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Are Remittances a Substitute for Credit? Carrying the Financial Burden of Health Shocks in National and Transnational Households

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Abstract

The assumption that remittances are a substitute for credit has been an implicit or explicit theoretical foundation of many empirical studies on remittances. This paper directly tests this assumption by comparing the response to health-related shocks among national and transnational households using panel data from Mexico for 2002 and 2005. While the occurrence of serious health shocks that required hospital treatment doubled the average debt burden of exposed households compared to the control group, households with nuclear family members (a parent, child, or spouse) in the US did not increase their debts due to health shocks. This finding is consistent with the view that remittances respond to households' demand for financing emergencies and make them less reliant on debt-financing.

JEL Classification: F24, D14, I15, O12

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I. Introduction and related literature

Vulnerability to poverty depends, to a large to degree, on the household's ability to insure against and to cope with shocks (e.g. Kochar, 1995). Formal and informal borrowing has been shown to be a key instrument used by households to cover liquidity shortages in cases of idiosyncratic shocks, such as health-related shocks. In a quasi-experimental setting of bus accidents in India, Mohanan (2011), for example, finds that debt was the principal mechanism used by households to mitigate the shock's effects while consumption was smoothed quite well. Although taking up debt may be chosen by households to avoid other, eventually more harmful strategies to cope with such events, like the sale of assets, work more, take children out of school, or cut investment spending (Beegle, Dehejia, & Gatti, 2006; Gertler, Levine, & Moretti, 2009; Guarcello, Mealli, & Rosati, 2009; specifically on health shocks: Islam & Maitra, 2011; Jacoby & Skoufias, 1997), the financing of health care expenditures through debt can also create large and lasting financial burdens for households (Damme, Leemput, Por, Hardeman, & Meessen, 2004).

This paper's hypothesis is that remittances – the money sent home by migrants – function as a substitute for credit when households face liquidity shortages. The New Economics of Labor Migration (e.g. Stark & Bloom, 1985; Rosenzweig & Stark, 1989; Lucas & Stark, 1985) has described international migration as a household strategy of reducing vulnerability to negative shocks through the diversification of household income. Remittances provide an insurance function to the family staying behind and, from the perspective of the transnational household, can be considered a return on the cost of sending family members abroad. Building on these insights, many empirical studies have since confirmed that remittances follow altruistic motives and increase in the case of negative events (e.g. Agarwal & Horowitz, 2002; Gubert, 2002; Yang, 2008; Yang & Choi, 2007). Because the migrant's income earned abroad is usually not hit by the same shocks as the family income at home, remittances have even been found to reduce vulnerability to large covariate shocks like economic crises and natural disasters (Yang, 2008; Yang & Choi, 2007), where local insurance systems provide only limited protection (Carter, 1997; Dercon & Krishnan, 2000).

Although I am not aware of studies that directly test whether remittances and credits function as substitutes for credit, several studies implicitly or explicitly build on this assumption. Different behavior of spending by remittance-receiving households is often explained within a theoretical framework of imperfect credit markets, where remittances help poor households overcome liquidity constraints that restrict investment in human or physical capital (e.g. Calero, Bedi, & Sparrow, 2009; Taylor & Wyatt, T.J., 1996). More explicitly, Woodruff and Zenteno (2007) refer to the substitution between remittances and credit as an explanation for their empirical findings that credit-constrained Mexican microenterprises with transnational ties invest more than micro entrepreneurs without such ties. Along a similar line of argument, Giuliano and Ruiz-Arranz (2009) find a larger impact on growth in countries with low levels of financial development because – as they argue –, remittances can substitute for the lack of access to credit and enable households and enterprises to increase their investment in human and physical capital in countries with larger credit constraints, which translates into higher growth. Finally, recent research has investigated the impact of remittances on the financial sector and found that remittances had an impact on savings, but ambiguous evidence on the use of loans (Aggarwal, Demirgüç-Kunt, & Martinez Peria, 2010; Anzoategui, Demirgüç-Kunt, & Martinez Peria, 2011; Demirgüç-Kunt, López Córdova, Martinez Pería, & Woodruff, 2011), indicating that remittances may relax liquidity constraints among receiving households that then reduces their demand for credit.

This paper uses Mexican household panel data to answer the question of whether remittances and credits are substitutes for each other. The empirical strategy consists in studying the effect of health-related shocks that create a demand for finance among exposed households; and to compare the effect of these events on the debt levels of national and transnational households. The hypothesis is that households with close transnational ties were less prone to increased levels of indebtedness when they faced health shocks because they were able to cover liquidity shortages caused by catastrophic events through remittances. This research contributes to the existing literature in several ways. First, although liquidity constraints have been the theoretical underpinning of many empirical studies on remittances, to my knowledge, no studies have directly tested whether remittances and credit function as substitutes or as ‘functional equivalents’ of each other. Authors who have explicitly asked

whether remittances compensate for a lack of access to credit (Giuliano & Ruiz-Arranz, 2009; Woodruff & Zenteno, 2007) explained indirect outcomes such as investment, profit, and growth via an alleviation of capital constraints due to remittances, but have not directly studied the substitution of loans. Moreover, these studies have focused on productive credit. For households, the financing of liquidity shortages due to negative events such as health shocks may be just as important.

Second, up until the present, migration and remittances have almost exclusively been studied as causally linked to health spending (Amuedo-Dorantes & Pozo, 2009; Amuedo-Dorantes, Sainz, & Pozo, 2007; Valero & de Lourdes Treviño, 2010) or health indicators (López-Córdova, 2005; Frank & Hummer, 2002; Zhunio, Vishwasrao, & Chiang, 2012; Hildebrandt & McKenzie, 2005; Kanaiaupuni & Donato, 1999). In fact, increased health spending may not (only) be a voluntary household choice of human capital investment driven by changes in income composition or by migrants' influence on income allocation decisions, as argued by these authors;[1] rather, increased health spending caused by health shocks may create demand for alternative financial sources like credit or remittances by liquidity-constrained households. In this paper, support is given to a perspective based on the insights of the New Economics of Labor Migration where remittances respond to the need of transnational families to finance emergencies, therefore reducing a household's need to rely on debt-financing.

