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Community-Based Development and Aggregate Shocks in Developing Countries: The Experience of an NGO in Pakistan

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Community-Based Development and Aggregate Shocks in Developing Countries: The Experience of an NGO in Pakistan*

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Abstract: This paper empirically investigates whether a community-based development (CBD) approach is effective in mitigating the ill effects of aggregate shocks. The analysis is based on a three-year panel dataset of approximately 600 households in rural Pakistan where a local NGO has implemented CBD interventions. The results show that the mitigating effect was absent when the control group included both non-member households in villages under CBD interventions and households in villages without such interventions. On the other hand, within the former type of villages, a strong spillover effect from member to non-member households was found, mitigating the ill effects of aggregate shocks. Furthermore, CBD interventions accompanied by micro infrastructure construction or microcredit provision were found to be effective in mitigating the ill effects. These results suggest the possibility that whether a CBD approach mitigates aggregate shocks depends on the type of intervention and the nature of market failures.

Keywords: community-based development, consumption smoothing, aggregate shocks, microfinance, Pakistan.
JEL classifications: O12, L31, D12.

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1. Introduction

Households in developing countries are vulnerable to aggregate economic shocks such as economic stagnation and inflation. Given the relative lack of development of formal safety nets and the low accumulation of household assets for self-insurance, such households are likely to experience a serious decline in their welfare once hit by such shocks. For this reason, a number of empirical studies on household vulnerability against external shocks have been conducted in development economics (Dercon 2005, Fafchamps 2003, Kurosaki 2013b). However, as summarized by Sawada (2007) in his review paper, the empirical evidence relates to vulnerability against natural disasters rather than manmade disasters and against idiosyncratic shocks rather than aggregate shocks. Little attention has been paid to the impact of aggregate shocks and the role of communities in coping with such shocks.

Regarding the role of communities in economic development and poverty reduction, two strands of literature are worth noting. First, social capital has been analyzed by numerous development economists (e.g., Durlauf and Fafchamps 2005, Hayami 2009). The accumulation of social capital contributes to higher welfare through bridging different communities and bonding individuals within a community. In this paper, we use the term "social capital" to refer to the mechanism of such social relationships as networks, norms, and trust to induce people toward cooperation (Hayami 2009: 96).

The second strand of literature focuses on policies with community-based development (CBD) or community-driven development (CDD) approaches (Mansuri and Rao 2004, Binswanger-Mkhize et al. 2010). With the expectation that CBD approaches improve the targeting and accountability performance of poverty reduction policies, we observe a stark increase in recent years in World Bank funding for CBD projects (Mansuri and Rao 2004). On the other hand, whether the CBD approach results in better targeting of the poor and higher efficiency of policy implementations is theoretically ambiguous (Bardhan and Mookherjee 2000, 2005). This is because an unequal political structure in the locality could have a negative effect on resource allocation. Elite capture is an extreme form of such distortion.

To address these concerns, a number of empirical studies on CBD approaches have been conducted in recent years. For example, Rao and Ibanez (2005) and Labonne and Chase (2009) evaluated how much targeting gains are obtained through CBD approaches in favor of the poor, while Arimoto (2012), Bjorkman and Svensson (2009), Casey et al. (2012), Labonne and Chase (2011), Nkonya et al. (2012), Park and Wang (2010), and Voss (2008) evaluated how efficient CBD approaches are in terms of poverty reduction. As CBD approaches are expected to contribute to the accumulation of social capital, empirical studies on the impact of such approaches on social capital enhancement have emerged from developing countries (e.g., Vajja and White 2008, Labonne and Chase 2011, Feigenberg et al. 2013). Most of these existing studies that evaluated the impact of CBD approaches deal with cases where macroeconomic conditions were favorable or at least not detrimental. As far as the authors know, there is no study on CBD's impact when the study region was hit by aggregate negative shocks resulting in an overall decline in income levels.

To fill this gap in the literature, this paper attempts to answer the question of whether a CBD approach is effective in mitigating the ill effect of aggregate shocks. When a region is hit by aggregate negative shocks, were households under CBD poverty reduction policies more able to mitigate the ill effects of such shocks than households without such interventions? If there is such a mitigation effect, under what conditions does it become more effective? These are the specific questions addressed in this paper.

