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24 June 2008

WORKING PAPER
(June 22, 2008)

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[1] For detailed comments I thank Magali Valero, J. Ulyses Balderas, participants at the "Conference on Regional Trade Agreements, Migration and Remittances With Special Focus on CAFTA and Latin America" at Sam Houston State University, and participants at the Conference "*Capital Humano, Crecimiento, Pobreza : Problematica Mexicana. Tercer encuentro internacional" at the* Universidad Autonoma de Nuevo Leon, Mexico. I gratefully acknowledge the financial support provided by Conacyt and thank Selene Salinas for research assistance.

Remittances and the household's expenditures on health

Abstract

This paper considers the effect of remittances on the share of health expenditures to total household expenditure. The main purpose of this paper is to investigate whether remittances are especially targeted towards household's health in Mexico. We use a Tobit model with random effects and find a statistically significant effect of remittances on the proportion of health expenditures for households that do not have access to employment's medical insurance: Our results suggest that around 10% of changes in remittances are devoted to health expenditure.

Keywords: Health expenditure, Remittances, Tobit, Health related consumption.

1. Introduction

This paper analyzes the impact of transfers from remittances on health related consumption of Mexican households. Our data source is the National Income Expenditure Survey of Households of Mexico (ENIGH) for the year 2004. The objective of the paper is to find if remittances have the target of attending health problems of the original families in Mexico and to measure this effect. For that reason we need to distinguish between the proportional impacts of a greater income and the extra impact of targeted transfers from remittances. The study of remittances allows us to observe transfers between family members otherwise unobservable, to study target effects even when the sender is in a different country, and to compare these effects with public policy. The same magnitude of remittances that were in order of 23,821 billion dollars in Mexico in 2007 may generate changes in private investments and public policy decisions. In the same manner as Banerjee and Duflo (2007) ask "why the poor don't eat more?" motivated by the observations of how the poor spend the marginal dollar, we ask for the effect of the marginal dollar of remittances on health expenditures. Health expenditure is an attractive way to study remittances because according to data from the Mexican Migration Project of the period 2005-2007, even when 43.3 percent

of people report that the most important motive for sending remittances is food and sustenance, 35.8 percent consider that health expenditure is the most important reason. Amuedo, Sainz, and Pozo (2007, Table 1) report that 46 percent of people remitting money consider health expenditure to be the most important motive for sending these remittances.

Most of the research on the relationship between remittances and health that utilize household data find a strong link between them. For example, Acosta, Fajnzylber and Lopez (2007) found that children from households that report receiving remittances tend to exhibit higher health outcomes than those from non-recipients in the cases of Guatemala and Nicaragua. Hildebrand and McKenzie (2004) study the channels through which migration may affect health outcomes and find evidence that migration improves child health through raising the health knowledge of mothers, in addition to the direct effect on health of higher wealth after migration. Amuedo, Sainz and Pozo (2007) also study the relationship between remittances and health expenditures and McKenzie (2007) discusses some of the econometric problems. Our strategy in looking for the target effect of remittances consists in measuring the effects over the share of expenditures on health, controlling for the household's total expenditure per capita, which allows us to separate "income" and remittance effects.

National expenditure on health in Mexico was 6.5 percent of GDP, according to the World Health Organization (2007a), 3.0 percent of which came from government expenditures and 3.5 from private expenditures. Besides, the proportion of remittances on National Income has been increasing in Mexico through the years: from 3,673 million dollars in 1994 to 16,613 in 2004 according to Banco de Mexico (BANXICO, 2005). These remittances are partially observed at the household level in the ENIGH as we will discuss later.

Table 1 presents data about health expenditure, out-of-pocket expenditure, and remittances for the countries of CAFTA and Mexico. Total expenditure on health as a

percentage of GDP cannot be explained by general government expenditure or by remittances by themselves. Out-of-pocket expenditure on health seems to be directly related to remittances but the relation for every country is different. In this analysis we will study private expenditure in health. Therefore, in this paper we measure the relationship between household expenditures on health and remittances as percentages of total expenditure.

Table 1
Health expenditure and remittances for selected countries.

	Total expenditure on health as % of gross domestic product (2003)	General government expenditure on health as % of total expenditure on health (2003)	Out-of-pocket expenditure as % of private expenditure on health (2003)	Out-of-pocket expenditure as % of gross domestic product (2003)	Remittances as % of gross domestic product (2005)
	(1)	(2)	(3)	(4)	(5)
Costa Rica	7.3	78.8	88.7	1.4	1.8
Dominican Republic	7.0	33.2	70.8	3.3	9.1
El Salvador	8.1	46.1	93.5	4.1	17.1
Guatemala	5.4	60.3	91.9	3.0	9.3
Honduras	7.1	56.5	85.8	2.6	21.2
Mexico	*6.2*	*46.4*	*94.2*	*3.1*	*2.8*
Nicaragua	7.7	48.4	95.7	3.8	16.9

Columns (1) to (4) are from The World Health Organization (2007b, Table 2, p. 180) .Column (5) is from The Inter-American Development Bank (2006).

