The Impacts of Migration and Remittances on School Attainment of Children in Rural Cambodia[1)]

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福井清一・ルチ リカナン：出稼ぎと仕送りが子供の就学達成度におよぼす影響について　カンボジア農村の事例より

　途上国における出稼ぎ労働者の数と仕送りが急速に増加しており、それが家計におよぼす影響に関心が集まっている。本稿では、貧困世帯が多数居住するカンボジア農村を対象に、出稼ぎと仕送りが、6 歳から 17 歳までの子供の就学、とりわけ、就学達成度におよぼす影響について分析する。そのために、『カンボジア社会経済調査 2009 年版』を用い、操作変数法を適用することにより分析を行う。従来の研究では、適切な操作変数が得られず、出稼ぎ家計員の有無と仕送りの変数を同時に組み込んで、出稼ぎと仕送りによる子供の教育への純効果を推計することは困難であった。この点を克服するための方法を考案した点に、本稿の貢献がある。分析結果は、仕送りによる正の影響は家計員の出稼ぎにともなう不在による負の影響を相殺し、純効果が正であること、および、この効果は、とくに、女子において顕著であることを示している。

1. Introduction

The impacts of labor migration and remittances on household welfare in developing countries have drawn attention of many scholars and policy makers.

This is no exception to Cambodia (Tong 2011). Although the effects of remittances from migrants on welfare of the poor has received significant attention, to date, the effects of migration on the education of children have not been investigated in Cambodia, where educational attainment is still low: only 54% of students finish primary school and 35% complete the lower secondary school (UNESCO 2012). This paper attempts to investigate the impacts of internal and international migration of family members on the school attainment of children in rural Cambodia where there is a significant room for improvement of school attainment although school attendance has been improved very much.

In general, even though the body of literature on this topic has been increasing significantly, the existing studies have produced contradictory results on the impacts of migration on the education of children (Amuedo-Dorantes and Pozo 2010, Acosta 2011, Adams 2011,

McKenzie and Rapoport 2011, Alcaraz *et al*. 2012). There are at least two possible reasons for the contradictory results. First, these studies mostly do not disentangle the effects of the absence of adults from the effects of remittances on the education of children. The remittances from migrant family members are expected to have a positive effect on the education of children, assuming such remittances mitigate the liquidity constraints and increase the education expenditures. On the other hand, the absence of migrant family members is expected to have a negative effect on the education of the children who are left behind. Thus, it is possible that the impact of the absence of migrant family members could negate the benefits of receiving remittances on the children's education. A significant number of studies focus on the impacts of migration on the education of children (Hanson and Woodruff 2003, Borraz 2005, Acosta *et al*., 2007, Giannelli and Mangiavacchi 2010, Antman 2012, McKenzie and Rapoport 2011, Nguyen and Purnamasari 2011) and the impacts of remittances (Yang 2008, Calero *et al*. 2009, Adams and Cuecuecha 2010, Amuedo-Dorantes and Pozo 2010, Amuedo-Dorantes *et al*. 2010, Kroeger and Anderson 2011, Mansour *et al*. 2011, Alcaraz *et al*. 2012, Binci and Gianelli 2016, Bonoiyoiur and Miftah 2016). Although these studies have yielded useful insights on the impacts of migration and remittances, these two effects need to be disentangled and compared in order to draw policy implications. Taking this need into consideration, Bansak and Chezum (2009) and Hu (2011) developed some models using the instrumental variable (IV) methodology or a conditional, mixed-process estimator.

Another issue in these existing studies are the endogeneity problems caused by the simultaneous decisions of migrating and sending remittances, omitted variables, and selection bias (McKenzie and Sasin 2007, Adams 2011). To cope with these endogeneity problems, random experiments and analysis of panel data are effective. However, there are significant difficulties associated with conducting randomized experiments and collecting panel data in Cambodia. Another possible solution to these problems is to construct a counterfactual situation using an econometric technique with cross-section data, such as propensity score matching (Bertoli and Marchetto 2014). However, it is not yet clear whether this approach would produce the best results because it ignores the problem of selection (Adams 2011). Furthermore, this method cannot be performed since we have two endogenous variables. Therefore, we choose not to use this methodology for the case of Cambodia. Instead, we use the IV methodology, which is quite a common solution for overcoming such endogeneity problems.