Readers may object that it is fundamentally difficult to mitigate the ill effects of aggregate negative shocks because the total resources in the community are reduced by the definition of aggregate shocks. How can CBD intervention have a shock-mitigating impact? We hypothesize its function as follows: households under CBD intervention are better able to cope with aggregate shocks through enhancing the so-called "bonding social capital" (e.g., a larger income transfer in the face of shocks from relatively affluent households to relatively poor households in the community) and the so-called "bridging social capital" (e.g., more opportunities to migrate temporarily to supplement income or credit/transfer exchanges with households/institutions outside the region). If these routes exist and function, we might be able to find a shock-mitigating role of CBD intervention. Using consumption as the ultimate measure of welfare, we attempt to investigate whether such impacts exist.

We analyze a three-year panel dataset of approximately 600 households in rural Pakistan where a local NGO has implemented CBD interventions. The province in which these households resided experienced a severe income decline during the panel survey period. The NGO is unique in the Pakistani context in that it is managed by a female president and its activities are not only community-based but also women-focused. Pakistan is known as a society where traditional patron–client relations play an important role, and the experiences of community-based economic development have been limited (Kurosaki 2005). This gives us a unique opportunity to evaluate the impact of CBDs with a focus not available in the existing literature.[1] Since one of the reasons for the income decline in the study region was inflation induced by the global food price booms that peaked in late 2010 and early 2011, our analysis is

[1] Few of the existing studies on CBD approaches in Pakistan provide econometric evidence. Notable exceptions include Kurosaki and Khan (2012), who investigated the mechanism by which microcredit schemes with community involvement failed with frequent strategic defaults; Khwaja (2004, 2009), who evaluated the performance of community-managed infrastructure projects in northern Pakistan; and Kurosaki (2005), who identified correlates of successful community-based organizations.

also expected to shed light on how households in developing countries were affected by the global price hikes (e.g., Bellemare et al. 2013).

We find that the mitigating effect was absent when the control group included both non-member households in villages under CBD interventions and households in villages without such interventions. On the other hand, a strong spillover effect within the former type of village from member to non-member households was found; it mitigated the ill effects of aggregate shocks. Furthermore, CBD interventions accompanied by micro infrastructure construction or microcredit provision were found to be effective in mitigating the ill effects. We will provide economic explanations of these findings.

In the remainder of this paper, Section 2 describes the study area and the household surveys. Motivated by a descriptive analysis of the household survey data, Section 3 proposes our empirical strategy. Section 4 shows the econometric results. Section 5 concludes the paper with our interpretations of the findings regarding vulnerability against aggregate shocks and the CBD approach.

2. Data and Study Area

2.1 Recent Economic Stagnation in Khyber Pakhtunkhwa, Pakistan

Pakistan, which had a population of 174 million in 2010, is a low-income country. The share of agriculture in the GDP continues to be high—over 20%—and the agricultural share in the labor force is approximately 45% (Government of Pakistan 2013). As the non-agricultural sector, which includes agro-industries (such as cotton-based textiles) and agro-services (such as the trade of agricultural produce) also depends on agriculture, the performance of Pakistan's economy fluctuates substantially depending on the weather, which results in unstable welfare levels at the household level. The country is also characterized by spatial disparity across the four provinces comprising Pakistan and between urban and rural areas. Among the four provinces, Punjab and Sindh are regarded as economically more advanced than Khyber Pakhtunkhwa (KP)[2] and Balochistan. KP's agriculture cannot feed the provincial population because of the high population–land ratio and the low proportion of irrigated agricultural land. This lack of irrigation implies a high fluctuation of agricultural production in the province (Kurosaki 2013a). As a result, KP's economy highly depends on remittances from workers outside the province, including those abroad.

According to government statistics (Government of Pakistan 2013), the real growth rate of the Pakistani economy dropped to 0.4% in the fiscal year of 2008/09[3] after

[2] Khyber Pakhtunkhwa was formerly known as the North-West Frontier Province (NWFP). In April 2010, the constitution of Pakistan was amended and the NWFP was renamed Khyber Pakhtunkhwa.
[3] The fiscal year of 2008/09 refers to the period from July 1, 2008, to June 30, 2009.

experiencing a solid growth rate of 5 to 6% a year. This stagnation continued with an average growth rate of 2.9% a year for the period 2009/10 to 2012/13. The same statistics show a rise in inflation: the average growth rate of consumer price indices (CPI) was 5.8% a year from 2000/01 to 2006/07, while the CPI inflation rate was accelerated in 2007/08, reaching 17% in 2008/09. Although it is likely that these official inflation rates underestimate the price hike faced by Pakistani households, the time series pattern of inflation, which peaked in 2008/09, is widely accepted. Thus, the common viewpoint is that the Pakistani macroeconomy experienced severely low growth rates and high inflation during the period from 2008/09 to 2012/13.