In order to study the relationship between health related consumption, total expenditure, and remittances, we use a model that is derived from a cost function, and implement it through a Tobit model that controls for the total expenditure per capita in the household, the size of the household, family composition, and other variables. This derivability from a cost function allows us to interpret the marginal effects as the distance to a threshold or as originated in a utility function. In addition, as we require to distinguish between health expenditure and consumption, we use a stochastic effects model in order to control for different prices at the level of clusters. Exogeneity related problems are also discussed.

The organization of this paper is as follows. In the next section the data will be discussed paying special attention to the data on employment's medical insurance and on

remittances. Then the model is discussed in Section 3. Section 4 presents the results of the Tobit model. Section 5 concludes.

2. The Data

Our source of data is the National Income Expenditure Survey of Households of Mexico (ENIGH) for the year 2004. The households' expenditure in the ENIGH is composed of two parts: a monetary and a non-monetary component. The non-monetary component refers to expenses that are not an out-of-pocket expenditure, but are estimated expenditures with data about auto-consumption, gifts, labor payment in goods, and non-monetary support from institutions. This non-monetary component is also characterized by the identical correspondence between each non-monetary expense and each non-monetary income. As the interest of this study is in the relationship between remittances and out-of-pocket health expenditures, the non-monetary component is not included.

Given the objective of this paper, it is important to know if the households have access to employment's medical insurance, since the lack of insurance could be an important motive for sending remittances to the household. In Mexico, the government workers and their children have access to employment's medical insurance through the ISSSTE ("Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado"), the private industry workers through the IMSS ("Instituto Mexicano del Seguro Social"), and some other workers through their firm's medical services. We consider a household as having access to Employment's Medical Insurance (EMI) if the head of the family or the spouse have access to at least one of the above mentioned medical insurance institutions[2]. The ENIGH sample has 22,595 households and just 31.6 % of the head of the households have access to EMI and 35.4 % if

[2] Usually when the father or mother of a family have employment's medical insurance in their job, their children also have access to it. But even if the head of the family or the spouse have access to medical insurance, this does not imply that other members would also have access. Therefore, this measure is only an approximation, but even with this broad definition we find differences in the means and in the estimated parameters of the two groups.

we consider the head or the spouse. An alternative we use is to take the households with at least one household member with access to EMI (45.2 %) but it is a dimmer concept as the employment medical insurance of the son or daughter cannot usually be extended to their parents, brothers and sisters. However the results are qualitatively similar with this definition showing their robustness.

Remittances. There are two issues to consider when using the information about remittances in Mexico. The first one is that there are big differences in the measurement of remittances between the information of the Banco de Mexico (BANXICO), the Central Bank of Mexico, and the household information collected by ENIGH, which is the database used in this paper. The total amount of worker remittances according to BANXICO (2008a, 2008b) in the quarter July – September 2004 is of 4,551 million dollars and the remittances captured by ENIGH in the period August – October 2004 are of 1,037 million dollars. This difference is huge. A discussion of BANXICO's methodology can be found in Cervantes (2007) and recent discussions about BANXICO's quality of information in Tuirán-Gutiérrez et al (2006) and in Cañas et al (2007). This difference is important because it is possible that the ENIGH has problems measuring remittances, and even when we assume that of all households who receive remittances the ones who admit to receive them are random, it is better to be aware that the results of this study cannot be safely extended to BANXICO's data. The second issue is that both information sources show that some of the more industrialized States, as Distrito Federal, State of Mexico and Jalisco are among the most important recipients of remittances which indicates that this is not necessarily a rural or poverty matter.

In Table 2 we present statistics about the average quarterly income of the household, the total transfers, and the transfers corresponding to remittances and social institutions, in pesos as well as in percentages of income. Remittances include the household income transfers that come from other countries excluding retirement pensions. Transfers from

institutions include the household income transfers that come from governmental and non-governmental organizations, including the programs "Oportunidades" and "Procampo" and income transfers for scholarships. It excludes income transfers from retirement, compensations, remittances, and transfers from other households. The reader will notice that even when remittances were measured as approximately 2.8 percent of gross domestic product in Table 1, when they are measured through the households in the ENIGH they only account for 1.9 percent of the average income. The average remittance is higher for households without access to employment's medical insurance, but their average income is lower. The table also contains information about transfers to the households from Institutions. Households with no access to employment's medical insurance seem to have higher transfers from institutions on average[3].

