example, when both parents of a child are absent from household for a reason other than migration, the household cannot choose the migration status $s = 1$. Hence, when the observed children in these households are living without their parents, the potential migration status of these households can only be $s = 2$ or $s = 3$. Thus, it may be more plausible to state that the relative odds between the choice probabilities of $s = 2$ and $s = 3$ differ when the household's feasible set of migration statuses is unrestricted. In the same manner, the relative odds between $s = 1$ and $s = 3$ in a nuclear family may differ from households whose feasible set of migration statuses is unrestricted since they cannot choose migration status $s = 2$.

Table 8: Robustness to the IIA assumption. 2SLS with selection bias correction without sample of children whose parents are both absent from households for reasons other than migration and the sample of children in nuclear families.

To assess the validity of the IIA assumption, we exclude the sample of children that have no parents for a reason other than migration or that live in nuclear families. Table 8 shows that the re-estimation results of the coefficients of log remittances for this subsample are the same in terms of signs and significance except the significance of the log remittances for $s = 2$ and $s = 3$ households which do not change the interpretation of our results. Thus, we conclude that the IIA assumption does not affect the interpretation of the estimation results.

[33] The magnitude of the estimates shrunk slightly for all migration statuses. However, this finding does not change the interpretation of our results because the signs are retained and the significance for $s = 2$ and $s = 3$ households remains.

[34] Since all households can choose the migration status $s = 3$, we need not consider this case.

6 Conclusions

This study used data derived from CSES 2009 in order to provide empirical evidence for the net positive effects of remittances and negative effects of migration on educational expenditure for children aged between 3 and 15 years. We found that the size of the adverse effects of migration depends crucially on differentiating between parental and non-parental migration. This result could explain the inconsistent results proposed in previous works that have investigated the aggregate effects of remittances and migration. According to the estimation results presented herein, the net effects of remittances are positive, but they are partially canceled out when non-parental migration occurs. We also showed that any type of migration leads to a labor shortage in the household and that the probability of a child participating in the labor force is higher for these households. Furthermore, the effects of remittances are completely wiped out when parental migration occurs. The supportive evidence indicates that the countervailing effects of parental migration are caused by a labor shortage in the household as well as insufficient parental input into the work/education decision-making process for children.

These results suggest that while policymakers should encourage migrants to remit, they should also be aware of the potential impact of household migration on child education. In particular, policies could be formulated that serve as a disincentive to parental migration in order to avoid eliminating the positive effects of receiving remittances. However, it must be noted that this study was limited to providing supportive evidence of whether the additional adverse effects of parental migration are led by a lack of parental input at home. Furthermore, the migrant effects on child education may differ across the periods of migration or the gender and the destination of migrants. Considering other types of heterogeneity is left for future research.

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Tables and Figures

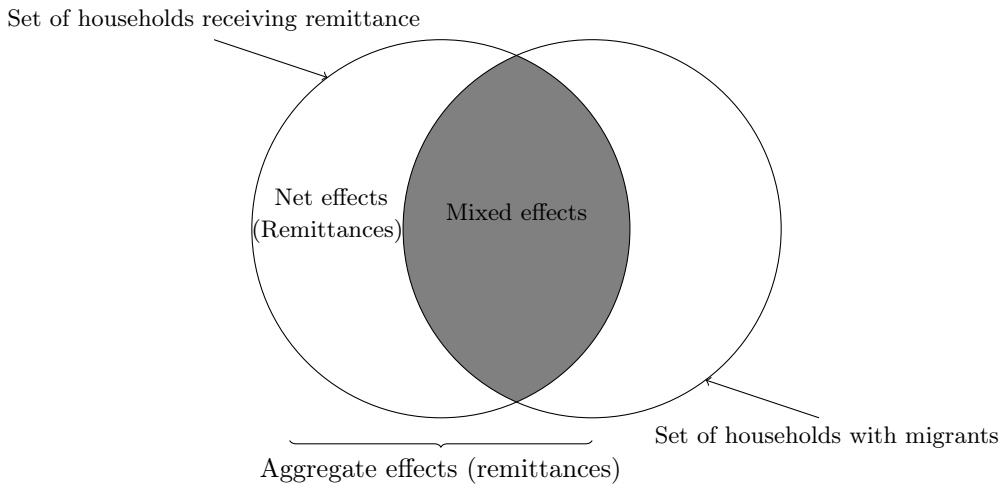

Figure 1: The set of households who receive remittances and have migrated members.

Table 1: Studies that investigate the effects of remittances and/or migration on child educational outcomes, classified into the three types of their effects.