The impact of health-related shocks on debt levels in national and transnational households is empirically studied with reference to Mexico, which provides a suitable case study for two reasons. First, despite the existence of a public health system in

[1] Beyond the direct income effect of remittances, which increases living standards and may translate into better sanitary conditions (Hildebrandt & McKenzie, 2005, p. 278; e.g. López-Córdova, 2005), two types of arguments are given as explanations for remittances' effect on health, even when controlling for income. The first type of argument postulates that remittances are used differently than other regular household income because they are perceived as non-permanent by receiving households. Building on the Friedman's life-cycle hypothesis (1957), these authors assume that the propensity to save (or to accumulate assets, e.g. to invest in human capital like health and education) is higher for income from transitory sources (Adams & Cuecuecha, 2010; Amuedo-Dorantes & Pozo, 2009, p. 71). The second argument is related to decision-making processes in transnational households, assuming that migrants have a say on how remittances are spent and prioritize health-related spending over other uses (e.g. Valero & de Lourdes Treviño, 2010, p. 213) or transmit 'health knowledge' (e.g. Frank & Hummer, 2002; Hildebrandt & McKenzie, 2005, p. 278f) to their families. This type of argument – and either the positive or negative effects of migration on health – can be framed within sociological theories on 'social remittances' (Levitt, 1998).

Mexico, its coverage is limited, with about half of the population being uninsured in 2002 (cp. Amuedo-Dorantes & Pozo, 2009, p. 74; Secretaría de Salud, 2002). Those that are not employed in the formal sector (the informal, self-employed, or unemployed population) are especially at risk, as they only receive incomplete public health care.[2] Moreover, even when they have access to basic health care, the informal or self-employed are usually not insured against the indirect effects of health shocks, such as an inability to work. In Mexico, many families face economic ruin and poverty as a consequence of financing their own health care (Felicia Marie Knaul et al., 2006) due to the immediate costs of treatment and medicine, but also due to secondary costs related, for example, to the loss or reduction of income from work. Second, many Mexican households have close transnational ties with the US and Mexican migration to the US has long historical roots (Durand, Massey, & Parrado, 1999). Emigration rates increased strongly in the 1990s and 2000s despite the US' stricter immigration rules and border enforcement policies. In 2009, an estimated 11.4 million Mexican-born immigrants (ca. 10% of the population of Mexico) lived in the US, about half of them without legal documents (Pew Hispanic Center, 2009). Mexico is one of the main receivers of remittances in absolute terms worldwide, with about 22 billion USD in 2009, after India and China (World Bank, 2011), and remittances contributed to 2.5% of GDP (ibid.), with an estimated 6% of all Mexican households receiving remittances in 2002 (Esquivel & Huerta-Pineda, 2007).

The rest of the paper is organized as follows: The following section (section II) describes the data and explains the econometric strategy, where the effect of health shocks on a change in debt burden is estimated on a dataset of treated households (exposed to health shocks) that where matched to households from the control group (unexposed to health shocks). Section III presents the main results. Health shocks in general have an important effect on a change in debt burdens, but not for households with nuclear family members (a parent, child, or spouse) in the US. Section IV draws conclusions from the findings and addresses open research questions.

[2] Although a 2004 reform of the health system aimed at more universal coverage and opened access to the informally employed via the Popular Health Insurance program "seguro popular" (Felicia Maria Knaul & Frenk, 2005)

II. Model specification and data description

Data for the empirical analysis comes from the Mexican Family Life Survey (MxFLS), a panel data survey carried out jointly by the *Centro de Investigación y Docencia Económica* (Center for Research and Teaching in Economics, CIDE) and the *Universidad Iberoamericana* in Mexico City. As a multi-thematic database, the MxFLS combines information on household finance with migration histories and a large number of additional socioeconomic characteristics of households and individuals, next to a book with community level data. The MxFLS is a nationally representative sample of households that were selected under criteria considering national, urban-rural, and regional representations on pre-established demographic and economic variables undertaken by the National Institute of Geography, Statistics, and Information (*Instituto Nacional de Estadística, Geografía e Informática* INEGI). The approximate sampling size is 8,440 households with approximately 35,000 individual interviews in 150 communities throughout the Mexican Republic. Out of a total of four survey rounds that are planned through 2012, survey results for 2002 and 2005 are available at the time of writing. The same households in the MxFLS are followed over time so that changes across time can be observed for each household, while the empirical analysis below uses data from the 7,558 households where information on health shocks and debt were observed at both time periods.

The effect of health shocks on household debt as a function of their transnational family ties are estimated through ordinary least squares (OLS), with a difference-in-difference equation (Ashenfelter & Card, 1985) of the following basic form:

$$\Delta DBT_i = \beta_1 SHK_i + \beta_2 SHK_i * TRN_i + \beta_3 X_{i,2002} + u_i,$$

where ΔDBT is the dependent variable and stands for the change in debt burden of household i between 2002 and 2005. SHK is a binary treatment variable that takes the value "1" when a health shock occurred in household i during the same time period. TRN is a second binary variable that stands for transnational family linkages of household i. Interacting the two dummy variables SHK and TRN allows for an estimation of different coefficients for health shocks for households with or without

transnational linkages, while X is a matrix of pre-shock control variables for household i in 2002, β are the estimated coefficients, and u is the usual error term.

