the review of income and wealth

Review of Income and Wealth
Series 63, Number 2, June 2017
DOI: 10.1111/roiw.12213

DO SAVINGS AND CREDIT INSTITUTIONS REDUCE VULNERABILITY? NEW EVIDENCE FROM MEXICO

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This study examines whether membership in a savings and credit society (SACP) reduces vulnerability to poverty, using a representative survey from the National Savings and Financial Services Bank. The sample of households includes those that are and are not members of a SACP during 2004–2007. This evidence indicates that membership improves income; furthermore, membership decreases the variance in annual household per capita income. Both effects reduce the probability that somebody becomes poor. Finally, the results offer support for the proposition that households that join a SACP have better abilities to smooth consumption in the face of adverse shocks, and thus are less susceptible to shocks, than do households that are not members.

JEL Codes: G11, G21, H31, I32, O16

Keywords: banking, BANSEFI, Mexico, microfinance, savings societies, vulnerability, welfare

1. Introduction

A growing body of literature focuses on the impact of microfinance on the *ex post* poverty status of households; however, a dearth of articles actually studies the role of microfinance in terms of reducing vulnerability to poverty. This gap is unfortunate, because the crucial question is whether households that are not poor now might become poor in the future or if households that are poor now will remain so in the future (Chaudhuri, Jalan and Suryahadi, 2002). In most developing countries, insurance and credit markets function poorly (Besley, 1995), making it difficult for poor households to cope with the risk of events that could push them into extreme poverty, such as illness or death, theft of assets, bad harvests, job losses, physical insecurity, weather-related events (droughts, floods, earthquakes), or economic downturns and price fluctuations (Pritchett, Suryahadi, and Sumarto, 2000; Christiaensen and Subbarao, 2005). In such circumstances, policies that seek to help households reduce their vulnerability represent important poverty-reducing strategies (Holzmann and Jørgensen, 2001).

Households' vulnerability to and risk of poverty are two related concepts. Yet there is no clear-cut definition of a vulnerable household. In a disaster risk assessment framework, vulnerability is defined in relation to hazards, such that an external hazard that acts on a vulnerable entity can lead to an undesirable outcome or disaster. In a food security context, vulnerability instead refers to the undesirable

Note: The authors thank two anonymous referees for their constructive and relevant comments.
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outcome (e.g. hunger, food insecurity, famine) that vulnerable households face (Dilley and Boudreau, 2001). Policies to reduce a household's vulnerability thus might aim to eliminate the risk factors, mitigate the household's exposure to them, or strengthen its capacity to cope with them (Christiaensen and Subbarao, 2005).

With this study, we examine the hypothesis that membership in a microfinance institution (MFI) might reduce vulnerability to poverty. We anticipate that members of MFIs use a wider range of coping strategies, including precautionary savings (liquid and non-liquid), than do comparable non-member households. These coping strategies may help smooth consumption if adverse income shocks occur. We also argue that MFI membership may induce previously unproductive household members to contribute to household income, as well as stimulate households to diversify their income sources, such as by starting up new business activities. These activities not only increase income but also reduce its variance, and both these effects should lower the probability that a household falls below the poverty line. We test the prediction that microfinance membership reduces vulnerability to poverty with one specific type of MFI in Mexico, namely, savings and credit societies (SACPs).

We consider two related but distinct definitions of vulnerability to study whether MFI membership reduces vulnerability by either or both definitions. First, we explore vulnerability in terms of the probability that somebody becomes poor. The probability of becoming poor depends on welfare shocks and the household's initial position in the income distribution; households that are wealthier have a lower probability of becoming poor, even if they face more income variability. Vulnerability as a proxy for the probability of becoming poor thus depends on the level and variance of income, and we test whether membership improves income per capita and/or reduces variance in income per capita. An adapted version of Glejser's (1969) heteroscedasticity tests reveals whether membership reduces the variance of income per capita. Second, we consider vulnerability in terms of the ability to smooth consumption in the face of adverse shocks. Thus we examine whether SACP membership leads to consumption smoothing in the face of adverse income (and other types of) shocks. The estimates suggest that households that join SACPs become less susceptible to shocks.

The structure of this article is as follows: Section 2 contains our theoretical framework and provides hypotheses about the links between membership in a SACP and vulnerability. In Section 3 we present our data set. Then in the following sections, we examine the impact of membership on the level of per capita income (Section 4), the impact of membership on the variability of per capita income (Section 5), and whether consumption smoothing possibilities in the face of adverse shocks differ for members and non-members (Section 6). Finally, we offer some conclusions and implications in Section 7.

2. Role of Microfinance for Reducing Vulnerability

Poor households use various risk-management strategies to smooth their income and consumption levels. For example, a community might informally agree to insure one another or provide state-contingent transfers and remittances

to friends and neighbors (Rosenzweig, 1988; Besley, 1995; Morduch, 1995). Households also might sell assets such as grain reserves and livestock (Deaton, 1992) or send their children to work instead of school to supplement their incomes (Jacoby and Skoufias, 1997). Additional strategies include income diversification or skewing, kinship-based networks, multiple job holding, and engagement in other informal economic activities (Morduch, 1995; Kochar, 1999). Households also might use their savings (Paxson, 1992; Paxton and Young, 2011). As Lee and Sawada (2010) show in rural Pakistan, a precautionary savings motive is especially pronounced when access to credit markets is limited, as is the case in Mexico. Access to credit provides another important risk-management instrument. In low-income countries, the most important sources of credit for poor people are informal institutions, such as rotating savings and credit associations (ROSCAs), moneylenders, landlords, shopkeepers, friends, and family members (Fofana, 2010), particularly for non-banked people.