Another limitation of these studies is that most of them only use either the attendance dummy or enrolment rate as an indicator of children's school attendance (Hanson and Woodruff 2003, Borraz 2005, Acosta *et al*. 2007, Bansak and Chezum 2009, Yang 2008, Amuedo-Dorantes and Pozo 2010, Amuedo-Dorantes *et al*. 2010, Giannelli and Mangiavacchi 2010,

Acosta 2011, Hu 2011, Nguyen and Purnamasari 2011). Only a few studies use years of schooling or grades as an indicator of children's educational attainment (Edwards and Ureta 2003, Mansour *et al*. 2011, McKenzie and Rapoport 2011). In the Cambodian context, we need to examine the impacts of migration on school attainment using dropout and grade repetition rates as indicators, because they represent serious issues in children's education in Cambodia.

The existing studies point out that the impacts of migration on children's education differ by gender (Hanson and Woodruff 2003, Borraz 2005, Mansuri 2006, Giannelli and Mangia-vacchi 2010), by age group (Borraz 2005, Mansour *et al*. 2011), or by both gender and age group (Bansak and Chezum 2009, McKenzie and Rapoport 2011). Thus, in this study, in addition to using more meaningful indicators of children's achievements in school, we take into account gender and age in investigating the impacts of migration on the educational attainment of children.

This paper makes two significant contributions. First, this is among the few studies to investigate the impact of the absence of migrant family members and their remittances on the education of children by (1) separating the impact of the absence of such family members from the impact of their remittances[2], (2) estimating the impact of migration on children's school attendance and attainment, and (3) taking gender and age into account. Second, this is the first study to examine the effects of migration on the education of children in Cambodia.

Empirical methodologies play an important role in the study of the impacts of migration. Our empirical strategy is described as follows. For the purpose of examining the impacts of migration on the education of children in Cambodia, we estimate the impact of internal and international migrations on the school attainment of children aged 6 to 17 years in rural Cambodia and apply IV methodologies to the cross-sectional data from the Cambodia Socio-Economic Survey 2009 (CSES 2009), which we use owing to the lack of panel data or data of randomised or natural experiments. The CSES 2009 is a nationwide survey conducted by the National Institute of Statistics (NIS) of the Ministry of Planning (MOP) in Cambodia. For the purpose of examining the impacts of migration on dropout and grade repetition rates, we analyse the impact of migration on school attainment of children using school attainment relative to age (SAGE). For the purpose of disentangling the effect of migration from that of remittances on educational attainment, we formulate simultaneous equation models in which we can control the effect of both migration and remittances on school attendance and school attainment. This methodology differs from those used in previous studies.

Despite the advantages of our methodology over those of previous studies, however, our methodology poses some difficulties. First, our methodology uses instrumental variables

such as rainfall shocks, number of past migrants, and ratio of total current migrants in each village, in order to overcome various endogeneity problems. However, we have to determine whether these instruments provide support and whether they are valid. For the purposes of examining the reliability and suitability of the instruments, we test whether the results are robust based on the choice of instruments and on a variety of alternative specifications. Second, we do not use years of schooling or grades as a proxy variable of school attainment, as did McKenzie and Rapoport (2011) and Mansour *et al*. (2011), because these variables are not appropriate for our purpose, which is to measure the level of schooling each child aged 5 to 17 attended and successfully completed; consequently, we use school attainment relative to age (SAGE) following Miwa *et al*. (2010). Third, we need to overcome the potential problem of selection bias. However, it is difficult to identify the exogenous variables which cause migration or the receipt of remittances in the first-stage equation but which have no direct impact on the dependent variable in the second stage equation of the selection model (Adams 2011, Iwasawa et al. 2014). Another possible way to overcome selection bias problem is propensity score matching technique. However, we cannot use this technique since we have two endogenous variables. Therefore, we do not use the approach which involves the sample selection procedure.

This rest of this paper is organised as follows. Section two describes the current situation of education in Cambodia and compares the characteristics of households and schooling of children in nonmigrant households with those in migrant households. In addition, based on the CSES 2009, this section addresses the characteristics of households which do not receive remittances with those which do. Section three describes the econometric model and outlines the methodology used to estimate the impacts of migration on the education of children. Section four presents the results obtained using the estimation model. Section five presents our conclusions.