The dependent variable of interest, ΔDBT (the change in debt burden of households between 2002 and 2005), is measured in units (as a share) of total monthly household consumption. Scaling household debt in this way has several advantages compared to an indicator that measures debt in absolute amounts. First, it automatically weights household debts to the income position and paying capacities of households. One and the same amount of debt may be of a lighter burden for wealthier households (proxied by consumption levels) than for poorer households. Second, measuring the debt burden of households in units of monthly household consumption automatically takes into account the differences in household sizes and their changes, and automatically corrects for changes in average price levels. Finally, the results can be interpreted more easily and their magnitudes can be understood more intuitively than a monetary value that gains meaning only in relation to its purchasing power in a specific context. It is important to note that debt as reported by households do not necessarily refer to formal credit. Many households have debt with family members outside the household, friends, colleagues, moneylenders, pawnshops, etc. Here, the definition for the existence of household debt is a monetary obligation to pay back the loan and not its origin from a financial institution or other sources. Households are asked whether they owe money and how much, independently of its source.

The variable on health shocks SHK refers to households where at least one household member suffered a serious disease or accident that required hospital treatment, with 648 households reporting the occurrence of such an event by at least one household member between 2002 and 2005 (around 9% of all households). Beyond the direct costs of medical treatment, such events potentially have a strong impact on the household economy, for example through the disruption of work activity or long-term care for the affected.

Transnational household links, TRN, are defined as the existence of familial relationships in the US and are used as a proxy for access to remittances because close family relationships across borders have been identified as a good predictor for receiving remittances in a large number of studies (cp. Carling, 2008, p. 588). Moreover, many other variables that were found to be correlated with remittance-sending behavior, such as gender and time spent abroad, may actually reflect

transnational parental relationships and often separation from a couple (ibid.) Studies that have controlled for kinship variables have found time spent abroad to be insignificant (Merkle and Zimmermann, 1992; Goza and Marteleto, 1998), suggesting that it is not time spent abroad *per se* that matters, but the fact that migrants are often separated from family members at the initial stages of the migration process and reunify with their families in later stages. However, transnational ties may be of different intensity and not all households with transnational ties necessarily receive financial support. In Mexico, the share of households that regularly receives remittances from their relatives in the US was estimated to lie at around 6% in 2002 (Esquivel & Huerta-Pineda, 2007). In addition to these, households that that do not receive remittances on a regular basis might eventually receive special-event-transfers in order to cover emergency expenditures, such as medical care. For the present purpose, the criterion is a theoretical access to remittances and the existence of transnational (monetary) support systems within families, although this group is larger than those that receive remittances on a regular basis.

Monetary support mechanisms are plausibly stronger among close relatives from the nuclear family (parents, children, and couples) compared to more distant relatives (grandparents, grandchildren, cousins, uncles/aunts, nephews, nieces, parents-in-law, brothers-in-law, etc.) (e.g. Rodriguez, 1996). According to the MxFLS, almost one out of two Mexican households had a transnational family link in 2005 (46% of all households), defined broadly as those households where at least one household member had a relative living in the US. In 18% of all households, a member of the nuclear family (a, parent, child or spouse) lived in the US.[3] The data refers to transnational family linkages in 2005 because the interest lies in those households that were, at least in principle, able to receive remittances in 2005, *after* health shocks occurred.

The validity of the empirical model is based on two assumptions: First, a general concern in estimating causal effects in the social sciences is that 'treatment'

[3] The small group size prevented me from further disaggregating groups and comparing the strength of different kinds of parental ties within these groups. Moreover, groups were often overlapping because many households had more than one family member in the US. For example, excluding spouses from the definition of nuclear family members hardly made a difference because most households that had a spouse in the US also had a parent or child abroad.

conditions are often not applied randomly, but units of observations (in this case, households) self-select into groups of treatment or groups of control. Households that suffer from health shocks may on average be different from 'healthier' households in several ways: For example, they may differ in poverty and income levels, insurance coverage, age structures, and access to health infrastructure, among other things. The data allows taking into account these systematic differences across groups before they suffer a health shock and to control for the confounding covariates, which are correlated with both the occurrence of health shocks as well as with a change in their debt levels. The vector X in the equation above includes a number of pre-shock control variables for 2002 that are correlated with either the occurrence of health shocks or a change in debt levels between 2002 and 2005 (or both). Under the assumption of 'ignorability of treatment assignment' or 'selection on observables', the distribution across the treatment and control groups is therefore random with respect to outcomes, conditional on these confounding covariates (Rubin, 1974; cp. Gelman & Hill, 2006, p. 183ff). Second, according to Rosenbaum (1984), conditioning on post-treatment variables that have been affected by treatment leads to biased estimates of the treatment effect. Interacting health shocks with transnational family linkages in 2005 controls for a variable that could, in principle, be affected by treatment, either in a positive or negative way: For example, disease or accidents in the household could prevent family members from migrating because the physical presence of household members is required to take care of relatives or because the costs of health care undermine the financing of any possible migration. On the other hand, migration could also be an ex-post coping strategy by households and therefore increase with health shocks. The assumption that the transnational status of households was not affected by the occurrence of health shocks can be tested directly from the data by running a regression of health shocks on the existence of transnational linkages in 2005.

In order to validate the robustness of the results, the regression as described in the formula above is also run on a balanced dataset of 1,292 households that contains only those households from the control group that are, on average, very similar to the treatment group on a broad set of pre-treatment indicators, while other households are disregarded in the statistical analysis. Even when observable pre-treatment characteristics can be controlled for, the estimation of the treatment effects can still be

biased, either when the distribution of variables differs strongly between groups of treatment and control cases (imbalance, see King & Zeng, 2006) or when several variables have to be controlled for on many different dimensions, which makes it difficult to create comparable groups (Rosenbaum & Rubin, 1983). In order to minimize bias that may result from an imbalance and lack of common support, a propensity score is created for each household through logistic regression on pre-treatment characteristics describing the probability of suffering from a health shock between 2002 and 2005 (Rosenbaum & Rubin, 1983; cp. Gelman & Hill, 2006, p. 183f). This one-score summary is then used to find the nearest match from the control group for each of the 646 households from the treatment group.