	Aggregate	Mixed	Net
Edwards and Ureta (2003)	Remittance	-	-
Hanson and Woodruff (2003)	Migration	-	-
Mansuri (2006)	Migration	-	-
Bansak and Chezum (2009)	-	-	Remittance and Migration
Calero, Bedi, and Sparrow (2009)	Remittance	-	-
Amuedo-Dorantes and Pozo (2010)	-	-	Remittance
Giannelli and Mangiavacchi (2010)	Migration	-	-
Acosta (2011)	Remittance	-	-
Antman (2011)	Migration	-	-
McKenzie and Rapoport (2011)	Migration	-	-
Nguyen and Purnamasari (2011)	Remittance and Migration	-	-
Alcaraz, Chiquiar, and Salcedo (2012)	Remittance	-	-
Antman (2012)	Migration	-	-
Hu (2012)	-	-	Remittance and Migration
Luch and Fukui (2012)	-	-	Remittance and Migration
Cortes (2013)	Migration	-	-

Type I: the type I mixed effects, Type II: the type II mixed effects, Net: the net effect.

Table 2: Descriptive statistics for children aged between 3 and 15 years.

	Parental migration		Non-parental migration		No migration		Total	
	Mean	Std. dev	Mean	Std. dev	Mean	Std. dev	Mean	Std. dev
The amount of received remittance in million Riel	1.11	2.72	0.80	3.84	0.12	1.27	0.27	2.05
Annual educational expenditure for the child in million Riel	0.07	0.20	0.09	0.25	0.11	0.33	0.10	0.32
Characteristics of children								
Child is male (1=yes)	0.52	0.50	0.41	0.49	0.47	0.50	0.46	0.50
Child age	8.95	3.43	10.29	3.64	9.00	3.72	9.23	3.73
Demographic characteristics								
Household head is male (1=yes)	0.59	0.49	0.79	0.41	0.86	0.34	0.84	0.37
Number of household members aged between 1 and 5 years	0.44	0.67	0.49	0.66	0.71	0.75	0.66	0.74
Number of household members aged between 6 and 14 years	1.58	1.02	1.74	1.05	1.83	1.10	1.81	1.09
Number of household members aged over 65 years	2.55	1.74	3.73	1.56	3.03	1.40	3.14	1.46
Age of head is between 25 and 54 years (1=yes)	0.20	0.40	0.68	0.46	0.90	0.30	0.84	0.37
Age of head is between 55 and 64 years (1=yes)	0.44	0.50	0.20	0.40	0.06	0.23	0.10	0.29
Age of head is over 65 years (1=yes)	0.33	0.47	0.11	0.31	0.03	0.16	0.05	0.22
Ratio of household members who completed primary education	0.81	0.19	0.74	0.21	0.65	0.33	0 .67	0.31
Ratio of household members who completed secondary education	0.70	0.23	0.59	0.23	0.41	0.35	0.50	0.34
Head is not working (1=yes)	0.24	0.43	0.12	0.33	0.04	0.20	0.06	0.24
Head works in primary sector (1=yes)	0.50	0.50	0.61	0.49	0.56	0.50	0.56	0.50
Head works in manufacturing sector (1=yes)	0.07	0.26	0.07	0.25	0.08	0.28	0.08	0.27
Household income and assets								
Household income lies in the first quartile of income distribution (1=yes)	0.37	0.48	0.22	0.41	0.23	0.42	0.23	0.42
Household income lies in the second quartile of income distribution (1=yes)	0.28	0.45	0.27	0.44	0.27	0.44	0.26	0.44
Household income lies in the third quartile of income distribution (1=yes)	0.20	0.40	0.26	0.44	0.26	0.44	0.25	0.44
Household owns land greater than 0 and less than or equal to 0.5 (1=yes)	0.18	0.39	0.14	0.35	0.16	0.37	0.16	0.36
Household owns land greater than 0.5 and less than or equal to 0.9 ha (1=yes)	0.13	0.33	0.16	0.37	0.16	0.36	0.16	0.36
Household owns land greater than 1.0 and less than or equal to 1.9 ha (1=yes)	0.20	0.40	0.21	0.41	0.19	0.39	0.19	0.39
Household owns land greater than 2.0 and less than or equal to 3.9 ha (1=yes)	0.11	0.31	0.15	0.36	0.13	0.33	0.13	0.34
Household owns land greater than 4 ha (1=yes)	0.04	0.21	0.08	0.27	0.06	0.24	0.07	0.25
Value of electronics in million Riel	0.21	0.38	0.24	0.55	0.29	1.19	0.28	1.08
Value of durable goods in million Riel	0.50	1.00	0.49	1.47	0.56	1.74	0.54	1.68
Value of transportation in million Riel	1.47	9.25	2.17	9.67	2.57	10.04	2.47	9.96
Value of livestock in million Riel	2.22	2.75	3.27	5.89	2.69	4.13	2.79	4.51
Value of agricultural machine in million Riel	0.50	1.36	0.68	2.40	0.65	4.23	0.65	3.90
Number of rooms	1.40	0.68	1.45	0.75	1.38	0.85	1.40	0.83
Geographical characteristics								
Urban (1=yes)	0.17	0.38	0.12	0.33	0.18	0.38	0.17	0.37
Plane	0.43	0.50	0.45	0.50	0.40	0.49	0.41	0.49
Tonle Sap	0.36	0.48	0.29	0.46	0.30	0.46	0.30	0.46
Coast	0.06	0.24	0.10	0.31	0.09	0.28	0.09	0.28
Plateau and mountain	0.10	0.30	0.10	0.30	0.13	0.34	0.12	0.33
Village characteristics								
Electricity	23.27	36.78	18.64	33.60	24.57	37.50	23.48	36.89
Number of running NGP projects	0.66	0.99	0.68	1.08	0.69	1.15	0.69	1.13
Number of industry	1.56	0.57	1.56	0.52	1.56	0.53	1.56	0.53