2. Migration, Remittances, and the Education of Children in Cambodia

In Cambodia, the development of human capital is still limited, even though the government has implemented compulsory education for all children. The net enrolment rate in primary schools in Cambodia is almost 100 per cent, but the enrolment rate, which is one of the indicators of school attendance in secondary school, is still quite low (Table 1). Owing to significant dropout and grade repetition, yielding a 52 per cent survival rate for primary school children (the percentage of students who complete the final grade in primary school),

the rates of school attainment for all grades are still low (UNESCO 2012).

Table 1. School attendance and attainment in Cambodia (2010/2011)

	Region	Net enrolment rate (%)	Repetition rate (%)	Dropout rate (%)
Primary	Entire kingdom	95.2	7.1	8.7
	Urban	93.8	5	6.5
	Rural	95.5	7.4	9.1
Lower secondary	Entire kingdom	35	2	19.6
	Urban	51.3	3.3	11.1
	Rural	31.7	1.7	22
Upper secondary	Entire kingdom	20.6	1.8	11.8
	Urban	46.8	1.4	6.7
	Rural	14.9	2.1	15

Source: Ministry of Education, Youth and Sport, 2011, *Education Statistics and Indicators, 2010/2011.*

The data in Table 1 show that the annual dropout and repetition rates in rural areas are very high. Table 2 presents the characteristics of children's schooling, households, and villages from the CSES 2009, which includes statistics for 12,864 households which have children aged 6 to 17 years(for a more detailed explanation, see the CSES 2009 questionnaires). SAGE is calculated as [Years of Schooling/(Age-Formal School Entry Age)] * 100 (see Miwa *et al*. 2010). The SAGE sample consists of 9,102 observations (that is, children 6 to 17 years of age who are attending school).

Furthermore, in this study, school attainment is indicated by the specific grades attained by the children in a defined age range and who are currently attending school. In many cases, parents fail to report their children's current grades; therefore, in such cases, information about the students' current grades would more often be missing than other information such as whether the children are attending school or not. Moreover, when SAGE, as a proxy for school attainment, is generated, the SAGE of six-year-old children is missing because the formula for SAGE is [Year of Schooling/(Age-Formal School Entry Age)] * 100. Since the initial age for attending school in Cambodia is six years old, a SAGE value cannot be calculated for six-year-old children who are in school.

Table 2. Characteristics of child schooling, households and villages by migrant and remittance receipt status

Variable	All households		Non-migrant households		Migrant households			Non-remittance recipient households		Remittance recipient households		
	Obs.	Mean	Obs.	Mean	Obs.	Mean	t-value	Obs.	Mean	Obs.	Mean	t-value
SAGE	9102	94.604	7204	96.183	1898	88.612	7.14	6350	94.921	2752	93.875	1.06
SAGE male	4744	91.837	3744	93.611	1000	85.195	5.99	3280	92.278	1464	90.850	1.07
SAGE female	4358	97.617	3460	98.966	898	92.418	4.11	3070	97.745	1288	97.312	0.30
Remittances and migration												
Total remittances (dummy)		0.302		0.185		0.744	-60.34		0.000		1.000	--
Total remittances (riels)		230062.6		126112.3		623773.7	-13.12		0.000		761978.6	-20.96
Migrants' remittances dummy (2004–2009)		0.138		0.000		0.659	-72.12		0.000		0.456	-57.08
Migrants' remittances (2004–2009)	12,864	90658.66	10,177	0.000	2,687	434027.9	-14.20	8,980	0.000	3,884	300266	-14.04
Migrants (dummy)		0.209		0.000		1.000	--		0.077		0.515	-51.55
Migrants		0.338		0.000		1.619	-93.85		0.108		0.869	-42.67
Overall observations												

Note: Figures are calculated by the authors from the CSES 2009. Remittances are defined as the amount of money each recipient household receives from migrants and nonmigrants (that is, friends and relatives) residing domestically and abroad, but not gifts (either in-kind or money) and other transfers (for example scholarship, NGO donations).

Table 2 shows that the school attainment rate (SAGE) of migrant households is lower than those of nonmigrant households. As for the effect of gender on the education of children, we find that the school attendance rate for males is higher than that for females, while the rate of school attainment for males is lower than that for females. This may suggest that although females are more often refrained from schooling than males, they have a stronger desire to study in school than males.