However, informal insurance mechanisms often are not efficient for dealing with covariate risks, such as natural disasters. In such situations, access to mitigation resources becomes highly relevant; MFIs may be especially important in assisting the poor with suitable insurance mechanisms for adjusting to these risks (Vatsa and Krimgold, 2000).

Theoretical and empirical literature suggests that microfinance offers an efficient risk coping method (Kumar and Newport, 2005; Palier and Prevost, 2007). Fernando (2013) distinguishes direct and indirect ways in which MFI participation helps households become less susceptible to adverse shocks. The direct channels include awareness programs, micro-insurance programs, emergency relief activities, disaster communication, and providing post-disaster recovery loans. For example, after weather disasters, microfinance might provide assistance to farmers so they can rebuild their homes and reestablish their agricultural production, without having to wait for or rely on governmental disaster relief (Hoff et al., 2003). Even for extreme events, such as Bangladesh's major floods in 1988 or the 2004 tsunami in Sri Lanka, microfinance underlies relief and rehabilitation efforts, together with government attempts to mitigate the adverse impacts on the poor. Becchetti and Castriota (2011) examine the direct impact of microfinance as a recovery tool after the Sri Lanka tsunami and find that recovery loans had significantly positive effects on changes in real income for damaged borrowers. Fernando (2013) concurs that being a member of an MFI enhanced the probability of recovering from this tsunami. Matul and Tsilikounas (2004) also argue that post-war coping in Bosnia and Herzegovina were enhanced by microcredit provision. In Bangladesh, following natural disasters, Grameen Bank and the Bangladesh Rural Advancement Committee have worked with more than 3 million clients and 750 non-governmental organizations to operate microcredit schemes and deliver extra loans to meet consumption and investment expenses, with six-month extensions of repayment schedules. They also allowed clients to withdraw up to 50 percent of their savings if needed (Shah, 1999).

Indirectly, membership in an MFI could decrease the vulnerability of its members through increased income levels, because membership affects income through various channels. The original microfinance movement focused on business investment channels through microcredit or small loans to poor households

that did not have access to formal credit. These loans were designed to finance and encourage new businesses or expansions of existing businesses. In this sense, microcredit could improve income through investments in new or existing businesses. In Mexico, SACP membership thus may boost (productive) investment, which stimulates income. Because most SACP members represent the rural sector, they largely engage in farming activities; the SACP credits enable these farmers to diversify into non-agricultural activities, which leave them less vulnerable to seasonal patterns. Diversification also may reduce income variance, as well as increasing income levels. Despite these potential important benefits of business investment channels, microcredit can be used to finance consumption, which creates a risk that the business investment channel will fail.

Following the diversification of products offered by MFIs, from microcredit to microfinance, recent literature notes some beneficial effects of micro-savings and micro-insurance products. The SACPs in our sample do not offer micro-insurance products, but micro-savings are particularly important to them. Savings possibilities provide risk-sharing opportunities that can reduce vulnerability and guarantee continued investments, even when adverse shocks occur. Similar to standard insurance products, the savings possibilities offered by SACPs can help households shield themselves from negative risks due to adverse shocks and thereby stimulate riskier, but also more productive, investments that increase income. Several empirical studies provide further evidence that the savings possibilities offered by MFIs serve as buffers and a means to smooth consumption in the face of adverse economic shocks (Paxson, 1992; Paxton and Young, 2011; Paxton and Zhuo, 2011). That is, households accumulate savings prior to a shock and use them during or thereafter, to smooth their consumption. For example, Hoque (2008) finds that MFI members in Bangladesh coped better with natural disasters, because they had savings accumulation and a stronger social safety net, due to the group structure of the microfinance programs. Relatedly, Shoji (2010) indicates that a contingent repayment schedule of savings and installments during natural disasters such as the Bangladeshi floods of 2004 functioned as a safety net, decreasing the probability that MFI recipients—particularly landless and female victims—skipped meals by 5.1 percent. These prior findings thus demonstrate that membership in an MFI makes households less susceptible to economic shocks and better able to smooth consumption levels. Membership also prevents households from adopting costly self-insurance strategies in response to unanticipated income shocks.

In addition, microfinance may stimulate previously unproductive household members to become involved in income-generating activities. The savings products offered by SACPs then allow households to accumulate money in a risk-free manner; though households might save at home, such savings are much more vulnerable to theft. Therefore, the savings products offered by SACPs should facilitate monetary accumulations, which can be used to finance productive investments and boost income. Savings possibilities also provide households opportunities to top up small loans from the SACPs, to make larger investments themselves. This indirect effect is critical, because the small credits provided by SACPs (and most MFIs) rarely are substantial enough to finance larger, more productive, income-generating investment projects.

In line with common practices, SACPs offer also social services, such as financial literacy training and health and nutrition assistance, that may stimulate income per capita. A growing literature points to the importance of financial literacy training to improve income by enhancing financial knowledge, improving financial practices, and encouraging financial behavior. Sayingoza et al. (forthcoming) note that financial literacy training for cooperatives in Rwanda increased literacy, savings, and new business activities, which ultimately should enhance income per capita. Social services in the form of health assistance could also stimulate income-generating activities and income; households cannot work or do business if they cannot finance healthcare. Microfinance membership may thus help households increase their income, which indirectly lowers their probability of becoming poor if they face adverse income shocks. Moreover, microfinance can stimulate households to diversify their income sources, such as by starting up business activities along with their usual farming activities. Diversification in income-generating activities reduces the variance of income, which also reduces the probability of becoming poor, that is, vulnerability.