Table 1 gives an overview of all variables that were finally used in the analysis, either for matching households that were exposed to health shocks with comparable households from the control groups or as pre-treatment controls in the main regression. Variables refer to socioeconomic household characteristics, such as per capita consumption, household size, age, and working activity of the household's head. The model also accounts for initial debt levels, whether households know a person or institution where they could obtain a loan, and the history of health-related and other kinds of shocks suffered by households. A different set of variables is related to the location of households: Whether households lived in a rural community with less than 2,000 habitants, whether the community had health facilities, and whether credit opportunities (from bank or non-bank institutions) were available in the community. For additional details, definitions of variables, and descriptive statistics, see Table 1.

Table 1: Variables and Data Description

variable name	variable description	mean (share)	sd	number of obs.
dependent (outcome) variable				
change in debt burden	change in household debt between 2002 and 2005, measured in units of total monthly household consumption	0.00 *[0.52]*	7.07 *[6.40]*	7,558 *[1,292]*
treatment variable				
health shock	binary variable whether accident or disease by a household member occurred between 2002 and 2005 that required hospitalization	8.5% *[50%]*		7,558 *[1,292]*
transnational household links				
any relatives	at least one household member has a relative in the US (child, parent, sibling, spouse, grandparent/child, aunt/uncle, cousins, brothers/sisters in-law, parents in-law, etc.) in 2005	45.6% *[43.8%]*		7,558 *[1,292]*
nuclear family	at least one household member has either a parent, child, or spouse in the US in 2005	17.8% *[17.1%]*		7,558 *[1,292]*
control and matching variables: Pre-treatment household characteristics (2002)				
shock history	binary variable whether any shock – health shocks or other shocks (loss of job, business failure, natural disasters, crop loss, etc.) – occurred during the previous 5 years	30.5% *[34.2%]*		7,558 *[1,292]*
initial debt burden	household debt level, measured in units of total household consumption	1.08 *[0.92]*	4.76 *[3.64]*	7,558 *[1,292]*
per capita consumption	monthly per capita consumption, in Mexican pesos	1,148 *[1,086]*	1,601 *[1,466]*	7,558 *[1,292]*
household size	total number of household members	4.29 *[4.56]*	2.06 *[2.14]*	7,558 *[1,292]*
working	binary variable whether head of household is earning income from work or business	80.2% *[83.0%]*		7,558 *[1,292]*
borrowing options	binary variable whether at least one household member knows a person or an institution where he/she could obtain a loan	55.0% *[60.4%]*		7,558 *[1,292]*

Table 1: Variables and Data Description - Continued

variable name	variable description	mean (share)	sd	number of obs.
age	age of the head of household	48.11 *[48.07]*	15.58 *[15.02]*	7,558 *[1,292]*
control and matching variables: Community characteristics				
rural	binary variable that takes the value "1" for households that live in communities with less than 2,000 inhabitants	42.5% *[41.5%]*		7,558 *[1,292]*
credit opportunities	binary variable that takes the value "1" for communities with loan facilities (bank or non-bank institutions)	59.0% *[61.8%]*		7,558 *[1,292]*
health facilities	binary variable that takes the value "1" for communities with health facilities	57.8% *[54.9%]*		7,558 *[1,292]*

Missing data on the covariates have been imputed using the 'mice' package (Buuren & Groothuis-Oudshoorn, 2010, written for the statistical software R). Values in squared brackets refer to the matched data. The most extreme values of the dependent variable for a change in debt burden (ten households, or about 0.13% of the total sample) with a change in debt burden above/below 70 times the value of total household consumption were deleted. The estimated results were very sensitive to these outliers arising from very low consumption values together with moderate-to-high absolute debt levels. These were of low reliability because slight changes either in the denominator or the numerator strongly affected the size of the indicator.

III. Results

In order to ensure that the interaction term on a post-treatment variable (transnational family links) does not bias the results, the effect of health shocks on a change in transnational family linkages was tested using a logit regression model with the same pre-treatment variables as regressors that are included in the main model of health shocks on a change in debt burdens. Changes in transnational status can occur in two ways: Households without transnational links may turn into transnational households through emigration; or formerly transnational households did not anymore report relatives in the US in 2005, either because temporary migrants returned, or because household member(s) who formerly reported family links abroad are not members of the household anymore (for example, because they migrated as well, or left the households for other reasons). In order to be able to run logistic regressions of the effect of health shocks on changes of transnational status of households, changes in this binary dependent variable are split into positive and negative outcomes. Table 2 shows results for four different definitions of the outcome variable (positive/negative changes for households reporting any relative living in the US; and positive/negative changes for households reporting the existence of a nuclear family member – parent, child or spouse - in the US). Health shocks had neither a statistically significant effect on the broad definition of transnational households (any relative in the US) nor on the more narrow definition (parents, children and spouses). Based on the Chi^2 test statistics from log likelihood ratio tests, the Null Hypothesis, that the occurrence of health shocks had no effect on transnational links, could not be rejected in any of the four specifications. Following Rosenbaum (1984), the inclusion of an interaction term between health shocks and transnational family links in 2005 in the main model should therefore not bias the results.

In contrast to the model fitted to the complete dataset, the model was also run on the subset of matched data with only exposed and unexposed households that were, on average, the most similar to each other on a broad set of pre-shock indicators. Logistic regression on the occurrence of health shocks was used to find a matching subset of the data that provided a good balance between exposed and unexposed households on key characteristics that are expected to predict both the occurrence of health shocks as

well as a change in debt burdens. The adequacy of the model was assessed by evaluating the balance that resulted from matching based on the propensity scores as estimated from the logistic regression. The regression model that was finally used for the creation of a matched sample is given in Annex 1, using nearest-neighbor matching.[4] Figure 1 graphically compares standardized differences between exposed and unexposed households for the matched and unmatched data. The matching resulted in an improvement in the balance, especially for those variables that differed the most between exposed and unexposed households, notably the share of household members covered by medical insurance, the existence of health facilities in the community, household size, and the number of children relative to household size.