In order to find the variables which may affect the decision to migrate and to send remittances, as well as the education of children, we must determine whether statistically significant differences exist in the variables which describe the two subsamples-nonrecipient and recipient households, or nonmigrant and migrant households-following the methodology of Amuedo-Dorantes and Pozo (2010) and Karamba *et al*. (2011). Our results indicate that there exist differences in gender, age, education, occupation of household head, land holding, asset holding, village characteristics, and region between migrant and nonmigrant households or recipient and nonrecipient households (see Table 5.2 in Luch, 2012). In this study, all these variables are expected to affect the education of children, the decision to migrate, and the decision to send remittances.

3. Empirical Framework and Identification Strategy

The objective of our study is to measure the contribution of migration and remittances to the education of children aged 6 to 17 years. As a starting point for this analysis, we follow the ordinary least squares (OLS) for SAGE:

$$S_{ij} = \alpha + \beta R_j + \phi M_j + \delta X_{ij} + u_{ij}, \tag{1}$$

where S_{ij} stands for the SAGE of child i of household j. In the case of SAGE, S_{ij} is a continuous variable generated from the SAGE formula, that is, [Years of Schooling/(Age- Formal School Entry Age)] * 100.

Meanwhile, the vector X_{ij} pertains to the characteristics of the household, children, and village (Table 2). Community dummy variables are included to account for regional differences, such as per capita income levels and school infrastructure, which affect school attendance rate (Amuedo-Dorantes and Pozo 2010). Since village data are available, in this study, we control for several village characteristics, namely economic activities (number of

industries/enterprises), schooling infrastructure (primary school, secondary school, and upper secondary school), and region. R_j is a dummy variable indicating whether a household receives remittances from internal/international migrants and nonmigrants. M_j is a dummy variable which takes the value of "1" if the household has migrant members since 2004, and is otherwise "0". In Equation (1), we treat M_j and R_j as exogenous and also report the estimation results from the OLS in school attainment.

Furthermore, the migration and remittance variables in Equation (1) may be endogenous as a result of reverse causality and the omitted variable problem (McKenzie and Sasin 2007, Calero *et al.*, 2008). Reverse causality may arise when households face liquidity constraints and possibly send adult family members to work in cities or other areas in order to keep other school-age children at school. Meanwhile, the omitted variable bias may be due to unobservable factors, for example, natural disasters, which influence both school attainment of children and migration. Such phenomenon may cause children aged 15 to 17 years to drop out of school in order to migrate. Therefore, in order to overcome these potential pitfalls, we turn to the IV method:

$$M_j = \gamma + \mu X_{ij} + \varphi Z_{ij} + u_{ij}, \tag{2}$$

$$R_j = \eta + \lambda X_{ij} + \theta Z_{ij} + v_{ij}, \tag{3}$$

as mentioned above, M_j in Equation (2) is a binary variable which takes the value "1" if households have any adult member aged 15 to 64 years who were residing in other places from 2004 to 2009 and "0" otherwise[3]. R_j in Equation (3) takes the value "1" if recipient households received remittances either from migrants or nonmigrants in 2009 and "0" otherwise. Meanwhile, the vector X_{ij} contains both household and village characteristics which will be used in Equations (2) and (3). The control variables are selected based on previous literature such as Amuedo-Dorantes and Pozo (2010), Hu (2011) and our data availability. Z_j represents the set of instrumental variables, namely rainfall shocks at the village level, number of past migrants before 2004 (or migrants who have since returned), and ratio of current migrants in each village (total migrants per village/total population per village).We use this same set of instrumental variables in Equations (2) and (3).