Table2
Average quarterly income, remittances and institutional transfers by household. 2004. *Pesos and percentages*

	Total	Access to employment's medical insurance by head or spouse	
		Yes	No
		Pesos	
Income	24,167.84	33,390.72	19,534.41
Total Transfers	2,702.78	1,114.03	3,500.95
Remittances	461.54	92.07	646.70
Institutions	333.88	118.18	441.99
		Percentages	
Income	100.0	100.0	100.0
Total Transfers	11.2	3.3	17.9
Remittances	1.9	0.3	3.3
Institutions	1.4	0.4	2.3

Source: the data was elaborated with information from ENIGH 2004.

3. The Model

In order to study the target effect of remittances on health consumption, we require a model that relates remittances to the share of expenditures in health, and that simultaneously controls for the expenditure per capita of the household as an approximation for their wealth,

[3] ENIGH (2004) reports 22,595 household observations representing 25'561,447 households, of which 33.4 % have access to EMI. Of the households that have access to EMI, 2 % receive remittances and 7.2 % transfers from institutions. Considering a total of 17'027,683 households that do not have access to EMI, 7.3 % receive remittances and 25.2 % transfers from institutions.

for the size of the household to control for scale effects, for the household's composition, and for other characteristics. Therefore, we specify the model as an Engel function which linearly relates the fraction of total household expenditures devoted to health with total expenditure per capita, as in Working (1943), whose advantage among the models which comply with the assumption of additivity was discussed by Leser (1963). A log-log model, for example, does not comply with this assumption. This model discussed by Deaton (1989) has been widely used among others such as Case and Deaton (2002), Deaton (1987), Deaton, Ruiz and Duncan (1989), Gibson and Rozelle (2004), Hong and Kim (2000), and Peña and Ruiz-Castillo, (1998) and variants can be found in Atkinson, Gomulka and Stern (1990), Bhalotra and Attfield (1998), Michelini (2001), Parker and Wong (1997), and Valero-Gil (2006) for Mexico. The model is as follows[4]:

$$w_h = \frac{pq_h}{x_h} = \alpha + \beta_1 \ln\left(x/n\right)_h + \beta_2 \left[\ln\left(x/n\right)_h\right]^2 + \eta \ln n_h + \sum_{j=1}^{J} \gamma_j \left(\frac{n_{jh}}{n_h}\right) + \delta \cdot z_h + \varepsilon_h \qquad \textbf{(1)}$$

The left hand side of the equation is the fraction of total expenditure x on health pq_h, where p are prices and q_h quantities of "health goods" consumed by household h, pq_h is observed but not p and q_h separately, $ln(x/n)_h$ is the natural logarithm of the expenditure per capita of household h, n_h is the size of the household, n_{jh} is the number of people of group j in the household, and z_h are control variables such as region, marital status and sex of the head of the family, and the number of hours worked. The stochastic error ε has zero mean, constant variance, and is considered to be independently and identically distributed among households. Since many households do not make health expenditures at the time of the interview, a Tobit model is implemented.

[4] This function appears in Deaton (1997, pp. 268-69) and is derived from a cost function, $c(u,p,n) = n^{\theta}\alpha(p)u^{\beta(p)}$ where u is the utility function, θ is a parameter to control for scale economies in the household, $\alpha(p)$ is linearly homogeneous and $\beta(p)$ is homogeneous of degree zero in prices. Considering that $\partial lnc/\partial p_i = w_i$ and taking $\ln\alpha(p) = \Sigma\alpha_k \ln p_k$ and $\ln\beta(p) = \Sigma\beta_k \ln p_k$ the system of demands will take the form of a Working equation $w_i = \alpha_i^* + \beta_i \ln(x/n^{\theta}) = \alpha_i^* + \beta_i \ln(x/n) + \beta_i(1 - \theta)lnn$, which is the equation that is being used here.

In order to control for differences in prices we consider just one price in every locality, but we allow the price to vary among clusters as in Deaton's (1997) model. We require localities to be as small and as distant from each other as possible, since each locality has just one price for goods related to health. Besides localities we use sample expansion factors to expand from the sample to the population in order to build as many clusters as possible[5]. As these clusters come from a sample and we want to extend the results to the population, we use a random effects model and consider the clusters to be randomly distributed in the sample. The model is as follows:

$$w_{ch} = \alpha + \beta_1 \ln\left(x/n\right)_h + \beta_2 \left[\ln\left(x/n\right)_h\right]^2 + \eta_1 \ln n_{ch} + \eta_2 rem_{ch} + \eta_3 rem_{ch}^2 + \sum_{j=1}^{J} \gamma_j \left(\frac{n_{cjh}}{n_{ch}}\right) + \delta \cdot z_{ch} + u_c + \varepsilon_h \qquad \textbf{(2)}$$

In this model *c* represent different localities, u_c different prices, and *rem* are the remittances, which are censored at zero in 95.6% of the cases and cannot be included as logs. The introduction of u_c is implemented as a random effects model. Our null hypothesis is that η_2 and η_3 are equal to 0, implying that the proportion of health expenditures is constant with respect to remittances and that the changes are generated by factors such as household expenditure per capita, size of the household and scale effects, groups of different sex and age or other control factors. In order to compare the effect of remittances *rem* on health expenditures with the effect of other transfers, we run a similar regression using transfers from institutions by substituting remittances for transfers from institutions *insti*.