In Mexico, governmental efforts have been insufficient to support relief and reconstruction efforts after disasters. Funds from public programs often get shifted to assist the communities mainly affected by these risks—a practice that disrupts the important development efforts sought by such programs. An alternative mechanism would be to transfer the risk to other parties, such as insurance companies or capital markets (Kreimer et al., 1999). However, market imperfections prevent such channels from functioning well, because poor people lack access to formal insurance and capital markets. In such a context, microfinance institutions such as SACPs can play an important role in reducing households' vulnerability. Accordingly, we expect that SACP members in Mexico are less susceptible to adverse shocks than non-banked households. Formally,

H_1. Household participation in savings and credit societies improves per capita income.

H_2. Household participation in savings and credit societies reduces the variance of annual per capita income.

H_3. Household participation in savings and credit societies improves consumption smoothing in the face of adverse shocks, leaving households less susceptible to shocks.

Hypotheses 1 and 2 relate to our first definition of vulnerability, namely, the probability of becoming poor. If membership increases the level and reduces the variance of income, the probability of becoming poor declines. Hypothesis 3 refers to our second definition of vulnerability, namely the ability to smooth consumption in the face of adverse shocks. By considering the impact of microfinance membership in terms of both vulnerability definitions, we can investigate consumption smoothing possibilities if an income shock occurs and also acknowledge that households with poorer consumption smoothing possibilities may face weaker income shocks or that households that face great shocks are less likely to become poor if they are more wealthy.

3. Data

This study uses data from a representative household panel survey running from 2004 to 2007, commissioned by the National Savings and Financial Services Bank (BANSEFI) in Mexico through a collaborative project with the Ministry of Agriculture, Livestock, Fisheries, and Rural Development, and supported by a World Bank project on rural financial markets. The main objective was to learn about differences in access to financial services; the results revealed information about two groups of households: (1) banked households, in which at least one family member has been identified as a client of an MFI (in our case, SACP) at the time of the survey and five years prior to it; and (2) non-banked households, in which no family member was a client of an MFI at the time of the survey or five years prior. This classification matches previous empirical studies that analyze the liquidity profiles of Mexican households (Paxton and Young, 2011). The grouping also is suitable for testing our hypotheses about whether being a member of an SACP institution reduces household vulnerability to poverty.

To ensure comparability across groups, we checked that the banked and non-banked households shared similar socioeconomic characteristics and were living in a similar environment, such as the same or nearby communities. We acknowledge the remaining potential for selection biases, such as differences in the unobservable characteristics of the households; our data set ensures a comparison of banked and non-banked households that are similar in their observable socio-economic characteristics. For our estimates, we try to deal with remaining biases in various ways, as we detail subsequently.

Probability proportional to size sampling techniques, carried out in several steps, were used to gather information at the household level. First, Mexico comprises three geographic regions: Northern, Central, and Southern. Second, the survey team identified four strata of financial institutions, according to the total number of clients at the time of the survey: very small, small, medium, and large. In the first sampling stage, the number of institutions randomly selected from each stratum was proportional to its size (number of clients). In a second stage, banked households (treatment group) were selected randomly from the previously selected sample of institutions for each stratum. The sampling framework reflected the client directory of each financial institution (Berumen y Asociados, 2006). Next, after establishing which communities hosted banked households (treatment group), a random selection of non-banked households (control group) living in the same or nearby communities was gathered. Some filter questions served to ensure that we identified households that did not have any family member who was a client of any financial institution. This comparable group of households was identified as non-banked and formed the initial control group (Berumen y Asociados, 2006).

The four survey waves (2004, 2005, 2006, and 2007) each included about 5,700 households that provided detailed information about their household income, expenditures, credit and savings, risk, employment, remittances, cash transfers, assets, liabilities, demographic characteristics, and regional variables (Zapata-Alvarez, 2007). The overall survey, including banked and non-banked households, encompassed 19,090 observations, corresponding to households

TABLE 1
Risk Coping Strategies Used by Banked and Non-Banked Households in Mexico (2004–2007)

Coping Mechanism	Banked	%	Non-Banked	%	Total	%
Cut consumption	702	9.76	700	9.74	1402	19.50
Sell assets	44	0.61	30	0.42	74	1.03
Pawn personal items	9	0.13	10	0.14	19	0.26
Use of savings	445	6.19	305	4.24	750	10.43
Loans[1]	387	5.38	300	4.17	687	9.56
Stop paying debts	36	0.50	21	0.29	57	0.79
Job search	310	4.31	385	5.36	695	9.67
Temporary job	190	2.64	230	3.20	420	5.84
Work extra hours	48	0.67	63	0.88	111	1.54
Aid from family	150	2.09	172	2.39	322	4.48
Aid from friends	90	1.25	145	2.02	235	3.27
ROSCA[2]	4	0.06	2	0.03	6	0.08
Social insurance	58	0.81	42	0.58	100	1.39
Government aid	19	0.26	47	0.65	66	0.92
Reduce prices of products	47	0.65	24	0.33	71	0.99
Product promotion	57	0.79	22	0.31	79	1.10
Other	162	2.25	146	2.03	308	4.28
Nothing	957	13.31	830	11.55	1787	24.86
Total	3715	51.68	3474	48.32	7189	100.00

[1] Loans with and without interest.
[2] ROSCA = rotating savings and credit association.
Source: Authors' compilation of data from BANSEFI Bank.

linked to one of four programs: (1) savings and credit societies (SACPs), (2) the BANSEFI bank, (3) traditional MFIs, or (4) the COOPERA cash transfers program. For the purposes of this study though, we use information only from SACPs, which represent the largest program by far, corresponding to a stratified random sample of 14,245 observations.