Rainfall shocks occur at the village level and potentially affect the motivation of both mi-

grants and nonmigrants to send remittances, but do not have an effect on SAGE. When such shocks occur, migrants may send extra money home to mitigate its effects and to maintain consumption levels, and hence, remittances are expected to increase. The studies by Halliday (2006) and Yang and Choi (2007) stress the role of remittances as insurance in highly volatile environments. Shocks at the village and household levels could induce income shocks that stimulate higher remittance flows and school attainment at the same time. If part of the remittance flows compensate for the income shocks, remittances could be correlated with the error terms of school attainment (Acosta 2011). However, we argue that rainfall shocks at the village level may have very little impact on school attainment. The rainfall shock variable is defined as a dichotomic variable taking 1 if the total amount of rainfall in the past dry-season or the past rainy season is abnormal in relation to the requirement for main crop of the village, and 0 otherwise[3]. Such abnormal rainfall causes crop damage and a temporary reduction in household income. The temporary income reduction can induce emigration and remittances to cover this reduction. However, such income reduction does not necessarily affect child schooling seriously, because, according to our field observation in rural Cambodia, it can be compensated by receiving remittances and increasing labour work. In addition, the abnormal rainfall usually does not have a serious direct effect on child schooling except when heavy floods destroy houses and roads. During 2008-2009, only in September 2009 was there heavy flooding; this was in the basins of two big rivers (Office of Secretariat, Mekong River Commission 2010). Although we have not checked the data in detail, we expect that among the large number of sample households, only in a few households could children not attend school owing to such flood damage. In fact, the correlation coefficients between rainfall shocks and attainment are very low (see the correlation table in the online tables). Therefore, even if rainfall shocks negatively affect farmers, they do not necessarily become a serious and direct constraint to the children's schooling. In order to address this problem, we instrument rainfall shock for remittances.

The remaining instruments are the number of migrants before 2004[4] and percentage of migrants in each village, which are regarded as "network variables" (Rozelle *et al.* 1999, Taylor *et al.* 2003, Amuedo-Dorantes and Pozo 2010, Hu 2011, McKenzie and Rapoport 2011). We assume that the number of migrants before 2004 would have a positive effect on the number of current migrants since this would serve as a migration network that facilitates future migration and remittances, but would have no direct impact on attainment. This latter assumption is controversial in the existing literature since it could be correlated with SAGE. It is possible that the past migration experiences have affected child schooling through a rise of long-term household well-being. However, this is not a direct effect but an indirect ef-

Table 3. Instrumental Variables

Variable	All households	Nonmigrant households	Migrant households		Non-remittance recipient households	Remittance recipient households	
	Mean	Mean	Mean	t-value	Mean	Mean	t-value
Total remittances (dummy)	0.223	0.222	0.228	-0.61	0.208	0.26	-6.28
No. of total migrants before the last 5 years (before 2004)	1.528	1.487	1.682	-5.61	1.515	1.556	-1.44
Ratio of total migrants in village	0.015	0.013	0.022	-20.56	0.013	0.019	-17.55
N	12,864	10,177	2,687		8,980	3,884	

Source: Figures are calculated by the authors from the CSES 2009. Rainfall shocks refer to the level of rainfall which is worse than normal at the village level in 2009. It takes the value of "1" if the village suffered from abnormal rainfall in 2009 and "0" otherwise. The number of migrants before the past five years is defined as the number of migrants who have returned in each household. Some households in the data set have no current migrants, but they could have returned migrants. Ratio of total migrants is defined as the sum of all migrants, who are currently residing outside the villages in the last six years, per village, over total population per village (Ratio of total migrants per village = Total current migrants per village/Total population per village).

fect through the rise of household income. Therefore, for testing the hypothesis that past migration experiences have no direct impact on child schooling, we must examine the correlation between the error terms and the potential instrument. Our test results show that the past migration variable does not have any significant correlation with the variables of child schooling[5]. Unlike Hu (2011), who constructs the ratio of past migrants at the community level, we use the number of past migrants instead. We assume that the ratio of migrants in each village is positively correlated to both remittances and migration but not to school attainment. People in the community can obtain migration-related information, such as potential destinations, from current migrants from the same community, and consequently, decide whether to migrate using such information. In addition, migrants can transfer remittances to their families in rural areas through other migrants returning to such areas.

After choosing the instruments (Table 3), we check the validity, and relevancy of the instruments and the low correlation with regressor vectors from an econometric standpoint. A low correlation could result in a weak instrument. Wooldridge (2010) and Angrist and Krueger (2001) argue that the problem of a weak instrument occurs when there is a low correlation between the endogenous variables and the instruments, as well as when there are too many instruments. Thus, the F-test is used to draw the inferences (Cameron and Trivedi 2006).[6] If the test results suggest that the instruments are weak, a conditional test for weak instruments is used to check whether the instruments are indeed weak (Moreira and Poi 2003, Cameron and Trivedi 2009).