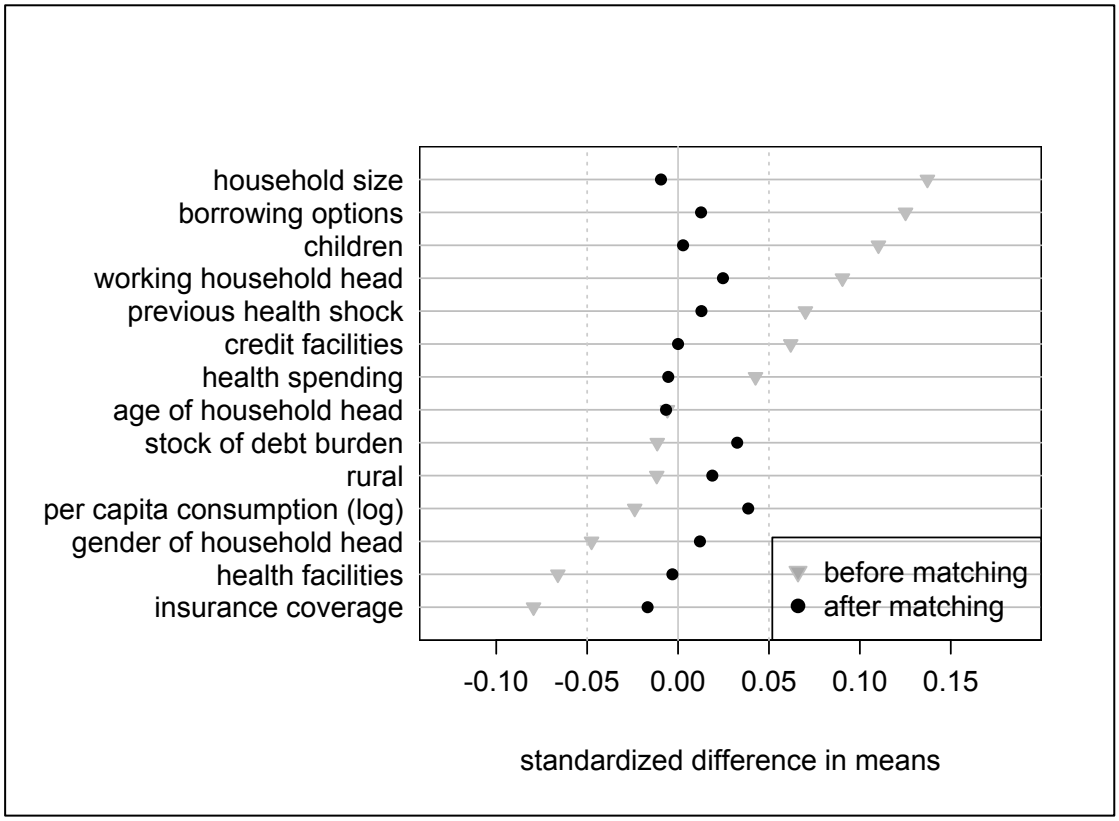
[4] The function 'matching' from the package 'arm' was used for the matching (Gelman et al., 2010, written for the statistical software R)

Table 2: Logit Regression for the Effect of Health Shocks on a Change in Transnational Status

	positive change in transnational family status		*negative change in transnational family status*	
	nuclear family	*any relative*	*nuclear family*	*any relative*
	I	II	III	IV
(Intercept)	-4.855***	-3.625***	-0.963*	0.27
	[0.678]	*[0.422]*	*[0.577]*	*[0.425]*
health shock between 2002 and 2005	-0.087	-0.009	-0.066	0.035
	[0.176]	*[0.113]*	*[0.156]*	*[0.116]*
shock history (pre 2002)	0.163	0.099	0.074	-0.071
	[0.1]	*[0.066]*	*[0.094]*	*[0.075]*
debt burden (2002)	0.021	0.022*	0.015	0.009
	[0.017]	*[0.013]*	*[0.019]*	*[0.015]*
debt burden^2 (2002)	-1.78E-04	-2.90E-04	-3.05E-04	-1.85E-04
	[2.74E-04]	*[2.35E-04]*	*[3.88E-04]*	*[2.67E-04]*
log of per capita consumption (2002)	0.059	0.125***	-0.241***	-0.113***
	[0.053]	*[0.035]*	*[0.049]*	*[0.038]*
age (2002)	0.016***	0.002	0.004	-0.006***
	[0.003]	*[0.002]*	*[0.003]*	*[0.002]*
working (2002)	-0.667***	-0.102	-0.124	0.111
	[0.114]	*[0.087]*	*[0.116]*	*[0.098]*
rural	0.211**	-0.324***	0.112	-0.175**
	[0.101]	*[0.068]*	*[0.093]*	*[0.073]*
borrowing options (2002)	0.07	0.205***	0.09	-0.226***
	[0.098]	*[0.064]*	*[0.09]*	*[0.069]*
state fixed effects	*(yes)*	*(yes)*	*(yes)*	*(yes)*
residual deviance	*3541*	*6896*	*4036*	*6063*
degrees of freedom	*7533*	*7533*	*7533*	*7533*
AIC	*3591*	*6946*	*4086*	*6113*
log likelihood test Chi^2	*0.247*	*0.007*	*0.182*	*0.091*
(p - value)	*(0.619)*	*(0.934)*	*(0.67)*	*(0.763)*

Dependent variables are measured as positive/negative changes in transnational status of households. A log-likelihood test is run against the Null Hypothesis that excluding health shocks from the regression has no effect on the results, given all the predictor variables used in specification III in Table 3a. The low Chi^2 (and high p-values) in all specifications do not justify a rejection of the Null Hypothesis. Standard errors are given in square brackets. Stars denote significance at 1% (***), 5% (**) and 10% (*).