During this period, it is likely that of the four provinces, only Punjab enjoyed positive income growth; the others experienced stagnation or deterioration (zero or negative income growth). However, there are no official statistics to demonstrate this, as neither regional GDPs nor regional CPIs are compiled in Pakistan. We therefore show two pieces of indirect evidence that KP suffered from the severe aggregate shocks of high inflation, shrinking public works, and shrinking migration opportunities, resulting in negative income growth during the period.[4]

The first piece of evidence is from the Household Integrated Economic Survey (HIES). HIES is a nationally representative, large-scale household survey conducted regularly. The summary results of its latest survey round (2010/11) are available in Government of Pakistan (2012) and are comparable to those from its previous round in 2007/08. The average household income in nominal terms increased by 56.6% in Punjab, while it increased by 43.3% in KP. Adjusting these figures using the national CPI inflation rates, the annual growth rate of real household income was +0.61% in Punjab, while the rate was –2.33% in KP. Thus, the KP economy indeed suffered from negative income growth from 2007/08 to 2010/11.

The second piece of evidence is the results of the general elections held in May 2013. At the federal level, the incumbent Pakistan People's Party (PPP) experienced heavy losses in the National Assembly election while the Pakistan Muslim League-Nawaz Group (PMLN) took power. Considering the results at the province level (province-level results for the National Assembly election and the results for Provincial Assembly elections), a slightly different picture emerges. In Punjab, the incumbent PMLN won the elections and remained in the power; in KP, the incumbent lost heavily in the Provincial Assembly election, resulting in the replacement of the provincial government by a new party called Pakistan Tehreek-e-Insaaf (PTI). As the elections were fought over two critical issues, fighting terrorism and restoring the

[4] One of the reasons for KP's difficulty was the floods of 2010 and 2011. The province suffered the most among the four provinces from the 2010 flash floods, resulting in direct loss in agricultural income and assets (Kurosaki and Khan 2011). The 2011 floods hit the country's grain basket, i.e. Punjab and Sindh, adversely affecting household consumption in KP through price hikes.

economy (specifically addressing high inflation and frequent blackouts), the election results in May 2013 suggest that the economic problems during 2009–2012 were much severer in KP than in Punjab.

2.2 The NGO

Given the Pakistani government's failure to deliver basic services to the nation, NGOs have intervened to provide such services. Since the 1990s, several have adopted CBD approaches. To analyze the impact of such NGOs and identify the conditions underlying their success or failure, in 2010, we began a study on an NGO called the Pakistani Hoslamand Khawateen Network (PHKN), which is headquartered in the Haripur District of KP.

The total area of Haripur District is 1,725 square kilometers, with an estimated population of 1.27 million in 2010. The district belongs to the Hazara region of KP, which is known to have better education achievement than other parts of KP. Nevertheless, Haripur shares many characteristics with other parts of KP, such as high dependence on migration, limited agricultural land, and the social seclusion of women.

PHKN intervenes in areas of microfinance, human resource development (HRD) training, micro infrastructure projects, and so on. In providing these services, PHKN employs a CBD approach under which dwellers of a village or rural community are organized into community-based organizations. In the case of PHKN, such organizations are called "community organisations" (COs). COs are organized before any kind of intervention takes place in a village. Because of social and cultural constraints, there are separate COs for males and females. Each CO has 16–40 members. Almost three quarters of PHKN's COs are female COs. A unique characteristic of PHKN is that it is led by a woman and managed by an executive board comprising mostly women, and it undertakes activities focused on women. Such NGOs are rare in Pakistan's male-dominated society.

PHKN's HRD training is provided to all the COs. This training covers livestock, poultry, plant nursery, kitchen gardening, agro-based cottage industries, traditional birth attendance, income-earning skills, and non-conventional training. PHKN has also provided HRD training to prevent crop income losses due to wild boar attacks; this was successful in reducing the losses in the short run, but appears to be non-sustainable (Kurosaki and Khans 2013).

PHKN's micro infrastructure projects include drinking water and drainage facilities, rural roads, and erosion prevention. These were implemented by less than half of the COs. Because of the nature of infrastructure projects, such interventions also involved non-CO members in the village. In 2011, only the ongoing projects continued but no new ones were undertaken; in 2012, no activities occurred related with micro infrastructure.