4. Estimation Results and Discussion

Tables 4, 5, and 6 present the estimation results from the SAGE equations for children aged 6 to 17, male children aged 6 to 17, and female children aged 6 to 17 years, respectively; these tables also show the results of the tests for validity of instruments.

The results in Table 4 show that the coefficients of remittances in OLS models (1) and (3) are significant at the 5 per cent level.[7] However, after we take the endogeneity problem into account in 2SLS models (2) and (4), the coefficients of remittances become significantly greater and statistically significant at the 1 per cent level. The significant difference between the coefficients from the OLS and 2SLS models implies that the estimates from the OLS models have a downward bias. Moreover, the positive impact of remittances on SAGE is robust to the model specifications. The existing studies on rural Cambodia, for example, by Miwa *et al*. (2010), which use OLS, show a positive effect of child labour on school attainment (SAGE). In this study, although we do not examine the effect of child labour on SAGE, we investigate the impact of remittances on SAGE, which includes grade repetitions. When a child i of a household j repeats a grade, the child's years of schooling remain constant, but his or her age increases, making the SAGE smaller. As suggested by Mansuri (2006), children of migrant households stay in school longer and work fewer hours than their counterparts. Thus, if remittances have a positive impact on SAGE, they can also reduce the repetition of grades. However, several studies have pointed out that children in households which receive remittances or have migrant family members may spend more time helping out in the household business and less time in school (Amuedo-Dorantes and Pozo, 2010, Giannelli and Mangiavacchi 2010, Kroeger and Anderson 2011, McKenzie and Rapoport 2011). Meanwhile, other studies have suggested that remittances relax credit constraints and

increase investments and off-farm activities (Adams 1998, Rozelle *et al*. 1999, Taylor *et al*. 2003, Halliday 2006, Adams and Cuecuecha 2010, Quisumbing and McNiven 2010).

The empirical evidence from our study suggests that remittances increase school attainment and reduce the repetition of grades among children aged 6 to 17 years. Also, we find that the absence of migrant family members significantly reduces the school attainment of children aged 6 to 17 years. This may be because the household must reallocate family labour, prompting school-age children to work more. However, the estimation results indicate that the impact of remittances is greater than the impact of migration. This suggests that although school-age children may have to work more in response to the absence of migrant family members, they attain more education as well. This is consistent with the finding of Miwa *et al*. (2010) that child labour does not affect schooling in rural Cambodia if the children do not work beyond a certain amount of time.

Table 4. School attainment of children aged 6–17 years

	Total remittances		Remittances from migrants	
	OLS	2SLS	OLS	2SLS
	Coef. (*t*-value)	Coef. (*z*-value)	Coef. (*t*-value)	Coef. (*z*-value)
Remittances (dummy)	2.4021**	73.4109***	4.1448**	142.7539***
	(2.34)	(3.36)	(2.50)	(2.99)
Migrant (dummy)	-3.2874***	-44.3674**	-4.8411***	-97.4206***
	(-3.09)	(-2.40)	(-3.50)	(-2.58)
Constant	126.5860***	111.4531***	126.8437***	116.8829***
	(13.14)	(9.42)	(13.15)	(10.36)
N	9102	9102	9102	9102
R^2	0.2752	--	0.2752	--
F	47.32	--	47.18	--
Wald	--	1812.82	--	1710.96
Test for validity, relevancy and weakness of instruments				
Overidentified				
Score Chi^2		.137 (.712)		1.28 (.258)
Endogenous				
Robust score Chi^2		23.963 (.0000)		23.603 (.0000)
Robust regression F		11.977 (.0000)		11.82 (.0000)
Weak instrument (F-value)				
$F_{Remittances}$		56.75 (.0000)		65.18 (.0000)
$F_{Migrants}$		83.73 (.0000)		83.73 (.0000)
Minimum eigenvalue statistic		9.77176		7.5183

Note: ***, **, and * indicate significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively.

