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Remittances, Household Expenditure and Investment in Guatemala

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Summary. — This paper uses a nationally-representative household data set from Guatemala to analyze how the receipt of internal remittances (from Guatemala) and international remittances (from United States) affects the marginal spending behavior of households. Two findings emerge. First, controlling for selection and endogeneity, households receiving international remittances spend less at the margin on one key consumption good—food—compared to what they would have spent on this good without remittances. Second, households receiving either internal or international remittances spend more at the margin on two investment goods—education and housing—compared to what they would have spent on these goods without remittances. These findings support the growing view that remittances can help increase the level of investment in human and physical capital in remittance-receiving countries.

Key words — remittances, consumption, investment, Guatemala

1. INTRODUCTION

Remittances refer to the money and goods that are transmitted to households by migrant workers working outside of their origin communities. At the start of the 21st Century these resource transfers represent one of the key issues in economic development. In 2006 official international remittances to developing countries were estimated at $221 billion per year (World Bank., 2008),[1] making them about twice as large as the level of official aid-related flows to the developing world.

From the standpoint of economic development, the basic question is quite simple: How are these remittances spent or used? Are these monies spent on newly desired consumer goods back home, or are they channeled into human and physical investments in origin countries?

In the literature there are at least three views on how remittances are spent or used and their effect on economic development. The first, and probably most widespread, view is that remittances are fungible and are spent at the margin like income from any other source. In other words, a dollar of remittance income is treated by the household just like a dollar of wage income, and remittance income is spent just like any other source of income. The second view argues that the receipt of remittances can cause behavioral changes at the household level and that remittances tend to get spent on consumption rather than investment goods. For example, a review of the literature by Chami, Fullenkamp, and Jahjah (2003, pp. 10–11) reports that a "significant proportion, and often the majority" of remittances are spent on "status-oriented" consumption goods. A third, and more recent, view arising out of the permanent income hypothesis is that since remittances are a transitory type of income households tend to spend them more at the margin on investment goods—human and physical capital investments—than on consumption goods, and that this can contribute positively to economic development (Adams, 1998). For instance, in a study of remittances and education in El Salvador, Edwards and Ureta (2003) find that international remittances (mainly from the United States) have a large positive impact on student retention rates in school. In a similar study in the Philippines, Yang (2005) reports that positive exchange rate shocks lead to a significant increase in remittance expenditures on education. Finally, in Nigeria, Osili (2004) finds that a large proportion of remittance income is spent on housing.

The purpose of this paper is to refine and extend the debate concerning how remittances are spent or used and their impact on economic development by using the results of a large, nationally-representative household budget survey in Guatemala. The results of this survey are used to rigorously compare the marginal spending behavior of three groups of households: those receiving no remittances, those receiving internal remittances (from Guatemala) and those receiving international remittances (from United States). Since all survey households are separated into one of these three groups, it becomes possible to compare the marginal budget shares of remittance- and non-remittance receiving households to a broad range of consumption and investment goods, including food, education and housing.

At the outset it should be emphasized that such a comparative analysis of the marginal spending behavior of non-remittance receiving and remittance-receiving households is not without its problems. One obvious issue is that of selection, that is, households receiving remittances might have unmeasured characteristics (e.g., more skilled, able or motivated members) which are different from households not receiving remittances. We address this concern by using a two-stage multinomial logit model to estimate the marginal spending behavior of households controlling for selection in unobservable characteristics. The identification of this model is based on the use of instrumental variables. Since past research has found that distance to railroad lines, historical migration rates, changes in rainfall patterns and

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employment creation rates in labor-receiving countries are important in migration and the receipt of remittances (e.g., Woodruff & Zenteno, 2007, Hanson & Woodruff, 2002, McKenzie & Rapoport, 2007, Munshi, 2003 and Passel, 2006), our instrumental variables focus on these variables. This instrumental approach enables us to control for selection and to identify the marginal expenditure patterns of households with and without remittances. [2]

The paper proceeds in eight further parts. Section 2 describes the data set and Section 3 discusses the functional form for analyzing the expenditure patterns of remittance-receiving and non-receiving households. Since the problems of selection and identification are so important for identifying the impact of remittances on expenditure behavior, Section 4 presents the two-stage multinomial logit selection model used in the analysis. Section 5 specifies this two-stage model using an instrumental variables approach focusing on variations in distance to the nearest railroad station, historical migration rates, changes in rainfall patterns and the US employment creation rate. Section 6 estimates the model and Sections 7 and 8 present robustness checks. Section 9 summarizes the findings.

2. DATA SET

Data come from the 2000 Guatemala ENCOVI Survey, a national household survey done by the *Instituto Nacional de Estadistica* in Guatemala during the period July to December 2000. [3] The survey included 7145 urban and rural households and was designed to be statistically representative both at the national level and for urban and rural areas. The survey was comprehensive, collecting detailed information on a wide range of topics, including income, expenditure, education, financial assets, household enterprises and remittances. [4]

It should, however, be emphasized that this 2000 Guatemala ENCOVI Survey was *not* designed as a migration or remittances survey. In fact, it collected very limited information on these topics. With respect to migration, the survey collected no information on the characteristics of the migrant: age, education or income earned away from home. This means that no data are available on the characteristics of migrants who are currently living outside of the household. With respect to remittances, the survey only asked three basic questions: (1) does your household receive remittances from family or friends?; (2) where do these people sending remittances live?; and (3) how much (remittance) money did your household receive in the past 12 months? The lack of data on individual migrant characteristics in the Guatemala survey is unfortunate, but the presence of detailed information on household expenditures makes it possible to use responses to these three questions to examine the impact of remittances on household expenditure behavior.

Since the focus is on remittances, it is important to clarify how these income transfers are measured and defined. Each household that is recorded as receiving remittances—internal or international—is assumed to be receiving exactly the amount of remittances measured by the survey. This means that households which have migrants who do not remit are not recorded in this study as receiving remittances; rather these households are classified as non-remittance receiving households. This assumption seems sensible because migration surveys in other countries generally find that about half of all migrants do not remit. [5] Since no data are available on the number of remitters per household, each household that is recorded as receiving remittances is assumed to be receiving remittances from just one migrant. Since the survey data also contain no information on the characteristics of the migrant, households may be receiving remittances from different people: family members or relatives. Because of data limitations, the focus throughout this study is on the receipt of remittances by the household rather than on migration or the type of person sending remittances. Finally, all remittances in this study are "cash" remittances: remittances in kind are not included in the calculations. To the extent that remittances in kind are important in Guatemala, this latter point may lead to an under-counting of the actual flow of remittances to households in Guatemala.

Table 1 presents summary data from the 2000 Guatemala survey. It shows that the survey contains three mutually exclusive groups of households: 5665 households (79.3 percent of all households) receive no remittances, 975 households (13.6%) receive internal remittances (from Guatemala) and 505 households (7.1%) receive international remittances (from United States). [6] For households receiving remittances, remittances represent a large share of household income: 17.9% of income for households receiving internal remittances and 31.2% of income for households receiving international remittances.

Since we want to examine the impact of remittances on expenditures, it is important to present the type of expenditure data contained in the 2000 Guatemala Survey. Table 2 shows that the survey collected detailed information on six major categories of expenditure, and on several subdivisions within each category. While the time base over which these expenditure outlays were measured varied (from last 7 days for most food items, to last year for most durable goods), all expenditures were aggregated to obtain yearly values. For household durables (stove, refrigerator, automobile, *etc.*), annual use values were calculated to obtain an estimate of the cost of one year's use of that good. Annual use values were also calculated to obtain an estimate of the one year use value of housing (rented or owned).

Table 2 also shows the average budget shares devoted to the six categories of goods for each of the three groups of households: those receiving no remittances, those receiving internal remittances (from Guatemala) and those receiving international remittances (from United States). On average, each of the three groups of households spends over 62% of their budgets on the two categories of goods that are clearly consumption items: food and consumer goods, durables.

3. CHOICE OF FUNCTIONAL FORM

To analyze the marginal expenditure patterns of remittance-receiving and non-receiving households, it is necessary to choose a proper functional form for the econometric model. The selected functional form must do several things. First, it must provide a good statistical fit to a wide range of goods, including food, housing and education. Second, the selected form must mathematically allow for rising, falling or constant marginal propensities to spend over a broad range of goods and expenditure levels. A model specification that imposes the same slope (or marginal budget share) at all levels of expenditure would not be adequate. Third, the chosen form should conform to the criterion of additivity (i.e., the sum of the marginal propensities for all goods should equal unity).