The core of the PHKN's microfinance project is microcredit. A credit of Rs 5,000 to 10,000[5] is given to individuals who are CO members. The borrower repays the loan in monthly installments. Microcredit service was available to less than a half of COs. In 2011, the microcredit activities were reduced and no credit was provided since 2012. The main funding source of micro infrastructure and microcredit was the outside donors.

2.3 The Panel Survey and the Dataset

During September–December 2010, we implemented a three-tier survey as the baseline; the three tiers are villages, COs, and households. Khan et al. (2011) describe the three-tier baseline survey in detail. The baseline village survey was designed as a census survey to cover all the villages that were (potential) target areas for PHKN. We gathered 105 village observations, of which 99 are located in Haripur District. In the CO baseline survey, we successfully collected information from all 90 COs registered with PHKN; all 90 were located in Haripur District. In the household baseline survey, three types of households were randomly chosen: (i) those who had been members of PHKN's COs, (ii) non-member households living in villages with COs (CO villages), and (iii) households living in villages where no CO existed (non-CO villages). The total size of the sample is 583, comprising 249 member households, 234 non-member households in CO villages, and 100 non-member households in non-CO villages. The population we intend to represent with the household data is that of rural households living in Haripur District that are potential targets for PHKN (excluding the rich).

A year later, in November–December 2011, we resurveyed the same sample households and collected village-level information from the villages with these resurveyed households. Because of refusal or non-availability, 12 households were not resurveyed in the second round, and two households had changed their membership status. In the resurvey, the 12 attrition households were replaced by 12 new households that were randomly chosen from the same household category to which the attrition households belonged.

After another year, in November–December 2012, we implemented the third round of the household survey. All 583 households that were surveyed in the second round were resurveyed successfully in the third round. Therefore, from these three rounds of surveys, we compiled a balanced panel dataset of 569 households comprising 249 member households, 234 non-member households in CO villages, and 88 non-member households in non-CO villages. The dataset includes detailed information on household characteristics; consumption expenditures, including the imputed cost of in-kind transactions; assets and credit access;

[5] "Rs" refers to Pakistani rupees. One rupee was almost equivalent to JPY 1 at the time of the baseline survey in 2010.

involvement in PHKN and government welfare activities; and so on. To compare monetary variables measured in Pakistan rupees across the three rounds of surveys in real terms, we deflated these variables from the resurvey and the third-round survey using the official statistics of consumer price indices (Government of Pakistan 2013).[6] Therefore, all monetary variables are denoted in 2010 prices.

The three-year, 569-household panel dataset potentially suffers from an attrition bias. From the initial sample of 583 households, 14 households were dropped from the analysis either because of a change in membership status or non-availability for follow-up surveys. As Khan (2013) found, the balance test of attrition and maintained households using the baseline survey resulted in mixed results: The rejection of the null hypothesis of equal means occurred slightly more often than indicated by the significance level. At the same time, the inclusion of the inverse Mills ratio derived from the attrition regression never changed the main regression results, and the correlates of the baseline consumption variables were not affected by the inclusion or exclusion of the attrition sample. Therefore, we judge that attrition correction is not required as far as our analysis is concerned.

2.4 Characteristics of the Sample Households

Table 1 summarizes the characteristics of the 569 panel households at the baseline survey in 2010. The average household size was 6.2 persons and the average age of household heads was 50; these are similar to provincial averages. Mobile phones had an incidence rate of 88%. The average landholding size was 6.29 kanals, or approximately 0.32 ha, which is below the provincial average. Because Haripur District's agriculture cannot feed its residents, migration is popular among the sample households, with the average annual remittance receipt of Rs 5,300. To facilitate migration, a necessary investment in human capital has resulted in a literacy rate of 73% and, on average, 5.9 years of schooling among household heads; both figures are higher than the provincial averages.

<Table 1. Characteristics of the Sample Households>

The annual consumption expenditure in real terms was compiled through the following steps. First, we multiplied by 52 the sum of weekly food expenditures, including the imputed value of transactions in kind (the imputation used village prices). Then we summed the annual non-food expenditures. The sum of the two is the annual consumption expenditure in nominal terms. Finally, we deflated the nominal expenditures using the national CPI

[6] This is unsatisfactory because the official inflation figures in Pakistan are notoriously underestimated, and there could be heterogeneous inflation across villages and household types. The use of more precise and disaggregated inflation rates is left for future research.