Figure 1: Standardized Differences in Pre-Treatment Means Compared to the Control Group for Matched and Unmatched Data



The figure shows the differences between households from the treatment and control groups in units of standard deviations to make them comparable before and after nearest-neighbor matching based on the logistic regression in Annex 1 is carried out. The balance (here shown as standardized differences on the means) improved after matching for most of the variables, especially for those variables with the largest imbalance before matching. The variable 'children' refers to the number of children below the age of 17 relative to household size; 'insurance' coverage refers to the share of household members covered by medical insurances; and 'health spending' refers to spending on health as a share of total household spending. Further details on variables that are not in Table 1 are available from the author upon request. The graphical representation is inspired by Gelman and Hill (2006, p. 202).

Tables 3a and 3b present the results for the main model of health shocks on a change in debt burdens of households for alternative specifications on the complete and matched data. In both tables, Columns I and II report the average estimated effect of health shocks on a change in debt burdens for all households, without considering the existence of transnational links. The coefficient for health shocks is significantly different from zero at a 1% level in all specifications. However, the model without any controls (Column I) has a low R^2, indicating that health shocks alone explain only a relatively small part of the variation of the change in debt burdens.

In both the matched and unmatched specifications of the model, adding pre-treatment control variables improved the model's fit, as indicated by the higher R^2. In both cases, income levels (proxied by the log of per capita consumption), initial debt levels, and whether households were located in rural areas were important predictors for a change in debt burdens in the following period. Households with older household heads also had, on average, increased their debt burden less compared to households headed by younger individuals, everything else being equal. Households with high debt burdens in 2002 had a higher probability of reducing their debt burden between 2002 and 2005. The significance of the squared term for the stock of debt burdens points to a non-linear relationship between the initial level of debt and a change in debt levels between 2002 and 2005. The model's fit also improved by including state fixed effects that account for differences across states that are not captured by individual variables, such as different growth rates across states or other regional effects, while the matched and unmatched model specifications differ on some of the control variables. In the specification fitted to the matched data, the size of households was controlled for, with smaller households having a higher probability of increasing their debt burden in the following period. In the model on the complete data, the existence of borrowing options in 2002 was an important predictor. The shock history of households prior to 2002, and whether the household's head was gaining income from work or business, were not individually significant in this specification on the whole data set, but did improve the overall fit of the model.

All specifications led to similar magnitudes and significance levels for the coefficient on health shocks. With an estimated coefficient around one when controlling for pre-treatment differences (Column II), the effect is sizeable and statistically significant. In 2002, the average debt burden across all households was 1.1 times the total monthly

household consumption (or about 0.9 times the value of total household consumption for the matched data). This means that, for the average household, the occurrence of a serious health shock doubled the average expected debt burden of households compared to the control group of households that were not exposed to health shocks in the same time period. This confirms previous findings from the literature that taking up loans is an important mechanism for coping with health shocks (e.g. Mohanan, 2011).

This paper's main interest (and its novel contribution) lies on the interaction term of health shocks with transnational family linkages. The coefficient on the interaction term informs whether the change in debt burdens among households with a transnational family link was affected differently by shocks compared to households without such links. Columns III and IV include interaction terms between health shocks on two alternative definitions of transnational household links based on the classification of family relationships in section II: The interaction term on transnational linkages in 2005 in Column III is defined as a binary variable based on whether households had a nuclear family member in the US (either a parent, child, or spouse). The interaction term in Column IV is based on the broadest possible definition of transnational family links, defined as the existence of any kind of family linkages by at least one household member, including siblings, uncles/aunts, grandparents and – children, cousins, etc. While interactions on the broader definitions of transnational households are not significantly different from zero and have the expected sign only in the specification on the unmatched data, the interaction on the narrowly defined transnational links (parent, child, or spouse) in Column III is important in size and is significant in both the matched and unmatched specifications (at a 5% level for the matched data and at a 1% level when fitted to the complete dataset). The results show that households with a member of the nuclear family – a parent, child, or spouse – in the US are much less vulnerable to the effects of health shocks on a change in their debt burdens. Taking into account uncertainty around the point estimate, health shock had basically no effect on a change in debt burdens among households with nuclear family members in the US when compared to an effect between 1.2 (matched data) and 1.3 (unmatched data) for households without nuclear family members in the US. The size and significance of the estimated effect of health shocks and its interaction term with transnational family links did not differ

strongly between the matched and unmatched version of the data. This is not surprising, since imbalances between exposed and unexposed households were not huge. The slightly more conservative estimates from the matched data are, however, preferred over the unmatched model because they rely on a comparison of the most similar households.

Figure 2 graphically compares the effect of health shocks on a change in debt burdens for households with and without nuclear family members in the US, fixing all other covariates at their median values. Estimates are graphed both for the estimations based on the complete dataset (upper graphs, based on specification III in Table 3a) as well as on the matched dataset (lower graphs, based on specification III in Table 3b). In order to picture uncertainties around the estimate, 100 random simulation draws from the estimation have been added to the plot (grey lines). Despite considerable uncertainty reflected in a large range of simulated values (especially for the intercept that is estimated from the matched data with fewer observations), the picture shows clearly distinct patterns for the slope in households with and without nuclear family members in the US.

Results were robust to different specifications, matching procedures, and data definitions. Alternative matching procedures gave similar results (with some variation on the significance levels of health shocks; and on their interaction with transnational status). In general, excluding the most extreme outliers in the dependent variables made the results more robust across different types of specifications and matching procedures. Results were also robust to different definitions of the dependent variable. Alternative specifications included measuring the debt burden in absolute amounts without adjusting for household income, measuring debt burden in per capita units, or measuring the debt burden in units of monthly food consumption instead of total consumption in order to avoid distortions that could arise through large one-time purchases during the observed period. The effect of health shocks was least robust for the indicator on the absolute (unscaled) amount of debt. The specifications shown in Tables 3a and 3b reflect the best fits, evaluated via the significance of the variables and the R^2 value.