One useful functional form which meets all of these criteria is the Working-Leser model, which relates budget shares linearly to the logarithm of total expenditure. This model can be written as: [7]

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Table 1. *Summary data on non-remittance and remittance-receiving households, Guatemala, 2000*

Variable	Receive no remittances	Receive internal remittances (from Guatemala)	Receive international remittances (from United States)	t-test (No remittances *vs.* internal remittances)	t-test (No remittances *vs.* international remittances
Household head is non-indigenous (1 = yes)	0.59 (0.49)	0.66 (0.47)	0.67 (0.47)	4.26***	3.74***
Mean age of household head (years)	42.88 (14.49)	51.08 (17.08)	47.74 (16.06)	15.77**	6.97***
Household head is between 25 and 59 years old (1 = yes)	0.80 (0.40)	0.66 (0.47)	0.71 (0.45)	9.52***	4.78***
Household head is above 59 years old (1 = yes)	0.13 (0.33)	0.28 (0.45)	0.21 (0.41)	12.12***	5.42***
There are children below age 5 in household (1 = yes)	0.55 (0.50)	0.41 (0.49)	0.47 (0.50)	7.70***	3.56***
There are children between 5 and 15 years old in household (1 = yes)	0.68 (0.47)	0.59 (0.49)	0.74 (0.44)	4.99***	2.79***
There are household members with primary education (1 = yes)	0.68 (0.47)	0.63 (0.48)	0.65 (0.48)	3.04***	1.02
There are household members with secondary education (1 = yes)	0.30 (0.46)	0.35 (0.48)	0.37 (0.48)	3.12***	3.57***
There are household members with high school education or more (1 = yes)	0.11 (0.32)	0.11 (0.32)	0.13 (0.33)	.04	.09
Area (0 = urban, 1 = rural)	0.55 (0.49)	0.45 (0.49)	0.46 (0.49)	5.68***	3.80**
Mean annual *per capita* income (including remittances) in Guatemalan quetzals	6,681.97 (14021.55)	7741.50 (10114.86)	9138.71 (14724.71)	1.96**	3.81***
Remittances as percent of total *per capita* income (including remittances)	0 (0)	17.90 (22)	31.24 (41)	33.39***	49.80***
N	5,665	975	505		

Notes: $N = 7{,}145$ households. All values are weighted; standard deviations are in parentheses. In 2000, 1 Guatemalan quetzal = US$0.128.
Source: 2000 Guatemala ENCOVI Survey, Instituto Nacional de Estadistica.
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

Table 2. *Expenditure categories and average budget shares, Guatemala, 2000*

Category	Description	Examples	Average budget shares		
			Households receiving no remittances ($N = 5{,}665$)	Households receiving internal remittances (from Guatemala) ($N = 975$)	Households receiving international remittances (from United States) ($N = 505$)
Food	Purchased food Non-purchased food	Bread, tortillas, milk, meat, fruit, vegetables Food from: own-production, gifts, donations, social programs	0.488	0.460	0.447
Consumer goods, durables	Consumer goods Household durables	Clothing, shoes, fabric Annual use value of stove, refrigerator, furniture, television, car	0.171	0.164	0.190
Housing	Housing value	Annual use value of housing (calculated from rental payments or imputed values)	0.126	0.151	0.131
Education	Educational expenses	Books, school supplies, uniforms, registration fees, travel to school	0.031	0.038	0.047
Health	Health expenses	Doctor fees, medicine, X-rays, tests, hospitalization, health insurance premiums	0.025	0.029	0.025
Other goods	Household services Transport, communications Legal, personal services	Water, gas, electricity, telephone Bus and taxi fees, gasoline, faxes, postage, internet charges Fees for lawyers, accountants, professionals	0.159	0.158	0.160

Source: 2000 Guatemala ENCOVI Survey, Instituto Nacional de Estadística.

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$$C_i/EXP = \beta_i + a_i/EXP + \gamma_i(\log EXP) \quad (1)$$

where C_i/EXP is the share of expenditure on good i in total expenditure EXP. Adding up requires that $\Sigma C_i/\mathrm{EXP} = 1$.

Eqn. (1) is equivalent to the Engel function:

$$C_i = a_i + \beta_i EXP + \gamma_i(EXP)(\log EXP) \quad (2)$$

In comparing the expenditure behavior of households with different levels of income, various socioeconomic and locational factors other than expenditure must be taken into account. Part of the observed differences in expenditure behavior may be due, for example, to differences in household composition (family size, number of children, *etc.*), education, geographic region or (in this sample) receipt of internal or international remittances. These household characteristic variables need to be included in the model in a way that allows them to shift both the intercept and the slope of the Engel functions. Let Z_j denote the jth household characteristic variable and let μ_{ij} and λ_{ij} be constants. The complete model is then:

$$C_i = a_i + \beta_i EXP + \gamma_i(EXP)(\log EXP) + \sum_j [(\mu_{ij})(Z_j) + \theta_i j(EXP)(Z_j)] \quad (3)$$

Written in expenditure share form, this is equivalent to:

$$C_i/EXP = \beta_i + a_i/EXP + \gamma_i(\log EXP) + \sum_j [(\mu_{ij})Z_j/EXP + \theta_{ij}(Z_j)] \quad (4)$$

Including the various household characteristic variables in Eqn. (4) is important, because it introduces considerably more flexibility in the way that marginal budget shares can vary by household type.

From Eqn. (4) the marginal and average budget shares for the ith good (the MBS_i and ABS_i, respectively) can be derived as follows:

$$MBS_i = dC_i/dEXP = \beta_i + \gamma_i(1 + \log EXP) + \sum_j [(\theta_{ij})(Z_j)] \quad (5)$$

$$ABS_i = C_i/EXP \quad (6)$$

Eqn. (5) shows the response in the budget share of good i, to one dollar increase in household expenditure, holding constant household characteristics Z_j.

4. ESTIMATING A TWO-STAGE MULTINOMIAL SELECTION MODEL

We now redefine the model in terms of the choices that households make. Assume that households choose between three mutually exclusive states (s): (1) receive no remittances; (2) receive internal remittances (from Guatemala); and (3) receive international remittances (from United States).[8] Once households have chosen a state, they decide their optimal consumption shares C_{si}, where C_{si} is the optimal consumption share for households that choose $s = k$, in good i. On this basis, we have a polychotomous-choice model (Lee, 1983), where we have an Eqn. like (4) for each type of expenditure good i that households choose and for each possible state s. Dubin and McFadden (1984) have shown that if the choice model and the consumption model contain correlated error components and if the choice model is estimated by a logit model, selection in the consumption model can be corrected by the addition of a term as follows:[9]

$$C_{si}/EXP = \beta_{si} + a_{si}/EXP + \gamma_{si}(\log EXP) + \sum_k [(\mu_{sik})Z_k/EXP + \theta_{sik}(Z_k)] + \sum_h \neq s \pi_{sih}\lambda_{ih} + v_{si}, \quad (7)$$

where $E(v_{si}|X,Z) = 0$; λ_{ih} represents the selection correction variable related to choice h.[10] Note that the parameter π to be estimated is directly proportional to the correlation between the error terms of the consumption and the choice equations.[11]

It is clear from Eqn. (7) that the Dubin and McFadden method represents a generalization of the Heckman two-stage method of selection correction. As in the Heckman method, identification of Eqn. (7) depends on both the existence of instrumental variables and the non-linearity of the selection part of the model.[12] We will use the Dubin McFadden method in this analysis because a recent review of the literature on selection bias (Bourguignon, Fournier, & Gurgand, 2004) shows that this method performs better than other selection methods in Monte Carlo experiments.[13]

To estimate the effect of remittances on the marginal spending behavior of households, we follow the literature on the evaluation of multiple treatments. This literature has shown that the pairwise comparison of treatments is enough to identify Average Treatment Effects on the Treated (ATT) (Lechner, 2002). Specifically, let the average treatment effect of treatment m compared to treatment l on the participants of treatment m be defined by:[14]

$$ATT_{ml} = E(MBS_m|s = m) - E(MBS_l|s = m) \quad (8)$$

where $E(\mathrm{MBS}_m|\mathrm{s} = m)$ represents the marginal budget share (MBS), estimated with the equation for households that choose action m, conditioning on the characteristics of households that choose action m.[15] We also have that $E(\mathrm{MBS}_l|\mathrm{s} = m)$ represents the MBS, estimated with the equation for individuals that choose action l, conditioning on the characteristics of households that choose action m.[16]

$$E(Cl/EXP|s = m) = \beta_l + al/EXP + \gamma_l(\log EXP) + \sum_j [(\mu_{lj})Zj/EXP + \theta_{lj}(Zj)] + \pi_{lh,m}\lambda_{h,m} + \pi_{lm,m}\lambda_{m,m} \quad (9)$$

It can be shown that the ATT is given by:

$$ATT_m l = \beta_h - \beta_l + (\gamma_h - \gamma_l)(1 + \log EXP) + \sum_j [(\theta_{hj} - \theta_{lj})(Z_j)] + \sum_{h \neq m} \pi_{mh}\lambda_h - \pi_{lh,m}\lambda_{h,m} - \pi_{lm,m}\lambda_{m,m} \quad (10)$$

where all λ terms represent the selection correction variables related to the different choices involved in the estimation of the ATT. Each pairwise ATT is estimated for each household that is involved in the estimation of the given pairwise ATT. In particular, we estimate ATT_{13} and ATT_{23}:

$$ATT_{13} = E(MBS_1|s = 1) - E(MBS_3|s = 1),$$

which represents the effect in MBS produced by the receipt of internal remittances(from Guatemala) (11)

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$$ATT_{23} = E(MBS_2|s=2) - E(MBS_3|s=2),$$

which represents the effect in *MBS* produced by the receipt of international remittances(from United States) (12)

In estimating each *MBS* there are as many *ATT's* as households in choice $s = k$. Following Maddala (1983), we use the mean and standard error of the ATT estimated to obtain its significance. [17]

5. SPECIFYING THE TWO-STAGE SELECTION MODEL

To operationalize our model, it is necessary to identify variables that are distinct for the receipt of remittances in the first-stage choice equation, and for the determination of household income in the second-stage equation. [18]

We constructed three instrumental variables, which are: (1) distance to railroad stations in 1930; (2) the interaction between the aggregate international migration rate in 2002 and unexpected rainfall shocks in 1990; and (3) the interaction between the US employment creation rate in 25 US cities in 1998 and the age of household head squared. Our rationale for using these instrumental variables is as follows.