The SACPs in Mexico include cooperatives, credit unions, cajas de ahorro, cajas solidarias, and savings and loan associations, all owned and managed by their members. They focus on savings, though they also offer credit and other assistance (e.g. financial literacy, technical assistance, education, healthcare). We exclude other programs to achieve a more homogeneous sample of institutions that offer similar microfinance services. Moreover, to ensure that the sample of observations and included households is similar in all regressions, we only include households that appeared in the data set more than twice. The number of observations per annum varied between approximately 1300 for non-banked households in 2006 to somewhat less than 2300 for banked households in 2004.[1]

Table 1 summarizes relevant coping strategies for households, according to their frequency. The data suggest no unique strategy: Households used a combination of formal and informal coping strategies, related to their specific characteristics and contexts. For example, they employed savings and acquired loans, cut consumption, searched for jobs, and turned to relatives and friends for assistance when they needed to cope with adverse shocks. All these alternatives enabled the households to improve their welfare level on various dimensions (e.g. income,

[1]Details are available on request.

consumption, education, health, production process) and reduce their vulnerability and poverty levels. Therefore, we expect that all strategies, including membership in SACP institutions, have important effects for reducing poverty and vulnerability, at least in the short term.

In Table A1 of the Appendix, we present the definitions of the core variables used to estimate the empirical models. Table A2 contains the descriptive statistics of the data set variables.

4. Impact of SACP Membership on Per Capita Income

To begin our empirical analysis, we tested H_1 by estimating an empirical model that captures the effect of membership in a savings and credit society (*Banked*) on the level of per capita income. As we have argued, more wealthy households are less likely to become poor, even if they experience large adverse shocks. Therefore, *ceteris paribus*, if membership increases the level of income, vulnerability to poverty, defined as the probability of becoming poor, declines.

Ideally, we would examine the various possible income-generating channels specified in Section 2 through which SACP membership stimulates income, which would represent a test of a so-called theory of change. However, our data set does not support such an analysis, because relevant details are missing. Instead, we adopted an approach similar to a reduced-form estimate of the effect of SACP membership on income per capita, such that we can provide an unbiased estimate of the total effect of SACP membership on per capita income, without detailing the channels through which these impacts take place.

The main methodological problem we face is that our dependent variable, income per capita, may depend on time-varying and time-invariant unobserved variables that also correlate with membership of a SACP (*Banked:* a binary indicator that equals 1 if household *i* is a client of a saving and credit society and 0 otherwise). To control for potential endogeneity bias, a standard instrumental variable approach would be preferable, but no appropriate external instruments are available that satisfy the exclusion restrictions. Therefore, we must rely on an alternative approach. Because *Banked* is time invariant, we also cannot adopt a fixed effects panel approach. Instead, we used the Hausman-Taylor (HT) regression method (Hausman and Taylor, 1981), which assumes that the set of explanatory variables contains both time-varying and time-invariant variables. Any subset of both types of variables can be assumed to be exogenous and uncorrelated with the unobserved time-invariant individual effect, whereas some of both types of variables could correlate with the time-invariant individual effect. That is, the HT model can be specified as follows:

$$(1) \qquad ln\, Y_{it} = X_{1it}\beta + X_{2it}\theta + Z_{1i}\gamma + Z_{21}\vartheta + \mu_i + v_{it},$$

where $Y_{i,t}$ is a continuous variable that refers to the natural logarithm of per capita income of household *i* at time *t*. The vectors $X_{1,i,t}$ and $X_{2,i,t}$ include time-variant control variables; the vectors $Z_{1,i}$ and $Z_{2,i}$ refer to vectors with time-invariant control variables. The variables with a subscript 1 are assumed to be exogenous, in that they are not correlated with μ_i and v_{it}. The variables with a subscript 2 instead

are assumed to be endogenous, correlated with μ_i but not with v_{it}. Finally, μ_i is a household-specific error term, and $v_{i,t}$ represents the idiosyncratic error term.

The HT approach uses internal instruments for the endogenous variables, which correlate with the time-invariant individual effects. The time-varying endogenous variables are instrumented by their deviation from individual means, whereas the time-invariant endogenous variables are instrumented by the individual averages of the exogenous time-variant variables. The main advantage of the HT approach is that it can identify time-invariant variables, even if they correlate with the individual time-invariant effects.

An increase in income relates to membership of a SACP but also might be attributed to various underlying sources. To improve the precision of the estimates of the impact of *Banked*, we need to include these attributes. The need to include covariates becomes even more acute if the decision to join a SACP depends on these covariates, because excluding them would produce biased estimates.

We therefore included covariates for the main measurable attributes, based on the sustainable livelihoods framework (Chambers and Conway, 1992). Specifically, the included covariates referred to

1. Village characteristics, such as an urban community (>10,000 inhabitants), central region, or southern region. These covariates control for program placement biases.
2. Time effects for the years 2004 and 2006. They control for the impact of business cycles and other shocks.
3. Human capital: Characteristics of the household head (gender, age, marital status); household size, household gender composition (percentage of women, gender household head), household's mean years of formal schooling, the number of employed family members.
4. Financial capital: Indicators of access to alternative credit possibilities and income flows (e.g. ROSCAs, moneylender relationship, non-business income due to remittances).
5. Social capital: Aid from family and friends, trader relationship.
6. Physical and natural capital: The value of assets.