[5] The ENIGH has information about 32 Federal States, 503 localities, 4 stratus (size of the locality) and 1,687 expansion factors that could be repeated in different States, localities or stratus. This information allows us to distinguish 3074 clusters or ultimate sampling units which for 22,595 observed households gives us an average of 7.4 households by cluster.

To analyze the existence of different effects of remittances if the household has access to employment's medical insurance, *AEMI*, we include this variable by itself, and also interact it with expenditure per member and with remittances as shown in equation (3).

$$w_{ch} = \alpha_1 + \beta_1 \ln\left(x/n\right)_{ch} + \beta_2 \left[\ln\left(x/n\right)_{ch}\right]^2 + \eta_1 \ln n_{ch} + \eta_2 rem_{ch} + \eta_3 rem_{ch}^2 + \alpha_2 ASMI_{ch} + \alpha_3 ASMI_{ch} * \ln\left(x/n\right)_{ch} + \alpha_4 ASMI_{ch} * rem_{ch} + \sum_{j=1}^{J} \gamma_j \left(\frac{n_{cjh}}{n_{ch}}\right) + \delta \cdot z_{ch} + u_c + \varepsilon_h \quad \textbf{(3)}$$

Marginal values. The proportion of health expenditure is censored at zero in 35% of the households and for this reason we follow a Tobit model characterized as follows:

$$w_{ch} = \boldsymbol{\beta' X}_{ch} + \boldsymbol{\varepsilon}_{ch}$$

$$w_{ch}^{*} = 0 \text{ if } w_{ch} \leq 0 \qquad \text{and} \qquad w_{ch}^{*} = w_{ch} \text{ if } w_{ch} > 0 \quad \textbf{(4)}$$

In the next section we are interested in obtaining $E[w_{ch}|\mathbf{X_{ch}}]$ for the total population, and comparing our results with those of the case $E[w_{ch}|\mathbf{X_{ch}}, w_{ch} > 0]$ and those of a GLS model (an OLS model plus random effects in order to control for changes in prices). When we consider the marginal values $\partial w/\partial \boldsymbol{X}$ for the case $E[w_{ch}|\mathbf{X_{ch}}]$ the unobservable results for $w_{ch} \leq 0$ are allowed and we interpret them as measuring the distance to a threshold to make expenditures in health or as part of a utility function because they are important for social policy. For example, the relationship between poverty and the probability of making health expenditures is well documented, as in Wagstaff (2002), Hernández et al. (2005), Ochoa et al. (1999), and Suarez (2000) The relationship between both marginal values, those generated by $E[w_{ch}|\mathbf{X_{ch}}]$ and those by $E[w_{ch}|\mathbf{X_{ch}}, w_{ch} > 0]$, is given by $\boldsymbol{\beta'}\phi(\boldsymbol{X'\beta}/\sigma_\varepsilon)$ where $\boldsymbol{X'\beta}$ are the estimated values and ϕ is the standard normal distribution. If what is desired to know is the sales of a medical service or product it could be more relevant to use $E[w_{ch}|\mathbf{X_{ch}}, w_{ch} > 0]$. But even in this sales case, Debb and Trivedi (2002) have shown that for the case of counting data

on expenditures on health a threshold model is preferred to a two-step model that separates the cases $w_{ch} = 0$ and $w_{ch} > 0$.

Exogeneity. To study the problem of exogeneity of remittances, as 4.5 % of cases receive remittances generating a censored variable, we study the problem of exogeneity in two parts: as a dichotomous variable to consider the effect through the probability of receiving remittances, and as a continuous variable to consider the effects through quantities received. In the first case we consider the relationship between the probability of making health expenditures and the one of receiving remittances with two probit regressions, one for the decision to make health expenditures z_{1w} and one for receiving remittances z_{2rem}:

$$z_{1w} = \boldsymbol{\alpha_w}' \mathbf{v_w} + u_w \qquad \textbf{(5)}$$

$$z_{2rem} = \boldsymbol{\alpha_r}' \mathbf{v_r} + u_r$$

The variable z_{1w} refers to the household decision of making expenditures on health greater than zero (1 if $w > 0$, 0 if $w = 0$), z_{2rem} to the fact of receiving remittances also greater than zero (1 if *rem* > 0, 0 if *rem* =0). We first run the regressions[6] for z_{1w} and z_{2rem} to see if there is a significant correlation between u_w and u_r and we find a Spearman's correlation coefficient $\rho_{1w,2rem}$ of 0.074 significantly different from zero.