The first railroad line in Guatemala opened in 1884. The railroad was acquired in 1908 by the United Fruit Company and continued operations until 1957. The railroad was then acquired by the government of Guatemala and conditions on the railroad line deteriorated until it was shut down in 1996. In Guatemala distance to railroad lines in 1930 represents a good instrumental variable because it is related to migration costs in the past and to the need for sending migrants in the past, [19] and therefore to the development of present day migrant social networks, but it is not correlated with the expenditure patterns of households at the time of the 2000 ENCOVI Survey. We calculated distance to railroad lines for each household using the distance from the Departamentós capital to the nearest railroad station in 1930, using maps from the Railroad Development Corporation, and then cross-checking this information with the 2000 ENCOVI Survey. This type of instrument has been used before in the literature by Woodruff and Zenteno (2007) for the case of Mexico.

The historical aggregate migration rate has also been used before in the literature as an instrument by Hanson and Woodruff (2002) and McKenzie and Rapoport (2007) in the case of Mexico. The argument here is that migration in the past facilitates present day migration, because a larger network of migrants in the past provides more contacts and job referrals for current day migrants. For Guatemala, we calculated the aggregate international migration rate by municipality from the Guatemala 2002 Census. However, this creates a potential problem because the aggregate international migration rate for 2002 is surely correlated to events in 2000, the year of our ENCOVI Survey. Consequently, we used the aggregate international migration rate by municipality in 2002, interacted with unexpected rainfall shocks in 1990. Changes in rainfall have been used before in the literature as an instrumental variable in the cases of Mexico and the Philippines (Munshi, 2003; Yang & Choi, 2007). The argument here is that rain is closely correlated with agricultural production and income, and so too little rain in one year may cause people to migrate out of rural areas. A potential problem with this argument is that unobserved components in the consumption equation may also be correlated with unexpected rain shocks in 1990. To ensure this is not the case, we include in our estimation the level of rainfall in the year 1999. [20] We obtained historical rainfall information at the meteorological station level from the *Instituto Nacional de Sismología, Vulcanología, Meteorología e Hidrología*. We then calculated the average change in rainfall by month, year to year by municipality. From this information we estimated a model in which the change in rainfall in time t is related to the level of rainfall in time $t-1$. We then used the residuals from this model as the unexpected rainfall shock in 1990.

Our third instrumental variable is the US employment creation rate in 25 US cities in 1998, which we obtained from the US Population Census, Local Unemployment Statistics (2008). This variable measures the employment creation rate in the top 25 US cities that received Guatemalans in 2004, according to surveys carried out by IOM (2004). [21] We then generated variation at the level of Guatemalan region *h*th by weighting the employment creation rate in the United States city *j*th by the fraction of Guatemalans from region *h*th that according to the IOM (2004) worked in that US city *j*th in 2004. To obtain variation at the household level, we interacted this variable with the square of the age of the head of household. [22] The rationale for using this instrumental variable follows the literature that has shown the importance of the employment creation rate in the United States for explaining the migration patterns of Mexicans (Passel, 2006; Rendon & Cuecuecha, 2010). [23]

For the three instrumental variables, our claim is that conditional on the set of household and municipality characteristics included in our specification, the unobserved components in the expenditure equation of the households is uncorrelated with the three instruments. To ensure this is the case, we included the level of rainfall in 1999 in the municipality in the second-stage equation.

Table 3 presents summary data on the instrumental variables classified by the eight administrative regions in Guatemala. The data show that the percentage of households receiving international remittances is highest in the region with the lowest *per capita* household income (Northwest region).

On the basis of the preceding, the first-stage choice function of the probability of a household receiving remittances can be estimated as:

$$\begin{aligned}
&\text{Prob}\ (Y = \text{receive remittances}) \\
&= f\ [\text{Human Capital}(\text{Dummy variables for whether there} \\
&\quad \times \text{are household members with primary education,} \\
&\quad \times \text{secondary education, or high school education or} \\
&\quad \times \text{more in household}),\ \text{Household Characteristics} \\
&\quad \times (\text{Dummy variable for whether household head is} \\
&\quad \times \text{non-indigenous, Dummy variable for whether} \\
&\quad \times \text{household head is between 25 and 59 years old,} \\
&\quad \times \text{Dummy variable for whether household head is} \\
&\quad \times \text{above 59 years old, Dummy variable for whether} \\
&\quad \times \text{there are children below age 5 in household,} \\
&\quad \times \text{Dummy variable for whether there are children} \\
&\quad \times \text{between 5 and 15 years old in household),} \\
&\quad \times \text{Rainfall in 1999, Instrumental Variables,} \\
&\quad \times \text{Urban/Rural Dummy, Regional Dummy Variables}]
\end{aligned}$$

The rationale for including these variables in the first-stage equation follows the standard literature on migration and

Table 3. *Means for per capita household income, receipt of internal remittances (from Guatemala) and international remittances (from United States), and instrumental variables by Administrative Region in Guatemala*

Region	*N*	Mean *per capita* household income in (quetzals)	Households receiving internal remittances (%)	Households receiving international remittances (%)	Distance from department capital to railroad station in 1930 (km)	International migration rate in 2002 in Guatemala municipality (%)	Rainfall residuals in 1990	Employment creation rate in 1998 in top 25 US cities that receive Guatemalan migrants (%)
Metropolitan	898	9576.3	14.73	6.86	8.79	2.77	−352.9	0.33
North	795	2952.04	6.24	1.70	57.41	0.97	−500.61	0.51
Northeast	582	5074.36	14.62	10.23	12.93	2.53	632.05	0.20
Southeast	788	3222.22	16.54	6.95	40.1	2.14	−277.56	0.44
Central	1,231	3631.72	10.85	3.47	25.32	1.47	561.64	0.28
Southwest	1,094	3207.87	13.91	10.18	114.15	3.58	−357.61	0.24
Northwest	1,174	2464.59	11.64	10.43	92.78	2.92	−73.6	0.19
Petén	583	3130.43	10.13	4.56	165.64	1.57	185.63	0.30

Notes: $N = 7{,}145$ households. All values weighted.
In 2000, 1 Guatemalan quetzal = US$0.128.
Notes: The 1998 employment creation rate in the top 25 US cities is obtained by weighting the employment creation rate in each city by the fraction of Guatemalan migrants from a given region that worked in that US city in 2004, according to IOM (2004).
Sources: *Per capita* household income: 2000 Guatemala ENCOVI Survey; Households receiving internal or international remittances: 2000 Guatemala ENCOVI Survey; Distance from department capital to railroad station in 1930, Railroad Development Corporation Maps; International migration rate: 2002 Guatemala Population Census; Rainfall residuals in 1990: Historic data base from INSIVUMEH; Employment creation rate in 25 US metropolitan areas: United States Census, Local Area Unemployment Statistics (2008) and International Migration Organization (2004).

remittances. According to the basic human capital model, human capital variables are likely to affect migration and remittances because more educated people enjoy greater employment and expected income-earning possibilities in destination areas (Schultz, 1982; Todaro, 1976). [24] More educated people can also face lower costs of migration (Chiquiar & Hanson, 2005). In the literature household characteristics—such as age of household head and number of children—are also hypothesized to affect the probability of migration and the receipt of remittances. In particular, some analysts (Adams, 1993; Lipton, 1980) have suggested that migration is partly a life-cycle event in which households with older heads and fewer children under age 5 are more likely to participate. In the model the human capital and household characteristics are introduced as dummy variables to allow more flexibility in the specification. [25] The level of rainfall in 1999 is also included in the model to ensure that our instruments will work well in the second stage equation. Finally, since urban/rural residence and geographic region may affect migration and the receipt of remittances, the model includes an urban/rural dummy and seven regional dummy variables (with metropolitan capital region omitted). [26]

The second-stage expenditure share equation can be estimated as:

$$\begin{aligned} C_{si}/EXP = {} & \beta_{si} + a_{si}/EXP + \gamma_{si}(\log EXP) + \mu_{si1}HD/EXP \\ & + \theta_{si1}HD + \mu_{si2}Age25/EXP + \theta_{si2}Age25 \\ & + \mu_{si3}Age59/EXP + \theta_{si3}Age59 + \mu_{si4}C5/EXP \\ & + \theta_{si4}C5 + \mu_{si5}C5_15/EXP + \theta_{si5}C5_15 \\ & + \mu_{si6}EDPRIM/EXP + \theta_{si6}EDPRIM \\ & + \mu_{si7}EDSEC/EXP + \theta_{si7}EDSEC \\ & + \mu_{si8}EDHS/EXP + \theta_{si8}EDHS + \theta_{si9}RAIN \\ & + \delta_{si0}AR + \sum_{j=1}^{7}\delta_{sij}REG_j + \sum_{hnem}\pi_{mh}\lambda_h + v_{si} \end{aligned} \tag{13}$$

where C_{si} is annual *per capita* household expenditure on one of six expenditure categories defined above (food, consumer goods/durables, housing, education, health or other) by households that chose category s, EXP is total annual *per capita* household expenditure, HD is one if household head is non-indigenous, AGE25 is one if age of household head is between 25 and 59 years, AGE59 is one if age of household head is above 59 years, C5 is one if the household has children below age 5, C5_15 is one if the household has children between 5 and 15 years, EDPRIM is one if the household has members with a primary education, EDSEC is one if the household has members with a secondary education, EDHS is one if the household has members with a high school education or higher, RAIN is the variable for 1999 rainfall at the nearest meteorological station and AR is the dummy variable for urban/rural location. Finally, REG (region) represents a set of seven regional dummy variables (with metropolitan region omitted).