In order to test the robustness of the results, we conduct regressions excluding family size (equation 1), excluding the percentage of female (equation 2) and excluding all insignificant control variables (equation 4). Applying the HT regressor requires distinguishing between endogenous and exogenous variables and determining which covariates likely correlate with the individual-specific effect. Every choice remains disputable, but indicators of alternative income flows, assets, and human capital likely are endogenous, in that they tend to correlate with individual-specific effects such as ability, personality, talent, and motivation. Therefore, we treat the following variables as endogenous: *Value of assets*, *Family labor*, *ROSCAs*, *Family and friends aid*, *Trader relationship*, *Moneylender relationship*, *Household's mean years of formal schooling*, *Non-business income*, and *Banked*. The individual-specific effects should not correlate with village characteristics, time effects, household size, household gender composition, or age and marital status. Therefore, we assume the following group of variables is exogenous: *Year 2004, Year 2005, Urban community, Central region, Southern region,*

Head gender, Head age, Head marital status, Percentage of female adults, and *Family members.*

To check the reliability of our approach, we first conducted a Hausman (1978) test, to determine if a random effects (RE) or fixed effects (FE) panel model would be most appropriate. If the test suggested a RE model is appropriate, there would be no need to continue using the HT approach. However, the Hausman test 1 in Table 2 reverts to the FE model. To check the relevance of the HT estimator, we conducted two additional tests: First, we conducted another Hausman (1978) test, for which the test statistic reflected the difference between the FE and HT estimators. It was insignificant for the different specifications estimated, suggesting that the HT estimator was consistent and should be prioritized over the FE estimator (Baltagi et al., 2003). Second, we conducted Sargan tests of overidentifying restrictions to check the validity of the instrumental variables and test the assumption that the (internally constructed) instrumental variables were uncorrelated with the error terms μ_i and v_{it}. That is, we tested a null hypothesis that the excluded instruments are valid instruments and appropriately excluded from the estimated equation. The Sargan test does not reject this assumption (see Table 2). Therefore, we have reasonable evidence that the model is well specified.

Although we are not primarily interested in the impact of the covariates, it is promising that most of these results are in line with our expectations. As Table 2 shows, income is significantly affected by the value of assets, family labor, and access to alternative credit and income sources. The impacts also differ across regions, time periods, and gender composition. *Banked* is significantly positive in all specifications, so membership in a SACP enhances per capita income, in empirical support of H_1.

5. Impact of SACP Membership on the Variance of Per Capita Income

Vulnerability, when defined as the probability of becoming poor, depends not only on the level of income but also the impact of membership on income variance. As we argued previously, microfinance membership may reduce income variance by enabling households to diversify income sources, such as by starting new business activities.

To estimate the impact of SACP membership on the variance of income per capita, we use the results from the estimates of the effect of membership on per capita income from the previous section. That is, we regress the squared residuals of the income per capita regressions (i.e. variance of the residuals), and thus the variance of $Y_{i,t}$, on a constant and the same set of covariates included in the income per capita regressions. Rather than assuming that the variance is the same for all observations (i.e. homoscedasticity), we explicitly test whether variance differs across households; we are especially interested in knowing whether SACP membership reduces the variability of per capita income of household i at time t. Specifically, we examine whether SACP member households experience less variance of per capita income than do non-member households.

Our approach is in line with Glejser's (1969) heteroscedasticity tests, as applied previously in finance literature by Adams *et al.* (2005), Cheng (2008), Pathan (2009), and Galema *et al.* (2012). This test can quantify performance