To test the exogeneity of remittances as a continuous variable we use the procedure of Smith and Blundell (1986) as discussed by Greene (2002, p. E21-77). We run an OLS regression on remittances and keep the residuals. Then we run the Tobit model for *w* and include these residuals as an additional right hand side variable, and we find that the coefficient of the residuals is not significantly different from zero. We conclude that remittances as a continuous variable was exogenous. Then, as an approximation and given the correlation between

[6] The variables included for z_{1w} and z_{2rem} are the geographic zone, size of the locality, access to employment's medical insurance by the head of the household or the spouse, sex and marital status of the head of the household, hours worked by the family linear and squared, and the logarithms of total expenditure per member and of size of the household.

u_w and u_r, we add the residuals of the z_{2rem} equation to equation (3) and run the Tobit model for *w,* and find that they are positive and significantly different from zero. Since there is no way to think in using instrumental variable methods for this variable, we conclude that it is important to include those residuals as an additional variable to diminish the problem of exogeneity. We also try to manage this problem as a problem of self selection in an equation for remittances, but the obtained inverse mills-ratio or Heckman's lambda was not significantly different from zero. This implied that it was not convenient to use that methodology to obtain corrected estimates.

The ENIGH does not give information about sickness in the household. We consider that the presence of sickness, through changes in hours worked, could originate changes in expenditure per member in the household, and that this would originate a relationship between one explanatory variable and the random term. Besides, sickness in the household could affect hours worked and remittances. To avoid this endogeneity problem we include the variable "*Family Hours Worked"*, both linear and squared as an explanatory variable. The variables are subject to the critic of Angrist and Krueger (1999) in that they are related to expenditures per household member and they could be generating a bias when we try to control for a possible inexistent sickness bias. For this reason we compare the results with the variables related to hours worked included and without them and verify that the changes are small as we will see in the discussion of the results for equation (2) in Table 4.

4. Variables and results

In order to control for the age and sex of the members of the household, we define ten groups, one for people 0 - 6 years of age and one for 66 or more, and four more groups for each sex according to the age groups 7 – 15, 16 – 24, 25 -54 and 55 – 65. With these groups we define the composition of the family as n_j/n, where j represents each of the ten groups, n_j

the number of people in group j and n_j/n the proportion of people in each group. We also utilize control variables z as sex and marital status of the head of the household, four divisions by geographic zone, and four divisions by size of the locality.

We present the mean and standard deviation of the variables of interest in Table 3. In the table, *w* is the proportion of household's monetary expenditures in health, *lnx/n* is the natural logarithm of monetary expenditure per member of the household, *lnn* represents the logarithm of the size of the household, *rem* represents remittances, *insti* are transfers from institutions to the household, AEMIhs is the fraction of households whose head or spouse have access to employment's medical insurance and AEMIh is the fraction of households whose at least one member has access to employment's medical insurance. The number of households in the sample is 22,547 which represent 25 million households. The Table also shows the means and standard deviations of the variables separated by whether the household has access to employment's medical insurance or not. The proportion of monetary expenditures on health is 3.3%, but it is 2.3% for households with access to employment's medical insurance and 3.8% for households without access. Households without access to employment's medical insurance have a higher proportion of total expenditure devoted to health, a lower expenditure per capita, a smaller household size, and higher transfers from remittances and from institutions.

Table 3
Sample Means and Standard Deviations

	All		Access to EMI		No access to EMI	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
w	0.033	0.073	0.023	0.052	0.038	0.081
x	20,937	27,236	27,906	26,442	17,126	26,907
lnx/n	8.27	0.97	8.66	0.82	8.05	0.97
$(lnx/n)^2$	69.31	16.12	75.64	14.48	65.83	15.92
lnn	1.27	0.55	1.30	0.46	1.25	0.59
rem	414	16,100	80	1,351	598	20,033
$rem^2/10^6$	260	38,300	1.8	93	402	47,700
Insti	340	1410	127	917	456	1608
$Insti^2$	2.1	54.2	0.9	21.2	2.8	65.5
AEMIh	0.45	0.50				
AEMIhs	0.35	0.48				

Table 4
Regression results for equation (2).
Effects of variables in the share of health related consumption

Variables	(1)	(2)	(3)
constant	-0.340	-0.333	-0.345
	(-10.14)	(-9.97)	(-10.30)
lnx/n	0.068	0.066	0.070
	(8.58)	(8.36)	(8.74)
$(lnx/n)^2$	-0.003	-0.002	-0.003
	(-5.64)	(-5.26)	(-5.76)
lnn	0.022	0.026	0.026
	(11.90)	(12.02)	(11.83)
rem	1.82E-06		1.68E-06
	(5.30)		(5.74)
rem^2	-6.46E-13		-5.85E-13
	(-8.58)		(-4.76)
insti		1.20E-06	
		(1.62)	
$insti^2$		-2.32E-11	
		(-1.27)	
Fam. hours worked			-1.32E-04
			(-3.59)
$(Fam. hours worked)^2$			3.54e-07
			(2.55)
Log likehood	8382.45	8341.68	8498.62
sigma σ_ε	0.094	0.095	0.094

Notes: t-statistics in parentheses. Number of observations; 22547, censored: 7920, uncensored 14,627; number of groups 3,074.Other control variables used are sex and marital status of the head of the family, 9 variables for composition of sex and age of the members of the household, 3 for geographic zone and 3 for size of the locality.