(Government of Pakistan 2013) to convert them into real expenditures denoted in terms of the baseline prices of 2010. In the empirical analysis, in addition to the total real consumption expenditure (*tot_exp*), we also use per-capita expenditure (*exp_pc*), food expenditure (*exp_food*), and non-food expenditure (*exp_nonfd*). As shown in the last rows of Table 1, the average per-capita expenditure was Rs 39,700 (approximately US$464), which is slightly higher than the provincial and national averages (HIES data, shown in Government of Pakistan 2012) but still at a low level in the global context. The imputed part of food consumption (*exp_kindfd*) accounted for Rs 21,850, or 13.3% of the total food expenditure. This percentage is lower than that observed in rural areas of Punjab, suggesting a high dependence on markets for food in the study area.

Table 2 summarizes the changes in consumption across the three years, distinguishing between member and non-member households. Consumption declined from the baseline survey (2010) to the resurvey (2011) and then from the resurvey to the third-round survey (2012). The average total expenditure (*tot_exp*) for the whole panel of households was Rs 230,000 in 2010, Rs 163,000 in 2011, and Rs 135,000 in 2012 (all in 2010 prices). Per-capita consumption shows similar declines. If we decompose the total expenditure into food and non-food expenditures, 2011 witnessed a similar decline for both variables, while 2012 experienced a larger decline for non-food expenditure than for food expenditure. To check for any measurement error contributing to spurious consumption declines (e.g., underreporting of consumption items in later rounds of surveys because of survey fatigue), we carefully examined the components of consumption expenditures. We found that relatively luxurious expenditures were cut in later rounds of surveys in a systematic way and were replaced by less expensive items. This confirms that the standard of living indeed declined during the three years; the declines are reflected in the summary statistics reported in Table 2.

<Table 2. Consumption in the Three Years by Membership Status>

At first glance, the figures in Table 2 suggest that there is no difference between member households and non-member households as far as the declining trends of consumption are concerned. However, this needs to be examined more carefully using microeconometric approaches. There may be heterogeneity of member households because of the heterogeneity in CO activities and characteristics. Table 3 thus summarizes the baseline information about the COs to which the member households in our sample belonged.

<Table 3. Characteristics of COs for the Sample Member Households>

The majority of member households belong to female COs (the male CO share was

28%). Some COs were very old (126 months since establishment), while others were established just before our baseline survey. The average CO age was 47.6 months (approximately four years). HRD trainings were provided an average of 6.2 times with an average variety of 3.9 kinds. Micro infrastructure projects were implemented among 46% of member households, and microcredit was provided in COs with an incidence rate of 24%. We expect that these diversities in CO activities and characteristics affect the way the member households protected their consumption when the study region was hit by aggregate economic shocks. As previously described, both micro infrastructure and microcredit activities declined in 2011–12. Therefore, if the provision of microcredit or the implementation of micro infrastructure projects makes a difference in the vulnerability against shocks, the difference is not due to direct effects of micro infrastructure (e.g., employment for the project) or microcredit (e.g., the PHKN microcredit itself was used to smooth consumption). The difference is attributable to indirect effects induced by the past implementation of micro infrastructure projects or microcredit provision.

3. Empirical Strategy

The basic empirical model is[7]

$$\Delta Y_{ivt} = b_{10}T_{2011} + b_{11}T_{2011}\times M_{icv} + b_{20}T_{2012} + b_{21}T_{2012}\times M_{icv} + Z_{ivt}a_1 + Z_{iv}a_2 + u_{ivt}, \quad t = 2011, 2012, \tag{1}$$

where ΔY_{ivt} is the first difference of real consumption for household i living in village v from year t-1 to year t, T_{2011} is a dummy for the second survey year (t = 2011), M_{icv} is a dummy for the PHKN membership of household i belonging to CO c and village v (M for "member"), T_{2012} is a dummy for the third survey year (t = 2012), Z_{ivt} is a vector of household-level idiosyncratic shocks that occurred between year t-1 and year t, Z_{iv} is a vector of household initial characteristics, and u_{ivt} is a zero-mean error term. As there were aggregate shocks in the study region (as discussed in Section 2), we expect b_{10} and b_{20} to be negative. The DID coefficients on the interaction terms of M_{icv} and T_t, b_{11} and b_{21}, indicate how the PHKN membership mitigated the ill-effects of the aggregate shocks. If the mitigation effect exists, each of these parameters should take a positive value.