In estimating the model we use household expenditure, rather than income data. We do this for several reasons. Since the purpose of the analysis is to estimate the impact of remittances on the marginal spending behavior of households, expenditure data is more useful than income data. Moreover, in developing country situations like Guatemala, expenditures are often easier to measure than income because of the many problems inherent in defining and measuring income for the self-employed in agriculture, who represent such a large proportion of the labor force.

It should be noted that the model as a whole is identifiable because the instrumental variables, which are included in the first-stage equation, are excluded in the second-stage equation. However, this type of identification creates several potential econometric problems. For example, since the instruments provide independent information at the municipality level, this information is shared by all individuals living in that municipality and thus generates correlation of observations within a municipality. We solve this problem by clustering standard errors by municipality. Another possible problem is that the estimation error which is introduced in the model by using a two-step procedure can inflate standard errors. To address this

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Table 4. *Multinomial logit model, using the Dubin and McFadden method*

Variable	Receive internal remittances (from Guatemala)			Receive international remittances (from United States)		
	Coefficient	Standard errors	Marginal effect	Coefficient	Standard errors	Marginal effect
Household characteristics						
Household head is non-indigenous (1 = yes)	0.202	0.163	0.02	0.461***	0.161	0.021
Household head is between 25 and 59 years old (1 = yes)	−0.183	0.191	−0.018	−0.470*	0.25	−0.026
Household head is above 59 years old (1 = yes)	0.395	0.387	0.058	−0.754***	0.19	−0.035
There are children below age 5 in household (1 = yes)	−0.038	0.065	−0.003	−0.178*	0.106	−0.009
There are children between 5 and 15 years old in household (1 = yes)	−0.247***	0.095	−0.032	0.17	0.181	0.011
Human capital						
There are household members with primary education (1 = yes)	−0.13	0.117	−0.015	−0.065	0.151	−0.002
There are household members with secondary education (1 = yes)	0.218***	0.076	0.023	0.467***	0.062	0.024
There are household members with high school education or more (1 = yes)	−0.149***	0.037	−0.013	−0.620***	0.143	−0.027
Instrumental variables						
Distance from department capital to nearest railroad station in 1930	0.0003	0.001	−0.001	0.005***	0.001	0.0003
The international migration rate in municipality in 2002 times the unexpected rainfall in nearest meteorological station in 1990	−0.14	0.157	−0.013	−0.423***	0.076	−0.022
Employment creation rate in United States in 1998 times the square of the age of household head	0.064***	0.011	0.007	0.106***	0.019	0.005
Constant	−1.440***	0.344	0.00004	−2.916***	0.373	0
Log likelihood	−4064.38					
Pseudo R^2	0.08					
Test of joint significance for all IV's in all equations Wald Chi-squared (6)	231.74					
N	7145					

Notes: All values are weighted. The model also includes: level of rainfall in 1999 at nearest meteorological station, an urban/rural dummy and seven regional dummy variables, but coefficients for these variables are not reported. Standard errors not shown in table are obtained clustering observations at the municipality level and using a bootstrap procedure.

* Significant at the 0.10 level.

*** Significant at the 0.01 level.

issue we implement a bootstrap procedure and these are the standard errors reported for the estimation of Eqn. (13). Other potential econometric problems facing our estimation are discussed in Section 8, which will show that our results are robust to various possible estimation biases.

6. ESTIMATING THE MODEL

Table 4 presents results from the first-stage equation of the multinomial logit model. The most important result in this table relates to the validity of the instruments. For households receiving international remittances, the table shows that all three of instrumental variables are strongly significant. For households receiving internal remittances one of the instrumental variables—employment creation rate in the USA times square of age of household head—is strongly significant. Table 4 also shows that the three instrumental variables pass the test of joint significance at the 1% level. This test shows that our instruments are relevant. [27]

Several results in Table 4 are interesting. For example, the instrumental variable measuring changes in rainfall shows the expected sign: if there is more rainfall in Guatemala, there are fewer international migrants to the United States and fewer households in Guatemala receiving international remittances. Similarly, the instrumental variable measuring the employment creation rate in the United States shows the expected sign: if there is more employment creation in the United States, then there is more international migration and more households in Guatemala receiving international remittances. However, the instrumental variable measuring distance to railroad line shows an unexpected positive sign: if the household lived farther away from a railroad station in 1930, it is more likely to receive international remittances now.

Tables 5–7 show the results of the second-stage equation for each expenditure category and for each type of household: households with no remittances (Table 5), households receiving internal remittances (from Guatemala) (Table 6), and households receiving international remittances (from United States) (Table 7).

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Table 5. *Household expenditure estimates (selection corrected) for households receiving no remittances, using the Dubin and McFadden method*

Variable	Food	Consumer goods, durables	Housing	Education	Health	Other goods
Log total annual *per capita* household expenditure (log EXP)	−0.120 (0.009)***	0.037 (0.006)***	0.024 (0.008)***	0.001 (0.004)	0.016 (0.004)***	0.042 (0.006)***
Household head is non-indigenous (1 = yes)	0.012 (0.011)	0.007 (0.007)	0.008 (0.007)	−0.004 (0.004)	−0.001 (0.003)	−0.023 (0.007)***
Household head is between 25 and 59 years old (1 = yes)	−0.009 (0.015)***	−0.026 (0.013)**	0.012 (0.009)	0.007 (0.005)	0.009 (0.003)***	0.007 (0.010)
Household head is above 59 years old (1 = yes)	−0.054 (0.022)	−0.041 (0.016)**	0.058 (0.014)***	−0.006 (0.006)	0.019 (0.007)***	0.024 (0.014)*
There are children below age 5 in household (1 = yes)	−0.013 (0.007)*	0.027 (0.006)***	−0.004 (0.007)	−0.022 (0.004)***	0.018 (0.003)***	−0.006 (0.006)
There are children between 5 and 15 years old in household (1 = yes)	−0.025 (0.011)**	0.013 (0.005)**	−0.018 (0.009)**	0.036 (0.005)***	−0.009 (0.003)***	0.003 (0.006)
There are household members with primary education (1 = yes)	−0.007 (0.009)	0.008 (0.006)	−0.007 (0.005)	0.005 (0.003)*	−0.001 (0.003)	0.003 (0.006)
There are household members with secondary education (1 = yes)	−0.060 (0.011)**	0.020 (0.006)***	0.001 (0.006)	0.030 (0.005)***	0.009 (0.004)**	0.001 (0.008)
There are household members with high school education or more (1 = yes)	−0.056 (0.009)***	0.016 (0.007)**	−0.002 (0.008)	0.038 (0.004)***	0.011 (0.006)*	−0.007 (0.006)
Rainfall in 1999 in nearest meteorological station	5.68E−06 (5.51E−06)	−1.31E−06 (2.45E−06)	−3.64E−06 (3.45E−06)	1.11E−06 (1.27E−06)	1.98E−07 (1.03E−06)	−2.03E−06 (2.46E−06)
λ_1	−0.067 (0.072)	0.055 (0.027)	−0.037 (0.036)	0.027 (0.020)	−0.012 (0.012)	0.034 (0.033)
λ_2	0.055 (0.076)	−0.011 (0.021)**	−0.001 (0.026)	−0.031 (0.020)	0.004 (0.008)	−0.016 (0.030)
Constant	1.532 (0.091)***	−0.141 (0.066)**	−0.070 (0.089)	0.003 (0.041)	−0.135 (0.037)***	−0.189 (0.062)***
Adj. R^2	0.45	0.14	0.17	0.31	0.14	0.1

Notes: $N = 7145$ households, 5665 households receiving no remittances, the rest only used in the first stage of the method. All values are weighted. The model also includes interactions of each of the exogenous variables with the inverse of the total expenditure, the inverse of the total expenditure, an urban/rural dummy and seven regional dummy variables, but coefficients for these variables are not reported. Figures in parentheses are standard errors, they are obtained clustering observations at the municipality level, and via bootstrapping (1000 repetitions). The first stage of the model is shown in Table 4.

* Significant at the 0.10 level.
** Significant at the 0.05 level
*** Significant at the 0.01 level.

The most important variable in these three tables is the selection term, which is the λ_h variable. For households with no remittances (Table 5), the λ_h variable is significant for one expenditure category. However, for households receiving internal remittances (Table 6) this variable is significant for three expenditure categories, and for households receiving international remittances (Table 7) it is significant for one expenditure category. These results suggest that selectivity in unobservable components matters for households receiving internal or international remittances. In other words, estimations ignoring the selectivity part of the model would be biased.

Table 8 takes the coefficients from Tables 5 to 7 and calculates the estimated marginal budget shares for the six categories of expenditure for each type of household.