Table 4 presents the results of the Tobit models of equation (2) which allows us to compare the effects of small changes in the models, the effect of changing the variable *rem*

(column 1) for the variable *insti* (column 2), and the effect of adding the control variable *Family hours worked* linear and squared (column 3). Column (1) shows that there is a positive effect of remittances on a household's health expenditure: higher remittances to the household are accompanied by a larger share of expenditure on health. On the other hand, although we also find a positive relationship between transfers from institutions and health expenditure in column (2), the coefficient is much smaller than the one for remittances and is not statistically significant. Transfers from remittances appear to have a stronger targeting effect on health expenditures compared to transfers from Institutions.

The third column shows the effects of adding the variable *Family hours worked.* The sign of the coefficient is negative in the mean (76.5 hours) as expected: sickness in the family decreases hours worked and increases the share of health expenditures. The difference in the coefficients of *lnx/n* of columns (1) and (3) is not significantly different from zero, nor the difference of the coefficients related to *rem*. The presence of the variables related to *Family Hours Worked* decrease the size of the coefficient of *rem* as expected. As discussed before, since this decrement is small we include this control variable in the regressions in Table 5.

In Table 5 we present the results of the regressions using equation (3), where the variable *access to employment's medical insurance* (AEMI) by the head of the household or their spouse is included. Column (1) gives the results including the residuals estimated in equation (5) for remittances, e_{2rem} and column (2) gives the results without those residuals. In column (3) we re-run the same regression but with an alternative definition of households with/without medical insurance as a robustness check. In particular, in this specification we define a household as having access to employment's medical insurance if at least one member has access to EMI. In column (4) the GLS results are presented, where we still control with clusters for differences in prices. All the results show that remittances have a positive impact on the fraction of health expenditures by the household, but as expected, this

effect is significantly smaller or even negative for households with employment's medical insurance. This result points to the lack of insurance as one of the reasons families receive remittances. Across all regressions, the coefficients of *lnn* are positive, indicating that when the household increases its number of members the proportion of expenditure on health also increases, which implies that there are no returns to scale for health expenditure.

The unexplained residuals in equation (5) for the probability of obtaining remittances e_{2rem} affect positively the share of health expenditures. If we do not include this variable, the coefficient of remittances of column (2) would be larger than the one of column (1). In any case the differences between the coefficients of both columns are small. Column (3) shows that our results are robust to the alternative definition of households with employment's medical insurance. We still find a positive relationship between remittances and the fraction of the household's expenditure on health that is much smaller for households with employment's medical insurance. The coefficient of AEMI in column (3) is smaller in absolute value than that of column (1) and this is consistent with the hypothesis that measuring AEMI with the households that have at least one member with access to it should have a weaker effect on the share of health expenditure. Comparing columns (1) and (3) we also find that the differences between coefficients are small. However, as most of the variables are in linear and quadratic form or related to other variables, we also consider taking mean values to analyze the results.

The estimated regression refers to E[w|**X**]. In order to compare these results with the coefficients of E[w|**X**, w>0] we have to multiply them by $\boldsymbol{\beta}'\phi(\mathbf{X}'\boldsymbol{\beta}/\sigma_\varepsilon)$ where $\mathbf{X}'\boldsymbol{\beta}$ are the predicted values at the mean. We substitute the values obtained in Column (1) and we obtain that $\phi(\boldsymbol{X}'\boldsymbol{\beta}/\sigma_\varepsilon)$ is $\phi(0.00593/.094))$ which is equal to 0.525. To obtain these marginal effects of E[w|**X**, w>0] we multiplied the $\boldsymbol{\beta}$ coefficients of column (1) by that value and obtained column (5).

Table 5
Regression Results for Equation (3)
Effects of variables in the share of health related consumption