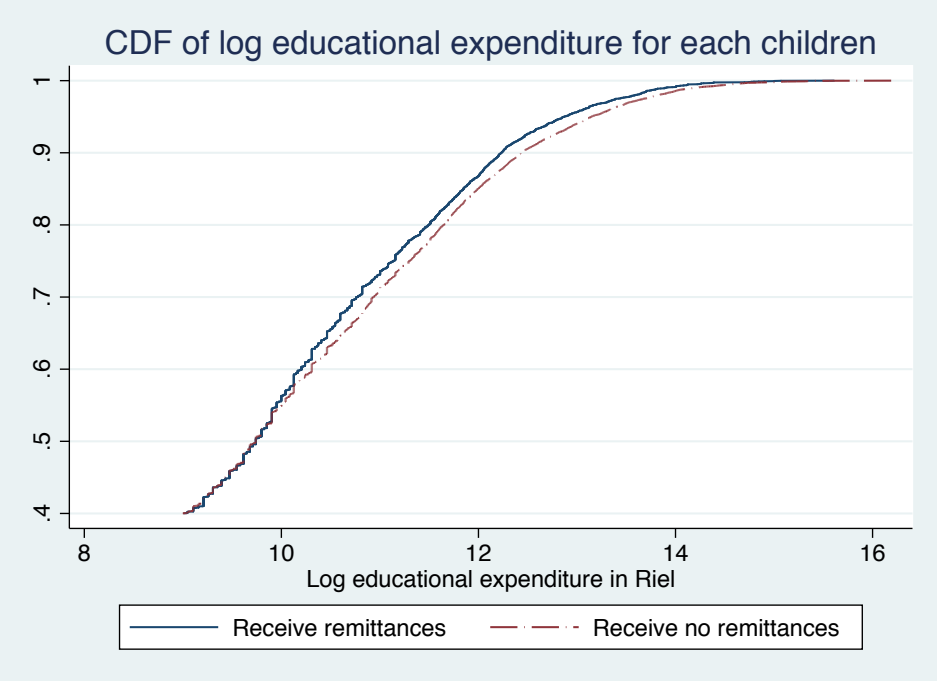

Figure 2: CDF of log educational expenditure in remittance-receiving and non-remittance-receiving households.

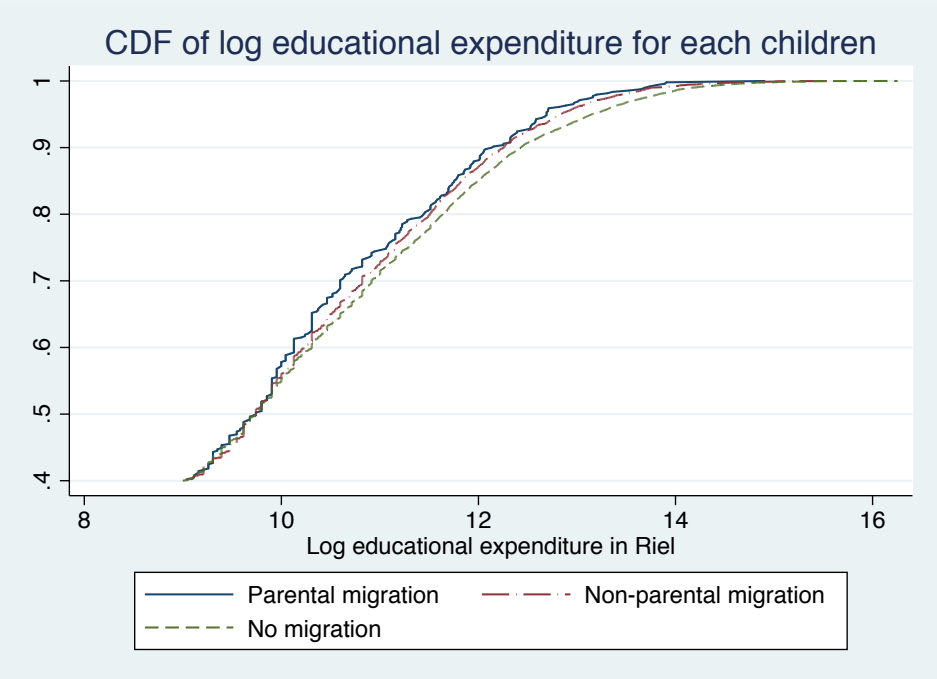

Figure 3: CDF of log educational expenditure by household migration type.