This specification allows for different impacts in year 2011 and 2012, as the year 2012 could have been associated with larger hardship due to consecutive aggregate shocks. In the literature, it is known that consecutive negative shocks bring households a larger difficulty

[7] As villages were employed as the primary sampling unit for the household survey (Khan et al., 2011), all regression analyses were based on robust standard errors clustered at the village level.

than the simple multiples of negative impacts caused by non-consecutive shocks (Fafchamps 2003). Furthermore, if CBD interventions mitigate aggregate shocks more efficiently after consecutive shocks, we expect $0 < b_{11} < b_{21}$ to hold. Another parameter of interest is $b_{11}+b_{21}$, which shows the cumulative impact of CBD interventions in mitigating aggregate shocks in the third year in comparison with the baseline year.

In equation (1), we also add the terms Z_{ivt} (household-level idiosyncratic shocks) and Z_{iv} (household initial characteristics) to cleanly identify the impact of aggregate shocks on consumption. In other words, our main empirical strategy is to define the aggregate shocks as the residual after we control for these factors.

Allowing for spillover effects within a village, we extend the model in equation (1) using the non-member households in non-CO villages as the reference. More specifically, our first extension is

$$\Delta Y_{ivt} = b_{10}T_{2011} + b_{11}T_{2011}\times M_{icv} + b_{12}T_{2011}\times N_{iv} + b_{20}T_{2012} + b_{21}T_{2012}\times M_{icv} + b_{22}T_{2012}\times N_{iv} + Z_{ivt}a_1 + Z_{iv}a_2 + u_{ivt}, \quad (2)$$

where N_{iv} is a dummy for non-member household i living in village v in which a CO exists (N for "neighbor"). By testing the null hypothesis $b_{12} = b_{22} = 0$, we can test the significance of the spillover effects. If the null is not rejected, equation (1) is supported against equation (2).

Our second extension is to allow the heterogeneity of the PHKN membership impact depending on the characteristics and activities of the CO to which member households belonged. Letting X_{cv} be the characteristics of CO c in village v. We extend equation (1) as

$$\Delta Y_{ivt} = b_{10}T_{2011} + T_{2011}\times M_{icv}\times(b_{11}+b_{12}\times X_{cv}) + b_{20}T_{2012} + T_{2012}\times M_{icv}\times(b_{21}+b_{22}\times X_{cv}) + Z_{ivt}a_1 + Z_{iv}a_2 + u_{ivt}, \quad (3)$$

where we use the baseline CO variables for X_{cv}. By testing the null hypothesis $b_{12} = b_{22} = 0$, we can test the significance of the heterogeneity. We are particularly interested in testing whether the impact differs along the dimensions shown in Table 3 (e.g., female vs. male COs, old vs. new COs, large vs. small COs, with vs. without micro infrastructure projects, with vs. without microfinance projects, etc.). As our sample size is not large and the variables in Table 3 are correlated, we first add only one variable as shifters in X_{cv}. If we find some variables associated with significant heterogeneity, we will attempt a multivariate heterogeneity extension.

As shown by Khan and Kurosaki (2013) using the same microdata, the membership variable M_{icv} is not chosen randomly, but in a way in which poorer villages and more vulnerable households are targeted. Therefore, the OLS estimation of equations such as (1)–(3) are subject to a potential endogeneity bias. To reduce this problem, our main identification strategy is based on the DID approach, where household fixed effects are implicitly included to control out all unobservable time-invariant factors, household-level idiosyncratic shocks are included, and the heterogeneity in consumption changes associated with observable household characteristics are controlled. Therefore, our DID coefficients b_{11} and b_{21} are biased estimates for the causal impact of PHKN membership only if the household-level unobservable heterogeneity in terms of endogenous program placement affects the *change* of household consumption. We judge this possibility to be very small. Nevertheless, we re-estimate equations (1) and (3) as robustness checks using different subsets of households as the control group. In the default specifications, we use all non-member households regardless of whether their village has a CO or not. Instead, we use only non-members in CO villages. If our DID identification assumption is correct, this re-estimation should not affect our DID impact parameters b_{11} and b_{21}.