Table 8 also shows the counterfactual marginal budget shares used in the estimation of the two pairwise Average Treatment Effects on the Treated (ATT). The first counterfactual is $E(\mathrm{MBS}_3|s = 1)$ which represents the expenditure that households that chose to receive internal remittances (from Guatemala) would have had without the receipt of remittances. It is obtained using the equation for expenditure shares for households that receive no remittances on households that receive internal remittances, taking into account the selection part that the household receives internal remittances (from Guatemala). The second counterfactual is $E(\mathrm{MBS}_3|s = 2)$ which represents the expenditure that households that chose to receive international remittances (from United States) would have had without the receipt of remittances.

Table 8 shows the Average Treatment Effects on the Treated (ATT) for the six categories of expenditure. Three of these ATT results are noteworthy. First, when compared to what they would have spent without the receipt of remittances, households receiving international remittances (from United States) spend less at the margin on one key consumption good: food. At the mean, households with international remittances spend 18% less at the margin on food that what they would have spent on this good without the receipt of remittances. [28]

Second, households receiving either internal or international remittances spend more at the margin on one important investment good: education. At the mean, households receiving internal or international remittances spend 377% or 194% more at the margin, respectively, on education than what they would have spent on this good without the receipt of remittances. These large marginal increases in spending on education are important because they can help raise the level of human capital in Guatemala. Finally, households receiving either internal or international remittances spend more at the margin on housing. At the mean, households receiving either internal or international remittances spend 136% or

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Table 6. *Household expenditure estimates (selection corrected) for households receiving internal remittances (from Guatemala), using the Dubin and McFadden method*

Variable	Food	Consumer goods, Durables	Housing	Education	Health	Other goods
Log total annual *per capita* household expenditure (log EXP)	−0.117 (0.026)***	0.028 (0.016)	0.053 (0.024)**	−0.004 (0.010)	0.027 (0.009)***	0.013 (0.015)
Household head is non-indigenous (1 = yes)	−0.010 (0.027)	−0.004 (0.016)	0.035 (0.014)**	−0.019 (0.013)	0.016 (0.008)**	−0.018 (0.015)
Household head is between 25 and 59 years old (1 = yes)	−0.009(0.032)	−0.013(0.022)	0.056(0.028)**	−0.027(0.025)	0.019(0.011)*	−0.025(0.025)
Household head is above 59 years old (1 = yes)	−0.033 (0.037)	−0.028 (0.024)	0.098 (0.026)***	−0.052 (0.025)**	0.016 (0.012)	−0.016 (0.010)
There are children below age 5 in household (1 = yes)	0.022 (0.018)	0.028 (0.013)**	−0.022 (0.011)**	−0.028 (0.007)***	0.016 (0.009)*	0.013 (0.011)
There are children between 5 and 15 years old in household (1 = yes)	−0.056 (0.024)**	0.049 (0.010)***	−0.049 (0.016)***	0.037 (0.011)***	0.007 (0.010)	−0.001 (0.028)
There are household members with primary education (1 = yes)	0.012 (0.017)	−0.003 (0.009)	−0.026 (0.014)*	0.015 (0.008)**	0.006 (0.007)	−0.004 (0.012)
There are household members with secondary education (1 = yes)	−0.087 (0.024)***	0.021 (0.012)	0.008 (0.015)	0.046 (0.014)***	0.000 (0.009)	0.012 (0.013)
There are household members with high school education or more (1 = yes)	−0.098 (0.019)***	0.010 (0.012)	−0.025 (0.019)	0.051 (0.012)*	0.021 (0.010)**	0.041 (0.012)***
Rainfall in 1999 in nearest meteorological station	1.04E−05 (1.12E−05)	7.06E−07 (5.85E−06)	−1.42E−05 (5.68E−06)**	1.44E−07 (2.73E−06)	7.00E−07 (1.96E−06)	2.20E−06 (6.00E−06)
λ_2	0.218 (0.069)***	−0.138 (0.028)***	0.032 (0.046)	−0.006 (0.017)	−0.012 (0.015)	−0.094 (0.035)***
λ_3	−0.232 (0.067)***	0.135 (0.030)***	−0.025 (0.049)	0.005 (0.017)	0.014 (0.014)	0.103 (0.034)***
Constant	1.646 (0.291)***	−0.208 (0.164)	−0.267 (0.221)	0.080 (0.110)	−0.272 (0.101)***	0.020 (0.152)
Adj. R^2	0.45	0.21	0.32	0.35	0.13	0.07

Notes: N = 7,145 households, 975 households receiving internal remittances (from Guatemala), the rest only used in the first stage of the method. All values are weighted. The model also includes interactions of each of the exogenous variables with the inverse of the total expenditure, the inverse of the total expenditure, an urban/rural dummy and seven regional dummy variables, but coefficients for these variables are not reported. Figures in parentheses are standard errors, they are obtained clustering observations at the municipality level, and via bootstrapping (1000 repetitions). The first stage of the model is shown in Table 4.

* Significant at the 0.10 level.
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

81% more, respectively, on housing than what they would have spent on this good without the receipt of remittances.

7. HETEROGENEITY IN EFFECTS: REMITTANCES AND EXPENDITURE ON EDUCATION AND HOUSING

Two of the more striking findings from the previous section are that households receiving internal or international remittances spend more at the margin on education and housing than what they would have spent on these investment goods without the receipt of remittances. Since households receiving remittances also enjoy higher levels of *per capita* income (expenditure),[29] it is possible that these findings are driven by the higher levels of income (expenditure) enjoyed by remittance-receiving households.

To test whether our findings are robust when controlling for level of household expenditure, we divide all 7,145 households in the data set into quintile groups on the basis of total annual *per capita* expenditure, including remittances. We then partition the quintiles into three mutually-exclusive groups of households: those with no remittances, those receiving internal remittances (from Guatemala) and those receiving international remittances (from United States). The regression results reported above can then be used to calculate counterfactual marginal budget shares and Average Treatment Effects on the Treated (ATT) for the various quintile groups.

Tables 9 and 10 show the expenditure behavior on education and housing for the three groups of households. Within each group of household, quintile means are determined by aggregating mean individual household values, and all households are evaluated on the basis of *per capita* income (expenditure) including remittances. Thus, the main difference for any quintile group between the three groups of households is that the "no remittance" group received no remittances, while the other two groups received either internal or international remittances.

According to Table 9, at the mean the estimated marginal budget share spent on education is quite low: less than 7% for each of the three groups of households. However, for all quintile groups, households receiving either internal or international remittances spend more at the margin on education than what they would have spent on this investment good without the receipt of remittances. For example, the final column in Table 9 shows that households receiving internal remittances spend between 126% and 883% more at the margin on education, while households receiving international

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Table 7. *Household expenditure estimates (selection corrected) for households receiving international remittances (from United States), using the Dubin and McFadden method*

Variable	Food	Consumer goods, Durables	Housing	Education	Health	Other goods
Log total annual *per capita* household expenditure (log EXP)	−0.124 (0.023)***	0.072 (0.018)***	0.036 (0.024)	−0.023 (0.007)***	0.036 (0.024)	0.023 (0.025)
Household head non-indigenous (1 = yes)	−0.023 (0.030)	0.029 (0.024)	−0.029 (0.028)	0.024 (0.009)***	−0.029 (0.028)	−0.006 (0.024)
Household head is between 25 and 59 years old (1 = yes)	−0.069 (0.028)**	0.017 (0.023)	0.010 (0.031)	0.026 (0.016)	0.010 (0.031)	0.017 (0.022)
Household head is above 59 years old (1 = yes)	−0.079 (0.031)**	−0.001 (0.024)	0.035 (0.038)	0.019 (0.016)	0.035 (0.038)	0.027 (0.030)
There are children below age 5 in household (1 = yes)	−0.008 (0.028)	0.080 (0.019)***	−0.025 (0.015)	−0.045 (0.011)***	−0.025 (0.015)	−0.018 (0.019)
There are children between 5 and 15 years old in household (1 = yes)	−0.003 (0.031)	0.065 (0.023)***	−0.054 (0.021)	0.031 (0.011)***	−0.054 (0.021)**	−0.052 (0.027)*
There are household members with primary education (1 = yes)	−0.015 (0.021)	0.016 (0.017)	−0.029 (0.018)	0.003 (0.010)	−0.029 (0.018)	0.024 (0.018)
There are household members with secondary education (1 = yes)	0.008 (0.025)	0.024 (0.018)	−0.050 (0.017)*	0.049 (0.012)***	−0.050 (0.017)***	−0.022 (0.024)
There are household members with high school education or more (1 = yes)	−0.022 (0.018)*	−0.026 (0.011)	−0.039 (0.015)	0.022 (0.007)**	−0.039 (0.015)	0.062 (0.011)**
Rainfall in 1999 in nearest meteorological station	−2.41E−06 (1.33E−05)	9.59E−06 (6.86E−06)	3.08E−06 (8.50E−06)	1.31E−06 (3.94E−06)	3.08E−06 (8.50E−06)	−1.36E−05 (5.99E−06)
λ_1	−0.043 (0.071)	0.019 (0.053)	0.053 (0.051)	−0.063 (0.024)***	0.053 (0.051)	−0.032 (0.063)
λ_3	0.020 (0.073)	−0.009 (0.059)	−0.040 (0.059)	0.068 (0.025)***	−0.040 (0.059)	0.024 (0.065)
Constant	1.544 (0.252)***	−0.605 (0.187)***	0.006 (0.236)	0.199 (0.072)***	0.006 (0.236)	−0.039 (0.260)
Adj. R^2	0.45	0.26	0.37	0.4	0.13	0.19

Notes: $N = 7{,}145$ households, 505 households receiving international remittances (from United States), the rest only used in the first stage of the method. All values are weighted. The model also includes interactions of each of the exogenous variables with the inverse of the total expenditure, the inverse of the total expenditure, an urban/rural dummy and seven regional dummy variables, but coefficients for these variables are not reported. Figures in parentheses are standard errors, they are obtained clustering observations at the municipality level, and via bootstrapping (1000 repetitions). The first stage of the model is shown in Table 4.