TABLE 2

Impacts of Microfinance Membership on Income Per Capita

Variables	(1)	(2)	(3)	(4)
TV exogenous				
Year 2004	0.0556*	0.0572*	0.06346**	0.0580**
	(0.061)	(0.054)	(0.032)	(0.043)
Year 2005	–0.8887***	–0.8872***	–0.8845***	–0.8866***
	(0.000)	(0.000)	(0.000)	(0.000)
Urban community (>10,000 inhabitants)	–0.0056	–0.0116	–0.0147	
	(0.866)	(0.729)	(0.656)	
Central region (yes = 1)	–0.1898***	–0.1936***	–0.1920***	–0.1975***
	(0.000)	(0.000)	(0.000)	(0.000)
Head gender (female = 1)	–0.1707***	–0.0384	–0.01064*	–0.1063*
	(0.005)	(0.519)	(0.082)	(0.083)
Head age (years)	0.0051***	0.0071***	0.0062***	0.0056***
	(0.000)	(0.000)	(0.000)	(0.000)
Head marital status (married = 1)	–0.2243***	–0.1483**	–0.1212*	–0.1261*
	(0.001)	(0.036)	(0.080)	(0.069)
Percentage of female adults	0.7640***		0.4111***	0.4060***
	(0.000)		(0.000)	(0.000)
Family members		–0.0986***	–0.0841***	–0.082***
		(0.000)	(0.000)	(0.000)
TV endogenous				
Value of assets (log)	0.1458***	0.1495***	0.1498***	0.1467***
	(0.000)	(0.000)	(0.000)	(0.000)
Family labor (number employed)	0.0909***	0.1050***	0.1023***	0.1024***
	(0.002)	(0.000)	(0.001)	(0.001)
ROSCA (participated = 1)	0.1447***	0.1448***	0.1471***	0.1403***
	(0.001)	(0.001)	(0.000)	(0.001)
Family and friends aid (gifts in cash: yes = 1)	0.2316***	0.2182***	0.2206***	0.2174***
	(0.000)	(0.000)	(0.000)	(0.000)
Trader relationship (yes = 1)	–0.0008	0.0029	0.0024	
	(0.989)	(0.962)	(0.920)	
Moneylender relationship (yes = 1)	–0.0246	–0.0019	–0.0116	
	(0.833)	(0.987)	(0.920)	
Household's mean years of formal schooling	0.0062	0.0101	0.0103	
	(0.530)	(0.313)	(0.299)	
Non-business income (log)	0.0846***	0.0858***	0.0858***	0.0855***
	(0.000)	(0.000)	(0.000)	(0.000)
TI exogenous				
Southern region (yes = 1)	–0.1469***	–0.1454***	–0.1438***	–0.1488***
	(0.002)	(0.003)	(0.003)	(0.002)
TI endogenous				
Banked (yes = 1)	0.6434**	0.7878***	0.5390**	0.6235**
	(0.014)	(0.003)	(0.037)	(0.015)
Constant	6.5224***	6.9169***	6.8364***	6.944***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	11,157	11,157	11,157	11160
Hausman test 1: FE and RE (χ^2)	122.97	121.38	122.02	128.12
Prob > χ^2	0.000	0.000	0.000	0.000
Hausman test 2: FE and HT (χ^2)	9.56	16.15	15.50	9.93
Prob > χ^2	0.888	0.442	0.559	0.6999
Sargan test	8.800	10.211	9.083	6.197
Prob > χ^2	0.267	0.177	0.335	0.516

***p < 0.01. **p < 0.05. *p < 0.1.

Notes: pval is in parentheses. The dependent variable in all specifications is the log of per capita income. TV denotes time varying; TI denotes time invariant, ROSCA is rotating savings and credit association.

variability both across and within households. The explicit modeling of the variance in the disturbance terms is also similar to a heteroscedasticity correction, which is why we use the term heteroscedasticity test.

Glejser's (1969) heteroscedasticity tests originally used ordinary least square (OLS) estimates for the income per capita and variance of income per capita regressions. However, OLS estimates may be biased, so we apply a different approach, using the results of the HT regressions. That is, we save the residuals of the three HT regression in Table 2. The HT estimators provide two random error terms: unobserved individual effects μ_i and idiosyncratic error terms v_{it}. According to the HT estimator, given the X and Z variables, $\text{Cov}(\mu_i, v_{it}) = 0$, so the variance of the combined error term equals $\sigma^2 = \sigma_\mu^2 + \sigma_v^2$. We then can calculate the variance of the combined error term and regress it on the same set of controls, including *Banked*.

In line with our approach in Section 4, we conduct RE and FE estimates to test whether the RE were consistent. They appeared consistent, so we present the results using the RE estimator, as summarized in Table 3.

The regression results show that *Banked* significantly reduces the variance of per capita income, in empirical support of H2. Our analyses so far thus have provided empirical support for the notion that membership in a SACP helps increase income per capita and reduces the variance of income per capita. Together, these empirical results suggest that MFI membership decreases the probability of becoming poor and reduces vulnerability to poverty.

6. Consumption Smoothing and SACP Membership

We proceed by considering whether MFI membership improves households' ability to smooth consumption in the face of adverse shocks, in line with our second definition of vulnerability. We test consumption smoothing in the face of income shocks, assuming some variant of a permanent income hypothesis based on an intertemporal choice model (e.g. Amin *et al*., 2003; Dercon and Krishnan, 2003; Japelli and Pistaferri, 2006). These models assume that households' utility over time depends on the flow of consumption in time. With a conventional utility function, households that face risk try to optimize their welfare by smoothing consumption over time. If efficient markets for risk exist, a rational household smoothens consumption over time, and perfect risk-sharing results. The perfect risk sharing model (e.g. Townsend, 1994), applied to a community of N households, predicts "that the growth path of marginal utilities of all households is the same and that it is only influenced by changes in the aggregate resource constraint" (Dercon and Krishnan, 2003, p. C87). In this case, income shocks do not affect consumption. However, in practice, many households—especially disadvantaged ones—are unable to purchase formal insurance contracts, so perfect risk-sharing does not exist. Instead, the poor often use informal mechanisms to reduce the effects of shocks and achieve a certain degree of consumption smoothing.

We follow Dercon and Krishnan's (2003) approach, which uses a standard optimization framework and assumes a constant relative risk aversion (CRRA) utility function, to specify the following equation:

TABLE 3

Impact of SACP Membership on the Variance of Income Per Capita

Variables	(1)	(2)	(3)	(4)
Banked (yes = 1)	–0.1471*	–0.1662**	–0.1704**	–0.1745**
	(0.051)	(0.028)	(0.024)	(0.018)
Year 2004	0.4607***	0.4512***	0.4689***	0.4912***
	(0.000)	(0.000)	(0.000)	(0.000)
Year 2005	1.3526***	1.3803***	1.4058***	1.4368***
	(0.000)	(0.000)	(0.000)	(0.000)
Urban community (>10,000 inhabitants)	0.3631***	0.3591***	0.3600***	
	(0.000)	(0.000)	(0.000)	
Southern region (yes = 1)	0.0792	0.0802	0.0868	–0.0012
	(0.425)	(0.421)	(0.384)	(0.906)
Central region (yes = 1)	0.3880***	0.3937***	0.3996***	0.4017***
	(0.000)	(0.000)	(0.000)	(0.000)
Head gender (female = 1)	–0.4768***	–0.3281**	–0.3996***	–0.396***
	(0.001)	(0.016)	(0.005)	(0.006)
Head age (years)	–0.0027	–0.0011	–0.0022	–0.0027
	(0.293)	(0.646)	(0.402)	(0.288)
Head marital status (married = 1)	–0.1853	–0.0831	–0.0877	–0.1117
	(0.166)	(0.541)	(0.521)	(0.415)
Household's mean years of formal schooling	0.0078	0.0078	0.0096	
	(0.538)	(0.538)	(0.450)	
Percentage of female adults	0.5448***		0.2894	0.3077
	(0.006)		(0.183)	(0.158)
Family labor (number employed)	–0.2029***	–0.1827***	–0.1827***	–0.1807***
	(0.001)	(0.003)	(0.003)	(0.003)
ROSCA (participated = 1)	0.0261	0.0337	0.0350	0.067
	(0.752)	(0.685)	(0.674)	(0.419)
Family and friends aid (gifts in cash: yes = 1)	–0.3409***	–0.3709***	–0.3576***	–0.3674***
	(0.000)	(0.000)	(0.000)	(0.000)
Trader relationship (yes = 1)	–0.1390	–0.1249	–0.1286	
	(0.298)	(0.353)	(0.341)	
Moneylender relationship (yes = 1)	–0.0550	–0.0321	–0.0313	
	(0.826)	(0.898)	(0.901)	
Value of assets (log)	0.0178	0.0153	0.0166	0.0382
	(0.471)	(0.537)	(0.504)	(0.103)
Non-business income (log)	–0.1196***	–0.1122***	–0.1139***	–0.1103***
	(0.000)	(0.000)	(0.000)	(0.000)
Family members		–0.0698***	–0.0624***	–0.0649***
		(0.000)	(0.002)	(0.001)
Constant	1.6759***	1.9636***	1.8520***	1.9506***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	11,157	11,157	11,157	11160
Hausman test: FE and RE (χ^2)	26.57	20.32	22.83	20.68
Prob > χ^2	0.05	0.21	0.16	0.08

***p < 0.01. **p < 0.05. *p < 0.1.

Note: pval are in parentheses. The dependent variable is the variance of the error term of the corresponding HT regressions in Table 2. All regressions are conducted with the random effect panel estimator. ROSCA is rotating savings and credit association.

$$lnC_t^j = \propto D_t + \beta Z_t^j + \delta S_t^j + \mu^j + \varepsilon_t^j, \tag{2}$$

where lnC_t^j is the natural logarithm of consumption per capita; D refers to time-varying community dummies; Z is a set of time-varying taste shifters (defined subsequently); S refers to a set of "shock" variables that affect income; μ^j is

assumed to contain all time-invariant taste shifters[2]; and ε is the error term. The most important testable implication of this model is that under perfect risk-sharing, the coefficient δ should equal 0.

To test whether household participation in SACPs improves consumption smoothing in the face of adverse shocks, we extend this equation by the individual dummy *Banked* and by an interaction term between the shock variable and *Banked*, such that:

$$(3a) \qquad lnc_t^j = \propto D_t + \beta Z_t^j + \delta S_t^j + \theta S_t^j * Banked^j + \gamma Banked^j + \mu^j + \varepsilon_t^j.$$

The drawback of this specification is that it is a static model, ruling out any feedback between past and future variables. To allow for the possibility that the influence of past shocks persist, we follow Porter (2008) and include a lagged dependent variable. The specification then becomes:

$$(3b) \qquad lnc_t^j = \propto D_t + \beta Z_t^j + \delta S_t^j + \theta S_t^j * Banked^j + \gamma Banked^j + \mu lnc_{t-1}^j + \mu^j + \varepsilon_t^j.$$

However, the correlation between the fixed effects and the lagged dependent variable means that uncorrected OLS estimates for a dynamic panel model could be severely biased (Nickell, 1981; Baltagi, 2008). Especially for short panels, this bias may be a significant concern. Therefore, we apply a first difference generalized methods of moments (GMM) estimator to correct for these biases (Arellano and Bover, 1995; Blundell and Bond, 1998).

For all specifications, we added time dummies to control for correlation across individuals in the idiosyncratic error terms. The autocorrelation test and robust estimates of the coefficient standard errors assume no correlation across individuals in the idiosyncratic disturbances (Roodman, 2009). The specification ultimately reads:

$$(4) \qquad lnc_t^j = \propto D_t + \beta Z_t^j + \delta S_t^j + \theta S_t^j * Banked^j + \gamma Banked^j + \vartheta_1 YEAR2004 + \vartheta_2 YEAR2005 + \mu lnc_{t-1}^j + \mu^j + \varepsilon_t^j.$$

We are interested in the coefficient θ. If θ equals 0, the estimates support the null hypothesis that membership in a SACP does not influence the effect of a shock. A significant θ suggests that SACP membership affects consumption smoothing. Opposite signs for δ and θ indicate that membership helps reduce the impact of an income shock and improve consumption smoothing. The individual effect of $Banked^j$ on consumption cannot be identified using a first difference GMM approach.