	(1)	(2)	(3)	(4)	(5)
constant	-0.416	-0.420	-0.432	-0.053	-0.218
	(-11.94)	(-12.06)	(-12.43)	(-2.38)	
*ln*x/n	0.084	0.085	0.087	0.017	0.044
	(10.00)	(10.13)	(10.4)	(3.09)	
$(ln x/n)^2$	-0.002	-0.004	-0.004	-0.004	-0.001
	(-6.86)	(-7.03)	(-7.17)	(-0.71)	
*ln*n	0.024	0.024	0.030	0.011	0.013
	(11.09)	(10.94)	(13.69)	(7.15)	
rem	9.46E-07	1.69E-06	9.700E-07	1.07E-06	4.97E-07
	(2.50)	(5.45)	(2.51)	(3.84)	
rem^2	-2.81E-13	-5.88E-13	-2.910E-13	-3.38E-13	-1.48E-13
	(-1.78)	(-4.52)	(-1.8)	(-2.91)	
AEMI	-0.069	-0.070	-0.058	-0.013	-0.036
	(-4.44)	(-4.54)	(-4.03)	(-1.2)	
*ln*x/n*AEMI	0.005	0.006	0.004	1.790E-05	0.003
	(2.97)	(3.08)	(2.32)	(0.01)	
rem*AEMI	-1.790E-06	-1.94E-06	-1.070E-06	-1.520E-06	-9.38E-07
	(-2.09)	(-2.26)	(-1.54)	(-2.43)	
e_{2rem}	.0142588		0.014	.0055816	0.007
	(3.43)		(3.39)	(1.86)	
# of observations	22547	22547	22547	22547	
Log likehood	8507.71	8501.82	8538.67		
sigma s_e	0.094	0.094	0.094	0.071	

Notes:t-statistics in parentheses. Number of observations; 22547, censored: 7920, uncensored 14,627; number of groups 3,074. See notes to Table 4 for other control variables.

The main results for expenditures and remittances appear in Table 6 which shows the effects on the means, and the elasticities of health expenditure on remittances and on total expenditures. The effects on the means are estimated through equation (3). For example, for remittances we estimate *∂w/∂rem* in the mean of *rem* and similarly[7] for *∂w/∂ln(x/n)*. The estimated elasticities refer to the change in quantity of health goods with respect to remittances and total expenditures, respectively. To test if the effect on the means, the partial

[7] The effects on means are estimated through equation (3). For example, for remittances we will have: $\partial w/\partial rem = \eta_2 + 2\eta_3 rem + \alpha_4 ASMI$. The elasticities of health expenditure with respect to total monetary expenditures (constant size of the household) and with respect to remittances, e_x and e_R, are defined as: $e_x = \frac{\partial \ln q}{\partial \ln x} = \frac{\partial w}{\partial \ln\left(x/n\right)} + 1; \quad e_R = \frac{\partial \ln q}{\partial \ln rem} = \frac{rem}{w} \cdot \frac{\partial w}{\partial rem} + \frac{rem}{x}$ where the term rem/x is the expenditure effect because it assumes $\partial x/\partial rem = 1$.

derivatives evaluated at the means, were significantly different from zero, we use the information of equation (3) and the mean values of rem and *lnx/n* of Table 3. Table 6 presents results for the columns (1), (4) and (5) of Table 5 for the Tobit, GLS and corrected Tobit results respectively.

Table 6
Effects on the means and elasticities

		Effects on the means		Elasticities	
	Concept	Access to EMI	No access to EMI	Access to EMI	No access to EMI
	Tobit results (Column 1 Table 5).				
	Remi	-8.44E-07	9.46E-07	0.009	0.032
	Expenditure	0.032	0.027	1.971	1.810
Prob > chi2	Remi	0.770**	0.000**		
	Expenditure	0.000**	0.000**		
	GLS results (column 4 Table 5)				
	Remi	-4.50E-07	1.07E-06	0.014	0.033
	Expenditure	0.013	0.013	1.387	1.386
Prob > chi2	Remi	0.477*	0.000*		
	Expenditure	0.467	0.478		
	Corrected Tobit (column 5 Table 5)				
	remi	-4.41E-07	4.97E-07	0.014	0.026
	Expenditure	0.030	0.027	1.921	1.830

The coefficients with and without AEMI are significantly different at 1% level (**), 5% level (*)

Nonlinear χ^2 tests are presented for the results on the means and the asterisks denote significant differences on mean coefficients with/without AEMI. The results for the effect on the mean for remittances have a positive sign if the household does not have access to EMI and a negative sign if it has access. This implies that remittances have a target effect of increasing the proportion of health expenditures at households without EMI, but that this effect is not found for households with access to EMI. The result is obtained when maintaining constant variables such as total expenditure, size of the household, proportion of old and young people, prices, and so on. Besides, the effects on the means are significantly different from zero for households without access to EMI and not significant for households with access to EMI. The resulting remittances elasticities are similar for the Tobit and

corrected Tobit cases and are higher for the GLS results. They are about .03 for households without access to EMI.

In the case of households without AEMI, the Tobit results can be read as follows. If we take the mean values of Table 3, *rem* = 414, *w* = 0.033, *x* = 20,937, gives us health expenditure of 690.92, and assuming an increase in remittances of 41.4, or 10 percent, we will obtain an increase on expenditure of 41.4/20937 %. The effect through remittances with an elasticity of .032 will be an increase in health expenditures of 2.211, and the effect through total expenditure with an elasticity of 1.81 will be of 2.473 adding to a total of 4.684. As the original increase in remittances was of 41.4 these findings indicate that for households without AEMI an average of 11.3 percent of remittances will be destined to health expenditures. For households with AEMI the expenditure and remittances elasticities are 1.91 and 0.009 respectively, generating and increase in health expenditures of 3.315, about 8 percent of the increase in remittances. This implies that around 10% of changes in remittances are devoted to health expenditure.