* Significant at the 0.10 level.
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

remittances spend between 152% and 306% more at the margin on education. In other words, when controlling for the level of expenditure, households receiving remittances spend more of their additional increments to expenditure on education.

Table 10 presents the expenditure behavior for housing for the three groups of households. At the mean, the estimated marginal budget share spent on housing is higher than that for education: 23% or less for each of the three groups of households. However, for all quintile groups, households receiving either internal or international remittances spend more at the margin on housing than what they would have spent on this good without the receipt of remittances. The last column in Table 10 shows that households receiving internal remittances spend between 93% and 946% more at the margin on housing, while households receiving international remittances spend between 50% and 751% more at the margin on housing. This is an important finding because it suggests that when controlling for level of expenditure, households receiving remittances spend more on housing than what they would have spent on this good without remittances. From the standpoint of the migrant, these remittance-inspired expenditures on housing represent investment to the extent that they provide migrant households with some expected future rate of financial return. From the standpoint of the economy at large, these remittance-inspired expenditures on housing also represent a type of productive investment because they have critical second- and third-round effects on wages, employment and business opportunities. As households receiving remittances spend more at the margin on housing, this creates new income and employment opportunities for laborers, and new business opportunities for merchants selling building materials.

8. ROBUSTNESS CHECKS

There are at least four possible econometric problems that might affect our preceding findings[30]: (1) endogeneity bias; (2) measurement error bias; (3) sample selection bias; and (4) specification bias. This section therefore tests the robustness of our Average Treatment Effects on the Treated (ATT) results by taking into consideration each of these potential problems.

Endogeneity bias could affect our findings because the model includes certain household characteristics that are chosen by the household and that are also important in the receipt of remittances. For instance, it is possible that household characteristic variables like household composition and the education of household members are selected by the household. Since our model uses interactions of expenditure with each of these household characteristics, our estimation could be

Table 8. *Marginal budget shares on expenditure and Average Treatment Effects (ATT) for non-remittance and remittance-receiving households, Guatemala, 2000*

Expenditure category	No remittances	Receive internal remittances (from Guatemala)			Receive international remittances (from United States)		
	Estimated marginal budget share	Estimated marginal budget share	Counterfactual marginal budget share	Average Treatment Effects (*ATT*)	Estimated marginal budget share	Counterfactual marginal budget share	Average Treatment Effects (*ATT*)
Food	0.468	0.435	0.432	0.002 (1.74)*	0.308	0.375	−0.067 (−16.04)***
Consumer goods, durables	0.268	0.103	0.188	−0.086 (19.57)***	0.277	0.206	0.071 (14.84)***
Housing	0.170	0.231	0.098	0.133 (24.44)***	0.181	0.100	0.081 (11.34)***
Education	0.043	0.062	0.013	0.049 (14.23)***	0.050	0.017	0.033 (11.06)***
Health	0.059	0.059	0.020	0.039 (15.54)***	0.050	0.019	0.031 (4.37)***
Other goods	0.218	0.174	0.142	0.031 (11.23)***	0.174	0.149	0.025 (5.15)***
Total	1.227	1.064	0.894		1.040	0.866	

Notes: $N = 7{,}145$ households. 5,665 non-remittance receiving households, 975 households receiving internal remittances (from Guatemala) and 505 households receiving international remittances (from United States). Expenditure categories defined in Table 2. Estimated *MBS* refers to using the *MBS* coefficients for type s households with households of type s. Counterfactual *MBS* obtained using the *MBS* coefficients for type l households with households of type s. Numbers in parenthesis are two tailed *t*-tests. *t*-tests conducted using clustered standard errors and weighting observations.

* Significant at the 0.10 level.

*** Significant at the 0.01 level.

Table 9. *Heterogeneity in effects: marginal budget shares and Average Treatment Effects (ATT) on education for households ranked by quintile group, Guatemala, 2000*

Ranked by total annual *per capita* expenditure including remittances	Percent of households in group	Mean of total annual *per capita* household expenditure (quetzals)	Percent of total household expenditure on education	Marginal budget share to education (estimated)	Marginal budget share to education (counter-factual)	Average Treatment Effects (*ATT*)	Percent difference (receive remittances *vs.* no remittances)
Households receiving no remittances							
Lowest 20%	22.18	1720.91	1.54	0.038	Na	Na	Na
Second 20%	20.67	3092.05	2.21	0.039	Na	Na	Na
Third 20%	20.06	4651.97	2.85	0.044	Na	Na	Na
Fourth 20%	18.66	7524.93	3.7	0.049	Na	Na	Na
Top 20%	18.43	18851.37	5.28	0.058	Na	Na	Na
All	100	4854.48	3.03	0.043	Na	Na	Na
Households receiving internal remittances (from Guatemala)							
Lowest 20%	13.41	1869.53	1.26	0.073	0.010	0.064 (6.82)***	665%
Second 20%	18.01	3116.259	2.5	0.061	0.006	0.055 (4.61)***	883%
Third 20%	19.71	4729.01	2.6	0.056	0.009	0.047 (4.88)***	522%
Fourth 20%	24.31	7748.88	4.5	0.058	0.016	0.042 (6.86)***	263%
Top 20%	24.55	17708.51	5.33	0.061	0.027	0.034 (17.49)***	126%
All	100	6039.89	3.53	0.062	0.013	0.049 (14.23)***	377%
Households receiving international remittances (from United States)							
Lowest 20%	8.61	1973.01	2.87	0.044	0.011	0.033 (4.48)***	306%
Second 20%	16.55	3181.86	3.04	0.053	0.019	0.034 (9.19)***	181%
Third 20%	19.73	4702.37	4.65	0.047	0.013	0.034 (5.87)***	262%
Fourth 20%	26.6	7509.71	4.93	0.053	0.021	0.032 (9.73)***	152%
Top 20%	28.51	16551.38	5.4	0.048	0.017	0.031 (3.62)***	182%
All	100	6632.5	4.51	0.05	0.017	0.033 (11.06)***	194%

Notes: $N = 7{,}145$ households. 5,665 non-remittance receiving households. Nine hundred and seventy five households receiving internal remittances (from Guatemala) and 505 households receiving international remittances (from United States). Estimated *MBS* refers to using the *MBS* coefficients for type *s* households with households of type *s*. Counterfactual *MBS* obtained using the *MBS* coefficients for type l households with households of types. Percent difference (remittances *vs.* no remittances) calculated by dividing *ATT* by the value of the counterfactual *MBS*.

In 2000, 1 Guatemalan quetzal = US$0.128.

*** Significant at the 0.01 level.

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Table 10. *Heterogeneity in effects: marginal budget shares and Average Treatment Effects (ATT) on housing for households ranked by quintile groups, Guatemala, 2000*

Ranked by total annual *per capita* expenditure including remittances	Percent of households in group	Mean of total annual *per capita* household expenditure (quetzals)	Percent of total household expenditure on Housing	Marginal budget share to Housing (estimated)	Marginal budget share to Housing(counter-factual)	Average Treatment Effects (*ATT*)	Percent Difference (receive remittances *vs.* no remittances)
Households receiving no remittances							
Lowest 20%	22.18	1720.91	10.91	0.140	Na	Na	Na
Second 20%	20.67	3092.05	10.82	0.161	Na	Na	Na
Third 20%	20.06	4651.97	11.74	0.178	Na	Na	Na
Fourth 20%	18.66	7524.93	13.45	0.194	Na	Na	Na
Top 20%	18.43	18851.37	16.65	0.218	Na	Na	Na
All	100	4854.48	12.55	0.17	Na	Na	Na
Households receiving internal remittances (from Guatemala)							
Lowest 20%	13.41	1869.53	11.11	0.191	0.018	0.173 (34.37)***	946%
Second 20%	18.01	3116.259	11.62	0.222	0.083	0.139 (23.74)***	167%
Third 20%	19.71	4729.01	14.04	0.237	0.101	0.136 (29.99)***	135%
Fourth 20%	24.31	7748.88	15.02	0.251	0.117	0.134 (13.47)***	115%
Top 20%	24.55	17708.51	20.81	0.263	0.136	0.127 (14.56)***	93%
All	100	6039.89	15.11	0.231	0.098	0.133 (24.44)***	136%
Households receiving international remittances (from United States)							
Lowest 20%	8.61	1973.01	11.82	0.159	0.019	0.140 (7.81)***	751%
Second 20%	16.55	3181.86	11.23	0.173	0.082	0.091 (6.74)***	111%
Third 20%	19.73	4702.37	10.94	0.174	0.091	0.083 (21.65)***	91%
Fourth 20%	26.6	7509.71	12.24	0.185	0.111	0.074 (10.78)***	67%
Top 20%	28.51	16551.38	16.85	0.207	0.138	0.069 (4.88)***	50%
All	100	6632.5	12.66	0.181	0.1	0.081 (11.34)***	81%

Notes: $N = 7{,}145$ households. 5,665 non-remittance receiving households. Nine hundred and seventy five households receiving internal remittances (from Guatemala) and 505 households receiving international remittances (from United States). Estimated *MBS* refers to using the *MBS* coefficients for type s households with households of type *s*. Counterfactual *MBS* obtained using the coefficients for type 1 households with households of types. Percent difference (remittances *vs.* no remittances) calculated by dividing *ATT* by the value of the counterfactual *MBS*.
In 2000, 1 Guatemalan quetzal = US$0.128.
*** Significant at the 0.01 level.

biased. However, if these variables are excluded from the model, we could face the problem of omitted variable bias, since these household characteristics also help to control for differences in household expenditure patterns.