Table 5. School attainment of male children aged 6–17 years

	Total remittances		Remittances from migrants	
	OLS	2SLS	OLS	2SLS
	Coef. (t-value)	Coef. (z-value)	Coef. (t-value)	Coef. (z-value)
Remittances (dummy)	1.4242	79.9194**	1.5673	113.1147**
	(0.99)	(2.31)	(0.69)	(2.10)
Migrant (dummy)	-2.9148**	-48.9680*	-3.2527*	-72.1194*
	(-2.00)	(-1.70)	(-1.69)	(-1.71)
Constant	110.8372***	94.2528***	110.9262***	92.6964***
	(8.17)	(5.64)	(8.15)	(5.72)
N	4744	4744	4744	4744
R^2	0.2687	--	0.2686	--
F	24.704	--	24.623	--
Wald	--	907.22	--	996.91

Test for validity, relevancy and weakness of instruments

Overidentified

Score Chi^2		.291 (.59)		1.92 (.166)

Endogenous

Robust score Chi^2		14.65 (.0007)		13.13 (.0014)
Robust regression F		7.28 (.0007)		6.52 (.0015)

Weak instrument (F-value)

F $_{Remittances}$		33.25 (.0000)		38.91 (.0000)
F $_{Migrants}$		49.48 (.0000)		49.48 (.0000)
Minimum eigenvalue statistic		4.12305		4.93696

Note: ***, ** and * indicate significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively. Chow Test (p > F) = 2.81.

Table 6. School attainment of female children aged 6–17 years

	Total remittances		Remittances from migrants	
	OLS	2SLS	OLS	2SLS
	Coef. (*t*-value)	Coef. (*z*-value)	Coef. (*t*-value)	Coef. (*z*-value)
Remittances (dummy)	3.5397**	70.9065**	7.0361***	207.0670**
	(2.41)	(2.32)	(2.92)	(2.01)
Migrant (dummy)	-4.2221***	-48.3713*	-7.1230***	-156.5846*
	(-2.69)	(-1.84)	(-3.57)	(-1.89)
Constant	138.8297***	124.3092***	139.7270***	143.8688***
	-10.42	-7.24	-10.51	-7.46
N	4358	4358	4358	4358
R^2	0.292	--	0.2922	--
F	25.403	--	25.365	--
Wald	--	956.41	--	--
Test for validity, relevancy and weakness of instruments				
Overidentified				
Score Chi^2		1.483 (.22)		.14 (.708)
Endogenous				
Robust score Chi^2		8.184 (.017)		10.88 (.004)
Robust regression F		4.075 (.017)		5.485 (.004)
Weak instrument (F-value)				
F $_{Remittances}$		23.15 (.0000)		25.9 (.0000)
F $_{Migrants}$		33.46 (.0000)		33.46 (.0000)
Minimum eigenvalue statistic		4.976		2.30927

Note: ***, ** and * indicate significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively. Chow Test (p > F) = 17.96.

Furthermore, we also investigate the impacts of migration and remittances on the SAGE of male and female children aged 6 to 17 years on the same basis, and the results are presented in Tables 5 and 6. Table 8 shows that the coefficients of total remittances and remittances from migrants are statistically significant at the 5 per cent level in the 2SLS model. In addition, the coefficients of migration are negative and significant at the 10 per cent level in the 2SLS model. The other variables of interest also significantly contribute to the school attainment of male and female children aged 6 to 17 years. Table 6 indicates that the coefficients of remittances and migration are statistically significant in all models, and that these estimation results are robust to the models' specifications. The coefficients of remittances and migration in the OLS models exhibit downward bias due the correlation between the error term and remittances and migration, but that these coefficients improve significantly in the 2SLS

models. Importantly, remittances from migrants are found to have a greater effect on school attainment by female children than do total remittances. On the other hand, the coefficients of migration are negative and significant at 10 per cent in the 2SLS models. In addition, the coefficients of remittances are significantly greater than those of migration. In rural Cambodia, farm households generally face liquidity constraints, and thus cannot send all of their children to school; furthermore, female children are less likely to attend or complete school compared to their male siblings. Female children are usually involved in household chores such as cooking, cleaning, and taking care of younger siblings, and thus have less time to study and complete school. The estimation results suggest that remittances relax household credit constraints and allow these households to invest more in their children's education, especially of female children.