Table 3: Multinomial logit estimates of migration status.

	(1)		(2)		(3)
	$s = 1$		$s = 2$		$s = 3$
	Parental migration		Non-parental migration		No migration
Exogenous variables					
Migration ratio in village	0.349***	(0.039)	0.276***	(0.029)	-
Motorroad dummy	1.219***	(0.379)	0.139	(0.158)	-
Head immigrant	0.124	(0.162)	0.363***	(0.083)	-
Characteristics of children					
Child is male	-0.011	(0.106)	0.046***	(0.006)	-
Child age	-0.072***	(0.018)	0.039	(0.047)	-
Demographic characteristics					
HH head is male	-0.564***	(0.172)	-0.391***	(0.096)	-
Number of members age between 1 and 5	-0.704***	(0.150)	-0.284***	(0.060)	-
Number of members age between 6 and 14	-0.039	(0.076)	-0.067*	(0.039)	-
Number of members age between 15 and 64	-0.178***	(0.069)	0.290***	(0.027)	-
Number of members age over 65	0.018	(0.192)	-0.258**	(0.115)	-
HH head's age between 25 and 54	-1.999***	(0.434)	1.161*	(0.630)	-
HH head's age between 55 and 65	1.561***	(0.435)	2.184***	(0.636)	-
HH head's age over 65	1.577***	(0.502)	3.051***	(0.656)	-
Ratio of members with primary education	-0.684*	(0.360)	-0.826***	(0.173)	-
Ratio of members with secondary education	2.887***	(0.325)	2.597***	(0.155)	-
Head is not working	0.512**	(0.240)	0.727***	(0.156)	-
Head is agricultural worker	0.146	(0.202)	0.319***	(0.102)	-
Head is production worker	0.030	(0.319)	0.067	(0.164)	-
Household income and assets					
Household income in the first quartile	0.570**	(0.245)	0.053	(0.126)	-
Household income in the second quartile	0.390*	(0.230)	0.120	(0.115)	-
Household income in the third quartile	0.221	(0.232)	0.080	(0.107)	-
Owned land $(0, 0.5]$ ha	-0.667***	(0.236)	-0.399***	(0.136)	-
Owned land $(0.5, 1.0]$ ha	-0.870***	(0.264)	-0.340**	(0.134)	-
Owned land $(1.0, 2.0]$ ha	-0.585**	(0.249)	-0.286**	(0.131)	-
Owned land $(2.0, 4.0]$ ha	-0.645**	(0.312)	-0.276*	(0.149)	-
Owned land more than 4 ha	-0.979***	(0.354)	-0.363**	(0.178)	-
Log electronics	0.063***	(0.018)	0.017*	(0.009)	-
Log durable goods	0.032	(0.021)	0.020*	(0.010)	-
Log transport equipment	-0.023	(0.014)	-0.006	(0.008)	-
Log owned livestock	0.024	(0.016)	0.044***	(0.009)	-
Log agricultural machinery	0.039	(0.026)	0.020	(0.014)	-
noNumber of rooms	-0.053	(0.093)	0.019	(0.043)	-
Geographical characteristics					
Urban	0.758***	(0.291)	0.095	(0.172)	-
Plane	1.278***	(0.371)	0.819***	(0.224)	-
Tonle Sap	1.606***	(0.372)	0.700***	(0.221)	-
Coast	1.225***	(0.428)	0.916***	(0.246)	-
Plateau and mountain	1.050**	(0.417)	0.325	(0.245)	-
Village characteristics					
Electricity	-0.005*	(0.003)	-0.004**	(0.002)	-
Number of NGP project	0.043	(0.063)	-0.008	(0.034)	-
Number of industry	0.170	(0.181)	-0.056	(0.081)	-
Instrumental variables					
Distance to the provincial headquarter	-0.002	(0.003)	-0.000	(0.001)	-
Rainfall	-0.206	(0.160)	-0.070	(0.085)	-
Constant	-3.788***	(0.886)	-6.511***	(0.735)	-
Hausman test for IIA assumption [P-val]	0.00[1.00]		0.00[1.00]		-
Pseudo R^2	0.246				
Observations	488		2,859		12,735

$s = 3$ is chosen to be the base category.

Standard errors in parentheses are clustered at household level.

P-values for test statistic is shown in square bracket.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: First- and second-stage results of the log educational expenditure by migration status.