To pinpoint the possible impact of endogeneity bias, we re-estimate our model excluding all household characteristic variables. Results are shown in Table 11 (line B)). For both types of households, when household characteristics are excluded, line (B) in Table 11 shows that our *ATT* results are the same in terms of signs and statistical significance in nine out of 12 cases as those for the base model (line A in Table 11). However, in terms of point estimates, the coefficients are different in magnitude across estimations in 6 of 12 cases, with the coefficients in line (B) being both higher and lower than those in line (A). This suggests that either endogeneity bias generates under estimation or that omitted variable bias generates over estimation.

It is also possible that measurement error bias could affect our findings because the model is based on *per capita* household expenditure rather than adult equivalence scales. To examine the impact of this possible bias, we re-estimate our model in Table 11 using adult equivalent scales. [31] For both types of households, when we re-estimate using adult equivalence scales, line (C) in Table 11 shows that our *ATT* results are the same in terms of signs and significance in 10 out of 12 cases as those for the base model (line A). However, in terms of point estimates, the coefficients are different in magnitude across estimations in 7 of 12 cases, with the coefficients in line (C) usually being lower than those in line (A). This suggests that the non-use of equivalence scales generates over estimation.

Sample selection bias might also affect our findings because we exclude from the model the 131 households that either receive international remittances from a country other than the United States or that receive remittances from both Guatemala and the United States. To examine the impact of this possible bias, we re-estimate our model by including these 131 households as an additional group. Specifically, we re-estimate the model using a multinomial specification that has four mutually-exclusive categories: (1) households with no remittances; (2) households with internal remittances (from Guatemala); (3) households with international remittances (from United States); and (4) the new fourth category. For both types of households, when we include this fourth category of households, line (D) in Table 11 shows that our *ATT* results are the same in terms of signs and significance in 10 out of 12 cases as those for the base model (line A). However, in terms of point estimates, the coefficients are different in magnitude in 7 of 12 cases, with the coefficients in line (D) usually being higher than those in line (A). This suggests that excluding the 131 households generates underestimation.

Finally, it is possible that specification bias might affect our findings because the multinomial logit procedure assumes the independence of irrelevant alternative (IIA) hypothesis, which, if violated, could result in an important source of bias. To examine the impact of this possible problem, we re-estimate the first stage of our model using a nested logit specification. The nested logit allows us to test for the validity of the IIA hypothesis; our results suggest rejecting the validity of this hypothesis. Line (E) of Table 11 shows results for the nested logit model. For both types of households, when we use a

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Table 11. *Robustness checks using Average Treatment Effects on the Treated (ATT)*

Expenditure category	Model	Receive internal remittances (from Guatemala)		Receive international remittances (from United States)	
		ATT	*t*	*ATT*	*t*
Food	Base model (A)	0.002	1.74*	−0.067	−16.04***
	Excluding household characteristics (B)	0.101	20.9***	0.013	0.05
	Adult Equivalent Scales (C)	0.189	15.81***	−0.031	−6.45***
	Including 131 household observations (D)	0.164	22.94***	0.087	6.16***
	Nested logit model (E)	0.001	2.18***	0.02	1.85*
Consumer goods	Base model (A)	−0.086	19.57***	0.071	14.84***
Durables	Excluding household characteristics (B)	−0.16	−52.7***	−0.02	−9.87***
	Adult Equivalent Scales (C)	−0.105	−31.02***	0.085	14.41***
	Including 131 household observations (D)	−0.153	−22.89***	−0.013	−4.72***
	Nested logit model (E)	0.077	21.31***	0.045	13.61***
Housing	Base model (A)	0.133	24.44***	0.081	11.34***
	Excluding household characteristics (B)	0.234	63.39***	0.155	19.53***
	Adult Equivalent Scales (C)	0.09	17.19***	0.081	18.27***
	Including 131 household observations (D)	0.148	32.65***	0.086	13.41***
	Nested logit model (E)	−0.004	−1.30	0.038	11.16***
Education	Base model (A)	0.049	14.23***	0.033	11.06***
	Excluding household characteristics (B)	−0.037	−20.85***	0.021	6.52***
	Adult Equivalent Scales (C)	0.015	14.56***	0.005	0.26*
	Including 131 household observations (D)	0.001	0.34***	0.001	5.42***
	Nested logit model (E)	0.03	7.41***	0.027	7.35***
Health	Base model (A)	0.039	15.54***	0.031	4.37***
	Excluding household characteristics (B)	0.001	0.88	0.021	7.55***
	Adult Equivalent Scales (C)	0.004	0.61	0.068	4.69***
	Including 131 household observations (D)	0.034	1.44	0.08	14.01***
	Nested logit model (E)	0.017	37.47***	−0.01	−8.40***
Other goods	Base model (A)	0.031	11.23***	0.025	5.15***
	Excluding household characteristics (B)	0.033	11.95***	0.022	5.65***
	Adult Equivalent Scales (C)	0.005	1.91*	−0.008	−3.37***
	Including 131 household observations (D)	0.021	2.64**	0.096	24.25***
	Nested logit model (E)	0.01	2.56**	0.016	4.45***

Notes: $N = 7{,}145$ households. 5,665 non-remittance receiving households. Nine hundred and seventy five households receiving internal remittances (from Guatemala) and 505 households receiving international remittances (from United States). Models: (A) base model as shown in Table 8; (B) excludes from its set of exogenous variables: children below age 5 and children between 5 and 15 years, the household head age dummies and the education dummies; (C) estimates the same model as (A) except that *per capita* household expenditure is adjusted by an adult equivalent scale as follows: each child counts 0.25, 1 for the first adult and 0.7 for the rest; (D) includes the 131 households that either receive international remittances from a country other than the United States or receive remittances from both Guatemala and the United States; all of these 131 households are included in a single additional category; and (E) uses a nested logit model in which individuals choose first whether to receive remittances or not, then decide which country to obtain remittances from, and finally, conditional on these choices the households select consumption. In all models, standard errors are clustered at the municipality level.

* Significant at the 0.10 level.
** Significant at the 0.05 level.
*** Significant at the 0.01 level.

nested logit, line (E) in Table 11 shows that our *ATT* results are the same in terms of signs and significance in 8 out of 12 cases as those for the base model (line A). However, in terms of point estimates, the coefficients are different in magnitude in 6 of 12 cases with the coefficients in line (E) usually being lower than those in line (A). This suggests that the assumption of the IIA hypothesis generates overestimation.

In sum, with respect to the three main categories of expenditure—food, education and housing—the robustness checks show that our findings are robust in terms of signs and significance, but that in terms of changes in point estimates our results show important variation. These changes in point estimates, however, can probably only be solved by using panel data, which we do not have for Guatemala. On the whole, our data set for Guatemala shows that households receiving international remittances spend less at the margin on food, and households receiving either internal or international remittances spend more at the margin on education and housing than what they would have spent on these investment goods without the receipt of remittances. [32]

9. CONCLUSION

This paper has used a large, nationally-representative household survey from Guatemala to analyze how the receipt of internal remittances (from Guatemala) and international remittances (from United States) affects the marginal spending behavior of households on a broad range of consumption and investment goods. Three key findings emerge.

First, when compared to what they would have spent without the receipt of remittances, households receiving international remittances (from United States) spend less at the margin on one key consumption good: food. Second, households receiving either internal or international remittances spend more at the margin on one important investment good: education. At the mean, households receiving internal or international remittances spend 377% or 194% more at the margin, respectively, on education than what they would have spent on this investment good without the receipt of remittances. Third, households receiving either internal or international remittances spend more at the margin on housing. At the mean,

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households receiving internal or international remittances spend 136% or 81% more at the margin, respectively, on housing than what they would have spent on this good without the receipt of remittances.

These three findings hold when we control for selection in unobservable household characteristics using a two-stage selection model with instrumental variables. These findings also hold when we partition the data by quintile group based on household expenditure and when we perform a variety of robustness checks.