Table 6 shows that remittances increase the relative school attainment of female children. The findings on the impacts of adult absence by migration are not consistent with those in the existing literature (Giannelli and Mangiavacchi 2010, McKenzie and Rapoport 2011, Mansour *et al*. 2011), which indicate negative impacts of the absence of adult family members on school attainment, particularly for female children. Furthermore, we find that the impacts of remittances on school attainment are positive both for male and female children.

5. Conclusions

In this study, we investigate the impact of total remittances and remittances from migrants, and the impact of migration on SAGE in rural Cambodia, using data from the CSES 2009. This study is the first to separate the effect of migration from that of remittances on the education of children aged 6 to 17 years. The estimation results are robust to the specifications of the models we use (OLS model, and 2SLS model).

The empirical findings of this study indicate that the migration of adult household members aged 15 to 65 years has a negative impact on the SAGE of children aged 6 to 17 years in rural Cambodia. However, the findings also indicate that remittances (total remittances and remittances from migrants) compensate for this negative impact to some extent. Furthermore, migration and remittances have greater impacts on the school attainment of female children aged 6 to 17 years than on male children. Since the effects of remittances (total remittances and remittances from migrants) are positive and greater than the effects of migration, the net effect of migration and remittances on school attainment of children aged 6 to 17 years is positive. This positive net effect implies that remittances relax household credit constraints,

allowing children (especially female children) to progress to higher grades. The empirical findings also suggest that migration and remittances, as well as other variables such as education levels of the household heads, number of siblings, and ownership of assets and land are significant determinants of children's education.

These empirical findings have some important implications. In rural Cambodia, where the dropout and grade repetition rates are quite high, remittances compensate, to some extent, for the absence of migrant family members. Taking into consideration the importance of education to the economic development of Cambodia, our findings imply that policies aimed at increasing the flow of remittances by lowering the associated costs of making such remittances and at enhancing investment incentives (for example, the promotion of mobile banking) can help improve the educational opportunities of children in rural Cambodia.

Note

1）The contribution of second author is not less than 50%. This work was supported by Japan Society of Promotion of Science under Grant-in-aid for Scientific Research (No.21248029).

2）We do not distinguish parental migrant from nonparental migrant. However, nonparental migration may not have a negative effect on child education. If it is the case, we should have examined the migrant heterogeneity, parental or nonparental (Antman 2012, Iwasawa *et al*. 2014, Fujii 2015).

3）From CSES 2009, we can obtain three other dichotomic variables taking 1 if (1) the distribution of rainfall across different months is abnormal, (2) the onset of rainfall was delayed, or (3) the crops were damaged by floods/too much rain; these variables take 0 otherwise. We selected the dichotomic variable taking 1 if the total amount of rain in the past dry season or the past rainy season is abnormal as an instrument because this variable is expected to affect remittances and migration more than (1), (2), and (3) mentioned above.

4）This variable takes the value of "1" if the household has had a migrant family member in the last six years (2004-2009) and "0" otherwise.

5）The estimation results of correlation are presented in the appendix table.

6）Cameron and Trivedi (2005) suggest that "based on the simulation, to insure that the maximal bias in IV is no more than 10 per cent that of OLS, we need $F>10$, but it decreases to around 6.5, for example, if one is comfortable with bias in IV of 20 per cent of that for OLS, so that a less-strict rule of thumb is $F>5$".

7）The statistical test of validity of the instruments is provided at the bottom of Tables 4, 5, and 6. The test results indicate that the instruments are valid in all the models.

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Appendix Table. Correlation among the variables & definition of variables	atten_new	dtotremit	drenitnew	dmignew	RWS	tot_past-mov	RWV
atten_new	1						
dtotremit	-0.0623	1					
drenitnew	-0.0498	0.6123	1				
dmignew	-0.0754	0.4974	0.7802	1			
RWS	0.0139	0.0541	0.0195	0.0008	1		
tot_pastmov	-0.0479	0.0142	0.0038	0.0517	-0.0406	1	
RWV	0.0219	0.1696	0.2033	0.2027	0.0341	-0.0712	1

Variables	Definition
dtotremit	if remittances from migrants and non-migrants 2004-2009
dremitnew	if remittances from migrant only 2004-2009
dmignew	if migrants between 2004-2009
RWS	Rainfall shock = 1
tot_pastmov	no. of past migrants
RMV	ratio of migrants in each village