Table 3a: Estimated Effect of Health Shocks on a Household's Change in Debt Burden (Unmatched Data)

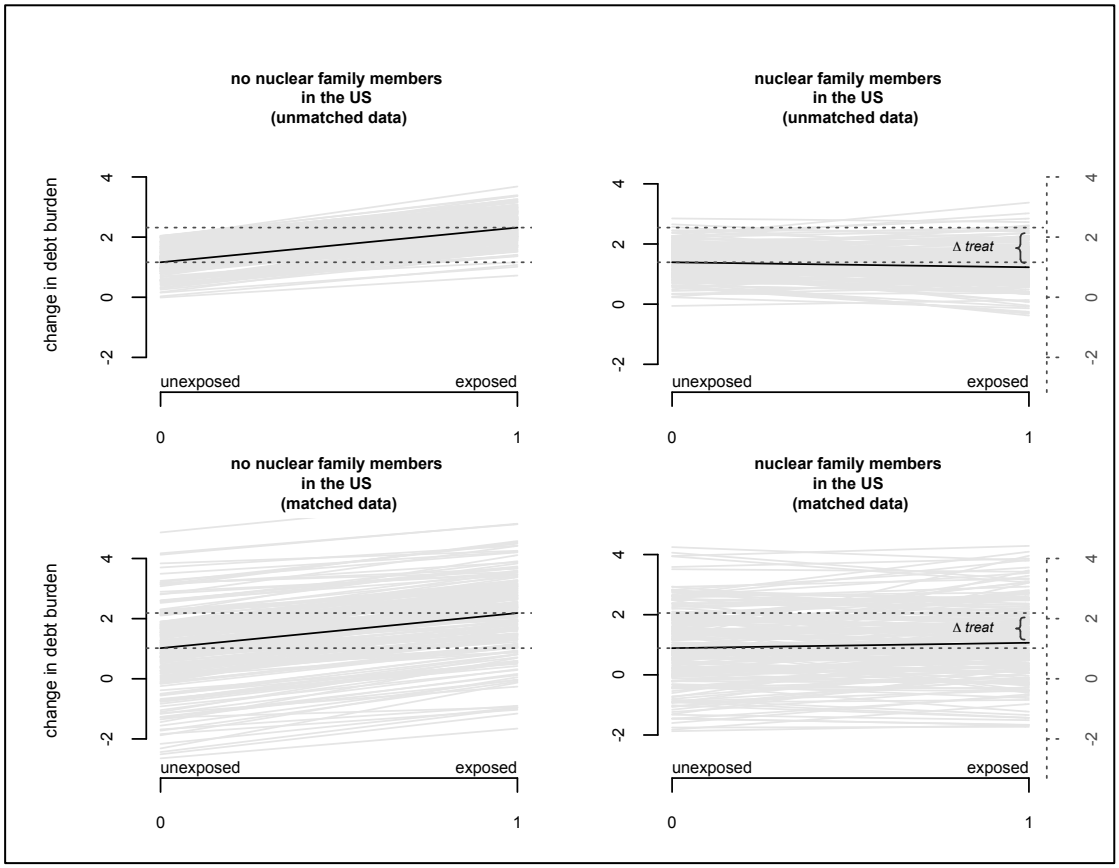
		no controls	*pre-treatment controls*		
				interaction on transnational links	
				nuclear family	*any relatives*
		I	*II*	*III*	*V*
	(Intercept)	-0.11	1.061**	1.042**	0.918**
		[0.076]	*[0.432]*	*[0.434]*	*[0.446]*
	transnational family link			0.136	0.307**
				[0.142]	*[0.124]*
treatment	health shock	1.202***	1.025***	1.259***	1.34***
		[0.316]	*[0.285]*	*[0.343]*	*[0.466]*
	health shock* transnational link			-1.246***	-0.651
				[0.449]	*[0.571]*
pre-treatment (2002) control variables	log of per capita consumption		0.185**	0.184**	0.181**
			[0.086]	*[0.086]*	*[0.086]*
	shock history		-0.145	-0.144	-0.146
			[0.118]	*[0.118]*	*[0.117]*
	initial debt burden		-0.871***	-0.87***	-0.871***
			[0.062]	*[0.062]*	*[0.062]*
	initital debt burden ^2		-0.001	-0.001	-0.001
			[0.001]	*[0.001]*	*[0.001]*
	age of household head		-0.011***	-0.012***	-0.011***
			[0.004]	*[0.004]*	*[0.004]*
	working household head		0.207	0.207	0.207
			[0.133]	*[0.133]*	*[0.133]*
	borrowing options		0.239**	0.239**	0.225*
			[0.115]	*[0.115]*	*[0.116]*
	rural		-0.479***	-0.484***	-0.488***
			[0.112]	*[0.111]*	*[0.112]*
	state fixed effects	*(no)*	*(yes)*	*(yes)*	*(yes)*
	R^2	*0.003*	*0.394*	*0.395*	*0.395*
	adj. R^2	*0.003*	*0.392*	*0.392*	*0.393*
	degrees of freedom	*7270*	*7247*	*7245*	*7245*

Table 3b: Estimated Effect of Health Shocks on a Household's Change in Debt Burden (Matched Data)

		no controls	*pre-treatment controls*		
				Interaction on transnational links	
				nuclear family	*any relatives*
		I	*II*	*III*	*V*
	(Intercept)	-0.042	0.33	0.113	0.437
		[0.195]	*[1]*	*[1.024]*	*[0.992]*
	transnational family link			-0.131	-0.524
				[0.279]	*[0.347]*
treatment	health shock	1.116***	0.994***	1.168***	1.02**
		[0.355]	*[0.28]*	*[0.333]*	*[0.439]*
	health shock* transnational link			-0.989**	0.011
				[0.496]	*[0.605]*
pre-treatment (2002) control variables	log of per capita consumption		0.511***	0.507***	0.532***
			[0.167]	*[0.167]*	*[0.168]*
	initial debt burden		-0.671***	-0.67***	-0.669***
			[0.156]	*[0.156]*	*[0.155]*
	initital debt burden ^2		-0.005**	-0.005**	-0.005**
			[0.003]	*[0.003]*	*[0.003]*
	age of household head		-0.025***	-0.023***	-0.026***
			[0.008]	*[0.008]*	*[0.008]*
	household size		0.172*	0.18*	0.187**
			[0.093]	*[0.093]*	*[0.095]*
	rural		-0.707**	-0.677**	-0.692**
			[0.307]	*[0.303]*	*[0.304]*
	state fixed effects	*(no)*	*(yes)*	*(yes)*	*(yes)*
	R^2	*0.008*	*0.279*	*0.281*	*0.28*
	adj. R^2	*0.007*	*0.266*	*0.267*	*0.266*
	degrees of freedom	*1290*	*1269*	*1267*	*1267*