In line with standard analyses, we start by including income per capita as the income shock variable. However, one of the unique features of our data set is that it includes variables that provide direct information about different types of shocks. These alternative shock variables refer to self-reported measures for different types of shocks. In particular, we add the following variables: natural disasters (drought, fire, flood, crop damage), job losses of family members, low prices (for products in the market), and lower production (decline in sales in the

[2]The time-invariant taste shifters refer to the fixed portions of aggregate resources, fixed placement effects, and Pareto weights (Dercon and Krishnan, 2003).

market). A common differentiation also separates covariate and idiosyncratic risks (Dercon, 2002). Idiosyncratic risks can be dealt with or managed within a community, because they affect only a particular individual or household. Covariate risks are aggregated and experienced across the economy, so they affect everybody and cannot be shared; they can only be dealt with through formal or informal transfers (e.g. credit, insurance, public transfers) or mechanisms originating outside the community. We define natural disasters and low prices as covariate shocks; job loss and lower production are idiosyncratic shocks.

We follow Dercon and Krishnan (2003) by using the total number of family members and the sex of the household head as proxies for taste shifters.

We present the first difference GMM regressions in Table 4. The first column reveals that per capita income has a significant (positive) effect on per capita consumption; perfect risk-sharing does not occur. However, the significant (negative) coefficient for the interaction term between *Banked* and per capita income

TABLE 4
Risk Sharing (Difference GMM Regressions)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Per capita income (log)	.0535***					
	(0.00)					
Banked × Per capita income (log)	–0.0276*					
	(0.06)					
a. Idiosyncratic shocks						
Lower production (less production than expected = 1)		–0.831**				–0.706**
		(0.015)				(0.02)
Lower production × Banked		1.361**				1.162**
		(0.01)				(0.01)
Job loss (job losses = 1)			–0.305			0.273
			(0.49)			(0.461)
Job loss × Banked			0.405			–0.791
			(0.65)			(0.30)
b. Covariate shocks						
Natural disaster (natural disaster = 1)				–1.570**		–0.790
				(0.02)		(0.15)
Natural disaster × Banked				2.534**		1.333*
				(0.01)		(0.10)
Low prices (prices fall = 1)					–1.947	0.279
					(0.19)	(0.75)
Low prices × Banked					3.207	–0.344
					(0.17)	(0.80)
c. Control variables						
Head gender (female = 1)	–0.058	–0.063	–0.055	–.044	–.0703	–0.066
	(0.17)	(0.13)	(0.23)	(0.31)	(0.13)	(0.13)
Family members	–0.143***	–0.140***	–0.138***	–0.145***	–0.145***	–0.137***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Hansen test of overidentifying restrictions (*p*-value)	0.087	0.707	0.053	0.617	0.242	0.187

***$p < .01$. **$p < .05$. *$p < .1$.

Notes: Dependent variable is per capita consumption. Results refer to two-step difference GMM estimates. Robust *p*-values are in parentheses (based on Windmeijer (2005) corrected standard errors). The estimates also include time dummies (for 2005 and 2006) and the lagged dependent variable. All estimates are done with Stata, using xtabond2 (Roodman, 2009).

suggests that membership helps smooth consumption and that members of a SACP are less affected by income shocks in general.

The results for the self-reported measures of shocks also provide some evidence that being banked improves consumption smoothing and makes households less susceptible to shocks. In the case of a sales shock (proxied by the variable *Lower production*) or a shock due to a disaster (*Natural disaster*), being a member of a SACP helps smooth consumption and reduce the impact. These results hold for the regressions in which we include only one shock variable (columns 2 and 4) and the regression in which we include all shock variables simultaneously (column 6 in Table 4). However, for the two other shock variables, *Job losses* and *Low prices*, we find no evidence that SACP membership helps smooth consumption. The coefficients for *Job losses* and *Low prices* switch signs in the joint regression (column 6). However, both in the joint regressions and the individual regressions *Job losses* and *Low prices* do not differ significantly from zero, implying that the different regressions do not contradict. Overall, the empirical results in this section provide some evidence that SACP membership reduces vulnerability and make households generally less susceptible to shocks.

7. Conclusion

We have addressed the potential positive effect of being a member of a microfinance organization on a household's vulnerability. The potential impact of banking on vulnerability is a critical topic but one largely ignored in microfinance literature. We differentiate two related definitions of vulnerability, namely the probability to become poor and the ability to smooth consumption in the face of adverse shocks, and we predict that microfinance membership reduces vulnerability in both forms. We test these predictions among SACPs in Mexico.

The random sample of banked and non-banked households during 2004–2007 reflected data from a representative panel survey, which is the property of the National Savings and Financial Services Bank in Mexico. We estimated the impact of membership on per capita income using a Hausman-Taylor specification; the resulting evidence shows that being a member of an SACP positively affects the mean of the log of per capita income. Moreover, using heteroscedasticity tests, we find that such membership reduces the variance of per capita income. Together, these effects suggest that SACP membership reduces the probability of becoming poor. With first difference GMM regressions, we also provide evidence that being a member of SACP helps smooth consumption in the face of adverse shocks.

Overall, this article provides new evidence regarding the importance of being a member of a MFI when it comes to improving household welfare. Specifically, we find evidence in line with the hypothesis that membership helps reduce vulnerability and makes households less susceptible to shocks. Further research should test the extent to which our conclusions also hold in other settings.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Appendix A.1: Key Variables
Appendix A.2: Summary Statistics of Key Variables by Household Banking Status, 2004–2007
Appendix A.3: Estimation Method