	(1)		(2)		(3)		(4)		(5)		(6)	
	Log remittance						Log educational expenditure					
	$s=1$		$s=2$		$s=3$		$s=1$		$s=2$		$s=3$	
	Parental migration		Non-parental migration		No migration		Parental migration		Non-parental migration		No migration	
Log remittance							-0.043	(0.893)	0.332**	(0.132)	0.504***	(0.169)
Instrumental variables												
Rainfall	1.238**	(0.485)	1.132***	(0.229)	0.378***	(0.091)						
Distance to provincial headquarter	0.006	(0.010)	-0.024***	(0.005)	-0.007***	(0.001)						
Characteristics of children												
Child is male	0.195	(0.415)	-0.204	(0.196)	0.110	(0.070)	0.175	(0.587)	-0.322*	(0.183)	-0.182**	(0.086)
Child age	0.065	(0.131)	-0.020	(0.038)	0.011	(0.013)	0.748**	(0.299)	0.438***	(0.035)	0.647***	(0.016)
Demographic characteristics												
HH head is male	-0.148	(0.528)	-0.865***	(0.288)	-0.408***	(0.135)	-0.059	(0.759)	0.236	(0.294)	0.586***	(0.164)
Number of members age between 1 and 5	1.308**	(0.522)	-0.071	(0.201)	-0.075	(0.055)	-0.847	(1.107)	-1.041***	(0.171)	-0.578***	(0.072)
Number of members age between 6 and 14	0.652***	(0.201)	-0.098	(0.104)	-0.118***	(0.035)	0.431	(0.787)	0.615***	(0.094)	0.439***	(0.047)
Number of members age between 15 and 64	-0.035	(0.517)	-0.188	(0.116)	0.017	(0.042)	0.203	(1.137)	-0.281***	(0.101)	-0.391***	(0.047)
Number of members age over 65	-0.037	(0.625)	1.418***	(0.285)	1.131***	(0.146)	-0.736	(1.032)	-0.254	(0.359)	-0.316	(0.245)
HH head's age between 25 and 54	2.908	(3.011)	6.452**	(2.650)	0.224	(0.353)	4.295	(6.247)	-1.799	(1.952)	1.168***	(0.326)
HH head's age between 55 and 65	1.142	(1.875)	6.700**	(2.669)	0.576	(0.413)	2.909	(2.741)	-1.285	(1.994)	0.933**	(0.409)
HH head's age over 65	1.682	(2.319)	4.465*	(2.706)	-0.313	(0.522)	3.809	(4.074)	-1.441	(1.957)	0.917*	(0.531)
Ratio of members with primary education	-2.068	(2.174)	1.956**	(0.770)	0.240	(0.151)	-1.040	(3.140)	0.831	(0.721)	0.492***	(0.178)
Ratio of members with secondary education	0.439	(2.159)	-1.362	(0.949)	-0.621***	(0.232)	-1.595	(3.263)	-1.748**	(0.825)	-0.910***	(0.294)
Head is not working	-0.116	(0.883)	0.902**	(0.410)	0.771***	(0.265)	0.441	(1.183)	-0.722*	(0.402)	-0.775***	(0.289)
Head is agricultural worker	0.093	(0.752)	0.617*	(0.322)	0.203**	(0.103)	0.608	(0.956)	-0.577**	(0.292)	-0.762***	(0.119)
Head is production worker	-0.452	(1.114)	-0.295	(0.509)	0.153	(0.152)	0.791	(1.208)	-0.182	(0.444)	-0.231	(0.180)
Household income and assets												
Household income in the first quartile	-0.210	(0.832)	0.053	(0.351)	-0.615***	(0.123)	-0.298	(1.747)	-0.651**	(0.305)	0.296	(0.180)
Household income in the second quartile	-0.854	(0.728)	-1.355***	(0.320)	-0.372***	(0.114)	0.020	(1.267)	-0.068	(0.322)	-0.053	(0.150)
Household income in the third quartile	-0.465	(0.743)	0.166	(0.309)	0.151	(0.113)	0.059	(0.887)	-0.585**	(0.256)	-0.210	(0.131)