4. Estimation Results

4.1 Basic Specifications

The estimation results of equation (1) are shown in Table 4. We used livestock loss due to death and the dummy for health shocks to household members as variables in vector Z_{ivt} (household-level idiosyncratic shocks) and household size, head's education, farmland size, and area of housing as variables in Z_{iv} (household initial characteristics). The variables in Z_{iv} were standardized by their means and standard deviations. Therefore, the estimates for b_{10} and b_{20} reported in Table 4 (and all following tables) show how much consumption decline occurred for non-member households with the average initial household characteristics, without livestock loss, and without health shocks to members. The DID estimates for b_{11} and b_{21} then show how much difference occurred for member households with similar characteristics.

<Table 4. Impact of Membership on Household Consumption (Basic Specifications)>

Of the eight DID parameters for b_{11} and b_{21} shown in Table 4, five are positive. However, none of them is statistically significant. Among the three negative parameter estimates, one on the non-food expenditure in 2012 was statistically significant. Furthermore, the sum of parameters for the cumulated effect, b_{11}+b_{21}, is also statistically insignificant for all four dependent variables (see the last row of Table 4). Therefore, PHKN membership in general does not mitigate the ill effects of aggregate shocks.

Idiosyncratic shocks (Z_{ivt}) have insignificant coefficients, suggesting the possibility of efficient risk sharing within a village. A more detailed analysis of how idiosyncratic shocks are insured is left for further research. Several of the variables included in Z_{iv} (household initial characteristics) have significant coefficients, suggesting that initially richer households experienced larger declines in consumption. As Z_{ivt} and Z_{iv} are included in our model as controls and the estimation results regarding the DID parameters were robust to alterations in the list of variables in Z_{ivt} and Z_{iv}, we do not discuss these terms further.

4.2 Spillover

The estimation results allowing for spillovers, equation (2), are shown in Table 5. Eight DID parameters for membership effect (b_{11} and b_{21}) become more positive than shown in Table 4. One of them (the follow-up year effect on non-food expenditures) is statistically significant as well. The sum of parameters for the cumulated effect (b_{11}+b_{21}) is positive for all four dependent variables, and two of them are statistically significant at the 10% level. This implies that PHKN membership mitigates the ill effects of aggregate shocks if the comparison group includes only those households in non-CO villages.

<Table 5. Impact of Membership on Consumption Allowing for Spillover>

Of the eight DID parameters for neighborhood effect (b_{12} and b_{22}), seven are positive. One of them (the follow-up year effect on non-food expenditures) is statistically significant. The magnitudes of membership effects and neighborhood effects are also similar. The null hypothesis that the two types of effects are the same (test for $b_{11} = b_{12}$ and $b_{21} = b_{22}$) is not rejected in all four dependent variables. This indicates strong spillover effects. However, the F-test results show that the null hypothesis of no spillover effect was not rejected either. This may show a lack of statistical power in identifying the spillover effects in our survey design. The number of villages from which the non-member households in non-CO villages was only 20. As we cluster the standard errors at the village level, the small effective sample size when using non-CO village households as the control resulted in low statistical power to identify the spillover effects. It is difficult to distinguish between the spillover membership effects from village-specific shocks by construction.

To examine whether the pattern in Table 5 was indeed due to spillover effects, we extended equation (2) in two directions. As shown in Appendix Table 1, neighbors (i.e., non-CO member households) in a village with a larger number of COs were better able to mitigate aggregate shocks; neighbors in a village where the COs implemented a micro infrastructure project were better able to mitigate aggregate shocks. This is evidence in support of the existence of spillover, as we expect that COs with more members affect non-members more and COs' infrastructure projects naturally bring benefits to non-members as well. We therefore conclude that a strong spillover effect within CO villages from member to non-member households was suggested, which mitigated the ill effects of aggregate shocks.

4.3 Heterogeneity According to CO Characteristics and Activities

Tables 6 and 7 show the regression results when we allow a heterogeneous impact according to the COs' characteristics and activities (equation (3)). To make coefficient estimates for b_{11} and b_{21}) easy to understand, we use the deviations of CO characteristics and activities from their median. Our main interests are, however, the sign and magnitudes of coefficients on the interaction terms (b_{12} and b_{22}), which show the heterogeneous impact.

Table 6 shows the regression results when we allow a heterogeneous impact according to the COs' compositional characteristics. Panel A shows that the shock-mitigating effect is stronger among female COs than male COs (the interaction coefficients for male COs are mostly negative, with two of them statistically significant). However, the difference was not as strong as we expected. As PHKN's activities were focused on women, we expected a sharper difference. The weak difference could be because PHKN is targeted toward females, even through male COs.