The three findings of this study lend support to the growing view in the literature that remittances can actually have a positive impact on economic development by increasing the level of investment in human and physical capital. Households receiving remittances in Guatemala tend to view their remittance earnings as a transitory (and possibly uncertain) stream of income, one to be spent more on investment than consumption. This finding is consistent with the permanent income hypothesis, which generally finds that the marginal propensity to invest out of transitory income (like remittances) is higher than that for permanent income (like wages).[33] At the household-level the higher marginal propensity to invest in education among remittance-receiving households in Guatemala can help build human capital in the country at large. At the same time, the higher marginal propensity to invest in housing among remittance-receiving households in Guatemala can represent an important type of investment for migrant households and a useful means for stimulating growth in wages, employment and business.

NOTES

1. These figures for official international remittances do not include the large—and unknown—amount of international remittances which return to developing countries through unrecorded, informal channels.

2. Other instruments used in the literature to study the effects of migration and remittances include assets held previous to migration (Lokshin, Bontch-Osmolovsky, & Glinskaya, 2007). That study, however, is focused on the effects of migration and remittances on poverty in Nepal. They were able to build that variable thanks to the fact that their data is a panel. We do not have such information in the 2000 Guatemala ENCOVI survey used in this article.

3. The 2000 Guatemala ENCOVI Survey was implemented as part of the "Program for the Improvement of Surveys and Measurement of Living Conditions in Latin America and the Caribbean" (ENCOVI), which was sponsored by the Inter-American Development Bank (IDB), the World Bank and the Economic Committee for Latin America and the Caribbean (CEPAL).

4. For more details on the 2000 Guatemala ENCOVI Survey, see World Bank. (2004).

5. For example, in their study in the Dominican Republic, de la Briere, Sadoulet, de Janvry, and Lambert (2002) find that fully half of all international migrants do not remit.

6. The 2000 Guatemala ENCOVI Survey included a total of 7,276 households, but for the purposes of this analysis we exclude 131 households that either receive international remittances from a country other than the United States or receive remittances from both Guatemala and the United States. Table 11 shows that excluding these 131 households does not affect our results.

7. The functional form used in this analysis differs from the Working-Leser model because it includes an intercept in Eqn. (1). In theory, C_i should always equal zero whenever total expenditure EXP is zero, and this restriction should be built into the function. But zero observations on EXP invariably lie well outside the sample range. Also, observing this restriction with the Working-Leser model can lead to poorer statistical fits. Including the intercept term in the model has little effect on the estimation of marginal budget shares for the average person, but it can make a significant difference for income redistribution results. For more on the Working-Leser model, see Prais and Houthakker (1971).

8. Ideally, we would like to model both the household decision of sending migrants and the household decision to receive remittances. However, as explained in the data section, this cannot be done because the 2000 Guatemala ENCOVI Survey contains no information on the characteristics of migrants. The survey only contains information on whether or not households receive remittances and the source (internal or international) of these remittances.

9. Details on this derivation are available from the authors upon request. The derivation follows Dubin and McFadden (1984) and Bourguinon *et al.* (2004).

10. Let λ_{ih} be equal to $\lambda_{ih} = P_h \ln P_h/(1 - P_h) + \ln P_s$, where P_j represents the probability that choice j will be the selected category by the household. Moreover, $\pi_{sih} = \sigma_{is} r_{ish}$, where σ_{is} is the standard deviation of u_s; r_{ish} represents thecorrelation coefficient between u_s and the unobserved component η_h. *η_h represents a random variable with type I extreme value distribution for choice h.*

11. We thank an anonymous referee for a very useful suggestion on this paragraph.

12. In principle, the non-linearity of the selection part of the model is sufficient to identify the parameters of the model, because this non-linearity helps break the relation between the selection part and the rest of the expenditure equation. However, in this analysis we use instrumental variables to obtain independent variations in the first-stage choice equation that identify the second-stage expenditure equation.

13. According to Bourguinon *et al.* (2004), the Dubin and McFadden (1984) performs better than other methodologies, like the Lee method (1983), in Monte Carlo experiments, even when the Independence of Irrelevant Alternatives, implicit in models using the multinomial logit model, is violated.

14. This same calculation of the ATT applies to all goods *i*. Consequently, we abstract from the sub index *i*.

15. The $E(MBS_m|s = m)$ is given by:

$$E(MBS_m|s = m) = \beta_m + \gamma_m(1 + \log EXP) + \sum_j [(\theta_{mj})(Z_j)] + \sum_{h \neq m} \pi_{mh}\lambda_h$$

16. To obtain this MBS we need an expression for the expected value of the consumption share (for any given good) used for households that chose action l, conditioning on the characteristics of households that chose action *m*:

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$$E(C_l/EXP|s=m) = \beta_l + a_l/EXP + \gamma_l(\log EXP) + \sum_j[(\mu_{lj})Z_j/EXP + \theta_{lj}(Z_j)] + \pi_{lh,m}\lambda_{h,m} + \pi_{lm,m}\lambda_{m,m},$$

where $\lambda_{j,m}$ is the counterfactual selectivity term for choice j, given unobserved characteristics of households m. The derivation of this expression is available from the authors upon request. We have that $\lambda_{j,m} = P_j - \ln P_j/(1-P_j) + \ln P_m$. Moreover, $\pi_{lh,m} = \sigma_l r_{lh}$ and $\pi_{lm,m} = -\sigma_l(r_{lh} + r_{lm})$. From this expression, follows that:

$$E(MBS_l|s=h) = \beta_l + \gamma_l(1+\log EXP) + \sum_j[(\theta_{lj})(Z_j)] + \pi_{lh,m}\lambda_{h,m} + \pi_{lm,m}\lambda_{m,m}$$

.

17. In the estimation we used standard errors clustered by municipality. This is because in our data we have correlation at the level of the municipality. See the last paragraph of Section 5 for further details.

18. In the first-stage choice equation, it is difficult to identify variables that are truly exogenous to migration and the receipt of remittances. In the literature, the cleanest strategies for identifying exogenous variables affecting migration and the receipt of remittances have focused on short-term economic shocks. For example, Yang (2005) uses panel data from the 1997 Asian currency crisis to analyze how short-term changes in currency rates affect the value of international remittances received by Filipino households.

19. The simple correlation between total expenditure *per capita* and distance to the nearest railroad line in 1930 is negative.

20. We also tried as instruments unexpected rainfall in 1991–1999. However, statistical tests (available upon request) showed that the unexpected residuals for 1998 and 1999 are not valid instruments, while unexpected rain shocks from 1990 to 1997 are valid instruments. However, unexpected rain shocks from 1990 obtain the lowest indicator of potential bias generated in our estimations by the use of IVs. A potential explanation for these results is that in 1998 Hurricane Mitch devastated Guatemala and Central America, generating a large migration of people to the United States.

21. The top 25 US cities include: Los Angeles, New York, Miami, Trenton, Washington, Houston, Norfolk, Boston, Chicago, Dallas, Denver, Atlanta, San Francisco, Charlotte, Las Vegas, Baltimore, Nashville, Phoenix, Portland, Indianapolis, Providence, Kansas, Montgomery, Lincoln and Philadelphia.

22. We would like to thank an anonymous referee for suggesting this interaction.

23. We also tried including as instruments the interaction of age and the employment rate in the United States, as well as a set of dummy variables for age groups interacted with the employment rate. These are all valid instruments, however, once we include them in our model, statistical tests show that we increase the risk of generating a larger bias in our estimation.

24. While early work on the human capital model found that education had a positive impact on migration (Schultz, 1982; Todaro, 1976), more recent empirical work in Egypt (Adams, 1991, 1993) and Mexico (Mora & Taylor, 2005; Taylor, 1987) has found that migrants are not necessarily positively selected with respect to education.

25. It is possible that these human capital and household characteristic variables are endogenous, because household choices in a migration model can shape these variables. Section 8 explores this issue in detail.

26. The seven regional dummy variables (with metropolitan capital region omitted) in the 2000 Guatemala ENCOVI Survey are: North, Northeast, Southeast, Central, Southwest, Northwest and Petén.

27. In addition, we preformed a test to show the validity of our instruments. This test is not shown in the text but details are available from the authors. This test was done on a simplified version of the model. The model is simplified because it assumes that all differences caused by the receipt of internal or international remittances can be captured by differences in the intercept of the model. In such a model, we can test whether the correlation that exists between our instruments and the expenditure share is strong enough to generate IV estimates better than OLS estimates. In general, if the bias produced by the use of IVs is less than a threshold of 10% relative to the bias of OLS, then the instruments are said to be strong (Stock & Yogo, 2004). Results show that our instruments are strong.

28. These percentage figures are calculated as follows: estimated ATT divided by the expected value of the counterfactual MBS. The intuition is that the ATT shows the change in expenditure behavior produced by remittances, while the counterfactual MBS shows the expenditure behavior that the households would have had without the receipt of remittances.

29. While mean annual *per capita* expenditures for households receiving no remittances is 4854.5 quetzals/capita/year, it rises to 6039.9 quetzals/capita/year for households receiving internal remittances (from Guatemala) and to 6632.5 quetzals/capita/year for households receiving international remittances (from United States).

30. We would like to thank the referees for calling our attention to these issues.

31. See the notes to Table 11 for the equivalency scales used.

32. According to the robustness checks in Table 11, in two out of five cases households receiving international remittances spend less at the margin on food than what they would have spent on this good without remittances. The robustness checks also show that in three out of five cases households receiving internal remittances spend more at the margin on education and housing, and that in all cases households receiving international remittances spend more at the margin on education and housing than what they would have spent on these goods without remittances.

33. See, for example, Paxson (1992) in Thailand.

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