Owned land $(0, 0.5]$ ha	-0.101	(0.652)	0.146	(0.389)	0.086	(0.138)	-0.242	(0.913)	0.340	(0.359)	0.561***	(0.154)
Owned land $(0.5, 1.0]$ ha	0.203	(0.794)	0.289	(0.379)	-0.288*	(0.148)	1.494	(1.117)	0.427	(0.356)	0.665***	(0.163)
Owned land $(1.0, 2.0]$ ha	0.401	(0.746)	-0.426	(0.381)	-0.359***	(0.134)	0.792	(1.008)	0.747**	(0.348)	0.736***	(0.163)
Owned land $(2.0, 4.0]$ ha	-0.541	(0.845)	-0.984**	(0.419)	-0.337**	(0.157)	0.427	(1.442)	0.290	(0.397)	0.756***	(0.183)
Owned land more than 4 ha	0.162	(1.506)	-1.168**	(0.498)	-0.452**	(0.200)	1.673	(1.703)	0.822*	(0.478)	0.656***	(0.230)
Log electronics	0.002	(0.071)	0.120***	(0.025)	-0.023***	(0.009)	-0.051	(0.100)	0.034	(0.029)	0.048***	(0.011)
Log durable goods	0.046	(0.049)	0.027	(0.030)	0.021**	(0.010)	0.028	(0.125)	0.072**	(0.030)	0.049***	(0.012)
Log transport equipment	0.143***	(0.051)	0.049**	(0.025)	0.009	(0.008)	0.147	(0.133)	0.036	(0.024)	0.060***	(0.009)
Log owned livestock	-0.094*	(0.051)	-0.015	(0.030)	-0.017*	(0.010)	-0.002	(0.136)	-0.007	(0.027)	0.009	(0.011)
Log agricultural machinery	-0.154*	(0.084)	-0.017	(0.039)	-0.040***	(0.014)	-0.105	(0.174)	-0.049	(0.036)	0.028*	(0.017)
Number of rooms	-0.103	(0.378)	0.152	(0.176)	0.108**	(0.049)	0.208	(0.433)	0.141	(0.144)	0.188***	(0.061)
Geographical characteristics												
Urban (1=yes)	-3.272***	(1.150)	0.435	(0.561)	-0.601***	(0.173)	-2.102	(2.981)	-0.228	(0.477)	0.604***	(0.197)
Plane	1.668	(1.574)	1.487**	(0.741)	0.762***	(0.192)	-3.185	(3.355)	-0.700	(0.651)	-1.860***	(0.252)
Tonle Sap	0.540	(1.658)	0.690	(0.739)	0.420**	(0.190)	-3.373	(3.320)	-0.846	(0.642)	-1.881***	(0.238)
Coast	1.090	(1.980)	0.399	(0.793)	0.273	(0.222)	-1.370	(3.118)	-0.111	(0.659)	-1.333***	(0.261)
Plateau and mountain	0.958	(1.795)	0.364	(0.778)	0.267	(0.198)	-3.660	(3.054)	-0.619	(0.648)	-2.008***	(0.244)
Village characteristics												
Electricity	0.022**	(0.010)	-0.013**	(0.005)	0.000	(0.002)	0.016	(0.021)	0.011**	(0.005)	0.008***	(0.002)
Number of NGP project	-0.069	(0.219)	-0.109	(0.101)	0.045	(0.031)	-0.233	(0.267)	0.070	(0.092)	-0.035	(0.038)
Number of industry	-0.175	(0.443)	0.206	(0.212)	0.170**	(0.081)	-0.243	(0.531)	0.274	(0.199)	-0.105	(0.100)
Estimated choice probability												
$\hat{\lambda}_1$	-0.726	(0.907)	-1.341	(1.704)	-4.252***	(1.234)	-0.672	(1.845)	2.401	(1.537)	0.742	(1.447)
$\hat{\lambda}_2$	0.876	(3.774)	-0.714*	(0.381)	-1.005	(0.764)	6.512	(8.885)	-0.294	(0.348)	-0.991	(0.871)
$\hat{\lambda}_3$	2.672	(2.015)	2.005	(1.366)	-0.407	(0.391)	2.917	(2.832)	-2.001	(1.372)	-0.264	(0.441)
Constant	12.737***	(3.856)	3.927	(3.510)	1.392***	(0.512)	7.950	(9.620)	1.290	(2.762)	-0.947*	(0.544)
R-squared	0.23		0.13		0.05							
First stage F statistic	3.07		11.84		12.61							
Sargan's statistic [P-val]							1.74	[0.17]	0.03	[0.87]	0.02	[0.89]
Observations	488		2,859		12,735		488		2,859		12,735	