Table 5 shows that the coefficients of remittances in both cases, Tobit and GLS, are significantly different for people with/without AEMI. Note that the three kinds of methodologies, Tobit, GLS and Corrected Tobit, give the same results for the remittances variable. This suggests our results are robust to the econometric technique used.

The results for elasticities of health consumption to total expenditure in the Tobit model for both kinds of marginal values, the Tobit model E[w|**X**] and the corrected Tobit E[w|**X**, w>0], are around 1.8 – 1.9; higher for households with AEMI which is consistent with a lower share of expenditure and higher substitution possibilities for these households. However, the results for the GLS give lower health consumption expenditure elasticities, around 1.38 but not significantly different from one, and an inability to distinguish between households with/without AEMI. Even where there are arguments in favor of modeling

together consumers and non-consumers as in the GLS model (see for example Deaton (1997, p. 92)), our results for the Tobit and corrected Tobit models suggest that these are the correct specifications when considering E[w|**X**, w>0] for health as a private good and as E[w|**X**] when considering public policy.

One of the most important features of this model is that it controls for changes in prices through 3,074 different clusters. The control for prices through random effects makes difficult the study of the problem of heterogeneity. Our intent in this analysis was to control for this problem through the inclusion of different kinds of variations, as composition of the family, total expenditure, scale effects, and so on. However, Table 7 in the appendix presents the relationship β/σ for the probit and tobit models, and shows that with the exception of the control variable for expenditures per member *Family Hours Worked*, the most important variables have the same sign.

5. Conclusion

This paper examines the relationship between remittances and the households' consumption on health, using data from Mexico for the year 2004. We study this link as a relationship between remittances and the proportion of total expenditure that goes to health expenses. We control for the household's total monetary expenditure, for composition and size of the family, for marital status and sex of the head of the household, for region and size of the locality. The most important control variable is the one related to household's expenditure. As remittances are a part of total household expenditure, a positive relationship with the proportion of the household's expenditure on health would indicate that the proportion devoted to expenditure on health is increasing with remittances, and so we can conclude that health expenditure is a target of remittances.

The relationship was studied for households with access to employment's medical insurance and for households without it. We found a statistically significant positive relationship between remittances and the household's expenditure on health for households without access to employment's medical insurance. In order to compare the effects of institutional transfers with the effects of remittances, we also studied the relationship of institutional transfers to the households and the proportion of expenditure on health, but we did not find a statistically significant relationship. The positive relationship between remittances and the proportion of the household's health expenditures together with the lack of a similar relationship for institutional transfers suggest that it is mainly remittances, and not institutional transfers, that contribute to a household's share of expenditure on health. The results are also consistent when the definition of access to employment's medical insurance is changed.

We also estimated both kinds of marginal results for the Tobit model, $E[w|\mathbf{X}]$ for public policy and $E[w|\mathbf{X}, w>0]$ for private applications, and we found that the results for remittances showed consistency, generating similar elasticities of health consumption in relation to remittances. This consistency was also found when we considered a GLS model. Our estimations suggest that the impact on health related consumption of an increase in remittances is about 11.3 % of the increase in remittances for households without access to employment's medical service, and of 8 % for households with access to employment's medical service.

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Appendix

Table 7

Heterocedasticity: β/σ for the Probit and Tobit models

	Probit	Tobit
constant	-16.14	-11.94
*ln*x/n	13.01	10.00
$(ln x/n)^2$	-9.58	-6.86
*ln*n	13.19	11.09
rem	0.69	2.50
rem^2	-0.33	-1.78
AEMI	-6.18	-4.44
*ln*x/n*AEMI	4.92	2.97
rem*AEMI	-1.57	-2.09
e2	3.66	3.43
Hours worked by the family	1.73	-2.33
(Hours worked by the family)^2	-0.89	1.40
n_{06}/n	9.13	1.03
n_{0715m}/n	-2.34	-10.96
n_{0715w}/n	-2.34	-11.19
n_{1624m}/n	-4.24	-11.84
n_{1624w}/n	-0.86	-8.34
n_{2554m}/n	-5.92	-13.67
n_{2554w}/n	1.93	-4.56
n_{5564m}/n	-5.04	-7.56
n_{5564w}/n	2.92	-0.34
marital status of the head	-1.59	-2.02
sex of the head	2.84	2.35
Geographic zone 1	-9.29	-7.29
Geographic zone 2	1.19	2.79
Geographic zone 3	3.78	3.94
locality size (> 100,000)	-5.27	-13.05
locality size (15,000 – 99,999)	-2.10	-5.21
locality size (2,500 – 14,999)	-1.52	-2.77