Table 3a gives the estimation results for the complete dataset and Table 3b gives the estimation results for the dataset containing matched households only. Heteroscedastic robust White standard errors are given in squared brackets. Stars denote significance at 1% (***), 5% (**) and 10% (*). For the definition of transnational links, see Table 1.

Figure 2: Estimated Effect of Health Shocks on a Household's Change in Debt Burden with or without nuclear family members in the US



The plots graphically compare the effect of health shocks on a change in debt burden for households with and without nuclear family members (a parent, child, or spouse) in the US. Estimates are given for the complete and matched data based on specifications III in Tables 3a and 3b, fixing all pre-treatment covariates at their median values. Grey lines represent uncertainty around the coefficient on health shocks and the intercept by randomly drawing 100 simulations from the model predictions, using the function 'sim' from the package 'arm' (Gelman et al., 2010, written for the statistical software R). Vertical axes (change in debt burdens) have (slightly) different scales due to different intercepts for households with and without transnational linkages. Dotted horizontal lines have been added to the graph in order to highlight the difference of the estimated average treatment effect for households with and without nuclear family members in the US, corresponding to the distance $\Delta\, treat$. *In spite of considerable uncertainty in the estimates as reflected in the random simulation draws, the graphs clearly show different patterns for the slopes in households with and without nuclear family members in the US.*

IV. Conclusions

The empirical results from this study add evidence to previous research that debt is an important mechanism to cope with health-related shocks. Households having experienced serious health shocks that required hospital treatment reported, on average, a doubling of their debt burden compared to households from the control group, controlling for pre-treatment differences across households. The findings are robust for the matching of households with the most similar households from the control group and for different definitions of the dependent variable. The large size of the effect suggests that health shocks affected household economies not only through the direct costs of health care like medication and treatment, but also through other direct and indirect costs, such as the loss of work or long-term care for the affected.

At the same time, health shocks had no effect on the debt burden of households with access to remittances via transnational family support networks (a child, parent, or spouse in the US). The observation that these households resorted less to incurring debt to finance the costs of health shocks confirms the assumption often made in the literature that remittances alleviate liquidity constraints and may therefore function as a substitute for taking up formal or informal loans. Next to many channels through which migration and remittances have an impact on receiving countries, they also reduce the dangers of indebtedness among receiving households and make them less vulnerable to the financial effects of negative shocks. This finding supports the view that remittances are driven by health shocks and help households to finance unanticipated health-related spending. This does not put into doubt that remittances also have an impact on health spending as found in previous studies, but it stresses the necessity of taking reverse causality from unexpected health costs to remittances seriously when correlations between remittances and health spending are observed. While this paper has focused on a substitution of remittances and credit to cover household emergencies, future research has to confirm whether remittances and credit are substitutes in a more general way, including, for example, entrepreneurial ('productive') credit (the argument made by Giuliano & Ruiz-Arranz, 2009; Woodruff & Zenteno, 2007).

Several lessons for policy makers can be drawn from this study. First, financial services designed for transnational households should be aware of the existence of

informal insurance arrangements among transnational households that may compete with or substitute formal schemes. While policy reports have frequently pointed to the benefits of providing remittance-receivers with access to formal financial services (GCIM, 2005; International Organization for Migration (IOM), 2006; Orozco & Fedewa, 2006; Terry, 2005; World Bank, 2006), the findings presented here would imply that transnational households have more demand for savings options compared to credit, a statement that is in line with empirical research on remittances and financial sector development (Aggarwal et al., 2010; Demirgüç-Kunt et al., 2011). Second, the findings underline a household's vulnerability to negative shocks and the importance of insurance schemes. Both the taking up of debt and the sending of family members abroad are second-best options for coping with the consequences of health shocks. Covering the financial burden of health shocks with loans bears the danger of over indebtedness and unsustainable debt spirals. On the other hand, international migration as an ex-ante coping strategy implies high economic and social costs for families in the face of stricter immigration rules in the destination countries and increased border enforcement, besides the inherent dangers of often undocumented migration. Extending formal insurance schemes could reduce both the perils of unsustainable debt burdens and the necessity of relying on migration as a strategy to cope with catastrophic health spending.

V. Literature

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VI. Annex

Annex 1: Logit Regression on the Occurrence of Health Shocks

(Intercept)	-2.908***
	[0.144]
borrowing options	0.209**
	[0.086]
debt burden	-0.004
	[0.021]
debt burden ^2	-1.07e-04
	[4.64e-04]
household size	0.051**
	[0.02]
shock history	0.14
	[0.088]
working household head	0.186*
	[0.112]
credit opportunities in locality	0.272***
	[0.098]
health facilities in locality	-0.283***
	[0.096]
residual deviance	*4378*
degrees of freedom	*7544*
AIC	*4396*

*The logistic regression on health shocks was used for matching households who suffered a health shocks during the previous three years with households from the control group. Evaluation of model fit was based on the balance achieved from matching exposed and unexposed households (see Figure 1). Standard errors are given in square brackets. Stars denote significance at 1% ("***"), 5% ("**") and 10% ("*").*

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