Standard errors in parentheses are clustered at household level and computed by bootstrapping (1000 repetitions).

P-values for test statistic is shown in square bracket.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Second-stage results of children's work and schooling by migration status.

	(1)		(2)		(3)		(4)		(5)		(6)	
	work as main activity						schooling as main activity					
	$s=1$		$s=2$		$s=3$		$s=1$		$s=2$		$s=3$	
	Parental migration		Non-parental migration		No migration		Parental migration		Non-parental migration		No migration	
Log remittance	0.037	(0.056)	-0.033***	(0.010)	-0.075***	(0.017)	-0.036	(0.089)	0.041***	(0.013)	0.113***	(0.022)
Characteristics of children												
Child is male	-0.014	(0.037)	0.002	(0.014)	0.004	(0.008)	0.022	(0.060)	-0.005	(0.019)	-0.019	(0.012)
Child age	0.020*	(0.012)	0.036***	(0.002)	0.032***	(0.001)	0.052**	(0.020)	0.024***	(0.004)	0.039***	(0.002)
Demographic characteristics												
Household head is male	0.018	(0.054)	-0.027	(0.020)	-0.066***	(0.016)	-0.016	(0.073)	0.031	(0.030)	0.087***	(0.022)
Number of members age between 1 and 5	-0.038	(0.073)	0.026**	(0.012)	0.004	(0.006)	-0.045	(0.133)	-0.102***	(0.018)	-0.050***	(0.010)
Number of members age between 6 and 14	-0.036	(0.037)	-0.025***	(0.007)	-0.015***	(0.004)	0.101*	(0.057)	0.071***	(0.010)	0.064***	(0.006)
Number of members age between 15 and 64	-0.032	(0.053)	-0.008	(0.008)	0.013***	(0.005)	0.081	(0.063)	-0.017*	(0.010)	-0.036***	(0.006)
Number of members age over 65	0.108*	(0.062)	0.045	(0.027)	0.066***	(0.024)	-0.111	(0.090)	-0.032	(0.036)	-0.112***	(0.033)
HH head's age between 25 and 54	-0.438	(0.301)	0.199	(0.153)	0.042	(0.033)	0.541	(0.590)	-0.196	(0.189)	0.076	(0.047)
HH head's age between 55 and 65	-0.291	(0.208)	0.230	(0.156)	0.094**	(0.040)	0.304	(0.347)	-0.226	(0.192)	0.012	(0.058)
HH head's age over 65	-0.491**	(0.244)	0.145	(0.154)	0.054	(0.049)	0.562	(0.437)	-0.162	(0.187)	0.072	(0.073)
Ratio of members with primary education	0.185	(0.264)	-0.004	(0.052)	-0.040**	(0.017)	-0.184	(0.349)	0.136*	(0.071)	0.052**	(0.025)
Ratio of members with secondary education	-0.095	(0.216)	0.074	(0.062)	0.079***	(0.027)	0.024	(0.251)	-0.281***	(0.083)	-0.111***	(0.038)
Head is not working	-0.095	(0.076)	0.019	(0.028)	0.102***	(0.027)	0.102	(0.117)	-0.075**	(0.037)	-0.171***	(0.041)
Head is agricultural worker	-0.045	(0.074)	0.011	(0.023)	0.044***	(0.011)	0.092	(0.105)	-0.032	(0.028)	-0.075***	(0.016)
Head is production worker	-0.071	(0.090)	-0.000	(0.035)	0.006	(0.015)	0.034	(0.148)	-0.019	(0.045)	-0.003	(0.023)
Household income and assets												
Household income in the first quartile	-0.080	(0.074)	0.000	(0.023)	-0.047***	(0.017)	0.019	(0.123)	-0.034	(0.032)	0.080***	(0.023)
Household income in the second quartile	-0.024	(0.084)	-0.045*	(0.025)	-0.013	(0.014)	0.043	(0.127)	0.053	(0.033)	0.019	(0.019)
Household income in the third quartile	-0.057	(0.072)	0.010	(0.020)	0.035***	(0.012)	0.054	(0.111)	-0.046*	(0.027)	-0.037**	(0.017)
Owned land $(0, 0.5]$ ha	0.025	(0.070)	0.005	(0.025)	0.010	(0.015)	0.039	(0.110)	0.055	(0.035)	0.044**	(0.021)
Owned land $(0.5, 1.0]$ ha	-0.053	(0.079)	0.001	(0.027)	-0.016	(0.016)	0.253**	(0.123)	0.041	(0.036)	0.055**	(0.023)
Owned land $(1.0, 2.0]$ ha	-0.022	(0.063)	-0.032	(0.025)	-0.033**	(0.016)	0.110	(0.128)	0.056	(0.035)	0.095***	(0.022)
Owned land $(2.0, 4.0]$ ha	0.077	(0.084)	-0.042	(0.030)	-0.044**	(0.017)	0.070	(0.169)	0.074*	(0.040)	0.079***	(0.025)
Owned land more than 4 ha	0.001	(0.151)	-0.049	(0.035)	-0.058***	(0.021)	0.184	(0.259)	0.077*	(0.046)	0.096***	(0.030)
Log electronics	-0.006	(0.007)	0.003	(0.002)	-0.001	(0.001)	0.004	(0.009)	-0.000	(0.003)	0.004***	(0.001)
Log durable goods	0.002	(0.006)	-0.002	(0.002)	0.001	(0.001)	-0.003	(0.010)	0.003	(0.003)	0.002	(0.002)
Log transport equipment	-0.011	(0.009)	-0.002	(0.002)	-0.001*	(0.001)	0.017	(0.015)	0.004*	(0.002)	0.004***	(0.001)
Log owned livestock	0.002	(0.008)	0.002	(0.002)	0.000	(0.001)	-0.002	(0.014)	-0.004	(0.003)	0.001	(0.002)
Log agricultural machinery	0.008	(0.010)	0.004	(0.003)	-0.002	(0.002)	-0.011	(0.019)	-0.004	(0.004)	0.006***	(0.002)
Number of rooms	-0.019	(0.034)	-0.000	(0.010)	0.003	(0.006)	0.013	(0.045)	0.001	(0.013)	-0.001	(0.008)
Geographical characteristics												
Urban (1=yes)	0.245	(0.180)	0.034	(0.033)	-0.026	(0.017)	-0.370	(0.404)	-0.056	(0.044)	0.044*	(0.026)
Plane	-0.004	(0.182)	0.034	(0.041)	0.089***	(0.023)	-0.174	(0.281)	-0.064	(0.058)	-0.160***	(0.033)
Tonle Sap	0.030	(0.168)	-0.002	(0.040)	0.063***	(0.020)	-0.215	(0.217)	0.004	(0.056)	-0.118***	(0.030)
Coast	-0.024	(0.204)	-0.035	(0.043)	0.025	(0.022)	-0.093	(0.332)	0.023	(0.060)	-0.060*	(0.034)
Plateau and mountain	0.246	(0.189)	0.064	(0.043)	0.096***	(0.021)	-0.448*	(0.236)	-0.063	(0.058)	-0.160***	(0.031)
Village characteristics												
Electricity	-0.001	(0.001)	-0.000	(0.000)	-0.001***	(0.000)	0.002	(0.002)	0.001*	(0.000)	0.001***	(0.000)
Number of NGP project	0.018	(0.019)	-0.002	(0.007)	0.011***	(0.004)	-0.034	(0.031)	0.003	(0.009)	-0.015***	(0.005)
Number of industry	0.086**	(0.042)	0.019	(0.016)	-0.007	(0.010)	-0.110	(0.080)	0.003	(0.020)	-0.000	(0.013)
Estimated choice probability												
$\hat{\lambda}_1$	0.064	(0.083)	-0.041	(0.112)	-0.256*	(0.139)	-0.129	(0.131)	0.096	(0.161)	0.328*	(0.189)
$\hat{\lambda}_2$	-0.249	(0.367)	0.001	(0.024)	0.228***	(0.087)	0.928*	(0.527)	-0.051	(0.034)	-0.219*	(0.116)
$\hat{\lambda}_3$	-0.004	(0.194)	0.104	(0.103)	0.033	(0.045)	0.227	(0.386)	-0.203	(0.136)	-0.027	(0.062)
Constant	-0.421	(0.700)	-0.108	(0.213)	-0.051	(0.054)	1.084	(1.250)	0.247	(0.267)	-0.112	(0.081)
Sargan's statistic [P-val]	2.85	[0.09]	0.57	[0.44]	3.05	[0.08]	0.01	[0.95]	0.14	[0.71]	1.91	[0.17]
Observations	488		2,859		12,735		488		2,859		12,735	

Standard errors in parentheses are clustered at household level and computed by bootstrapping (1000 repetitions).

P-values for test statistic is shown in square bracket.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Robustness to migration type assignments. 2SLS with selection bias correction, excluding the sample of children whose parents are both absent from household.

	Coefficients of log amount of remittance					
	$s=1$		$s=2$		$s=3$	
	Parental migration		Non-parental migration		No migration	
Dependent variables						
Log educational expenditure	-0.360	(0.594)	0.323***	(0.125)	0.500***	(0.176)
Work as main activity (yes=1)	0.038	(0.045)	-0.033***	(0.011)	-0.073***	(0.016)
School as main activity (yes=1)	-0.055	(0.052)	0.040***	(0.014)	0.111***	(0.023)
Set of covariates	Yes		Yes		Yes	
Observations	264		2,859		12,735	

The set of covariates indicates all covariates used in Subsection 4.1 and 4.2.

Standard errors in parentheses are clustered at household level and computed by bootstrapping (1000 repetitions).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Robustness to the instrument, rainfall. 2SLS with selection bias correction, excluding the sample of children whose households suffered worse rainfall and smaller crop yields compared with normal years.

	Log educational expenditure					
	$s = 1$		$s = 2$		$s = 3$	
	Parental migration		Non-parental migration		No migration	
Log remittances	-0.195	(0.639)	0.267**	(0.115)	0.425**	(0.185)
Set of covariates	Yes		Yes		Yes	
First-stage F statistic	3.20		14.63		12.55	
Sargan's statistic [P-val]	1.77 [0.18]		0.11 [0.74]		0.87 [0.35]	
Observations	472		2,763		12,294	

The set of covariates indicates all covariates used in Subsection 4.1 and 4.2.

Standard errors in parentheses are clustered at household level and computed by bootstrapping (1000 repetitions).

P-values for test statistic is shown in square bracket.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Robustness to the IIA assumption. 2SLS with selection bias correction without sample of children whose parents are both absent from households for reasons other than migration and the sample of children in nuclear families.

	Coefficients of log amount of remittance					
	$s = 1$		$s = 2$		$s = 3$	
	Parental migration		Non-parental migration		No migration	
Dependent variables						
Log educational expenditure	-0.045	(0.646)	0.346***	(0.127))	0.518**	(0.212)
Work as main activity (yes=1)	0.028	(0.057)	-0.034***	(0.010)	-0.091***	(0.023)
School as main activity (1=yes)	-0.026	(0.064)	0.041***	(0.014)	0.112***	(0.028)
Set of covariates	Yes		Yes		Yes	
Observations	480		2,785		6,459	

The set of covariates indicates all covariates used in Subsection 4.1 and 4.2.

Standard errors in parentheses are clustered at household level and computed by bootstrapping (1000 repetitions).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.