<Table 6. Heterogeneous Impact According to COs' Compositional Characteristics>

Panel B of Table 6 shows that the shock-mitigating effect is stronger among old COs than new COs and that this effect is realized in a cumulative way. Although neither of the interaction terms (b_{12} and b_{22}) is statistically significant, the cumulative effect (b_{12} + b_{22}) is large and statistically significant for the total expenditure (*dtot_exp*), per-capita expenditure (*dexp_pc*), and food expenditure (*dexp_food*), at the 5%, 1%, and 10% levels, respectively. The cumulative coefficient on *dexp_pc* is 0.077 (= 0.012 + 0.065), implying that members in the oldest CO (*co_age* – 32 = 126 – 32 = 94) enjoyed per-capita consumption that was Rs 7,300 higher than a member household in an average CO. Rs 7,300 corresponds to 18% of baseline consumption (see Table 1). This finding is consistent with our field observations that older COs are better able to enhance the standard of living of member households.

Panel C of Table 7 shows that the shock-mitigating effect is stronger among small COs than large COs. All four interaction terms involving the number of members (b_{22}) are negative for the third-round year and statistically significant. The third-year effect on *dtot_exp* is -3.396, implying that members in a CO with the smallest number of members (*co_size* – 23 = 16 – 23 = -7) enjoyed total consumption that was Rs 23,700 higher than a member household in an average CO. Rs 23,700 corresponds to 10.3% of the baseline consumption (see Table 1). This finding is consistent with our field observations that smaller COs are more active.

<Table 7. Heterogeneous Impact According to COs' Activities>

Table 7 shows the regression results when we allow a heterogeneous impact according to COs' activities. Panel A shows that the shock-mitigating effect is the same regardless of the number of HRD trainings. Panel B similarly shows that the shock-mitigating effect is the same regardless of the type of HRD training.[8] Although HRD training is a critical part of PHKN's interventions, its quantity and variety do not affect members' protection against aggregate shocks. This is surprising because PHKN's HRD training emphasizes income-generating activities. It is possible that this training has not been effective in transferring technology in a sustainable way, similar to our conclusion regarding the anti-wild boar attack program implemented by PHKN (Kurosaki and Khan 2013).

Panel C of Table 7 suggests a shock-mitigating effect from micro infrastructure projects. All of the interaction terms involving micro infrastructure (b_{12} and b_{22}) are positive. Although none of them is statistically significant at the conventional level, the cumulative effect (b_{12} + b_{22}) is large and statistically significant for all four dependent variables (the significance level is 5%). The cumulative effect on *dtot_exp* is 31.090 (= 7.859 + 23.231), implying that members in a CO with an infrastructure project enjoyed total consumption that was Rs 31,000 higher (13.5% of the baseline consumption) than a member household in a CO without such a project. This suggests that micro infrastructure projects have strong shock-mitigating effects, especially after the region has witnessed consecutive bad years. As our dataset allows disaggregating infrastructure projects into water-related and others, we attempted to distinguish between them. Probably because of the smaller number of samples, we were not able to find significant differences between the two types of infrastructure.

Panel D of Table 7 shows that a strong shock-mitigating effect existed among member households in 2011 when their COs implemented a microfinance project. Seven of the eight interaction terms involving microcredit (b_{12} and b_{22}) are positive, of which three are statistically significant (all in the re-survey round of 2011). Because of the high significance of the effect on 2011, the cumulative effect (b_{12} + b_{22}) is also positive and statistically significant for all four dependent variables (their significance levels are 5% or 1%). The effect on *dtot_exp* in 2011 is 41.56, implying that members in a CO providing microcredit enjoyed total consumption that was Rs 41,600 higher (18.1% of the baseline consumption) than a member household in a CO without microfinance. Because credit improves household ability to smooth

[8] The results remained insignificant when we used each type of HRD training separately and included its dummy and interaction term.

consumption, it is not surprising that the past provision of PHKN microcredit had a shock-mitigating effect in a year after bad aggregate shocks.

To explore the mechanism by which the past provision of PHKN microcredit mitigated the ill effects in 2011–12, we utilized the heterogeneity among members within a CO with microfinance activities. Not all members within such COs obtained PHKN microcredit. Instead of the CO-level indicator of providing microcredit (*mf* in Table 7), we use the individual-level indicator of receiving PHKN microcredit (*mf_individual*). Appendix Table 2 reports the regression results. When we replace *mf* with *mf_individual*, the results are qualitatively similar to those in Table 7, with slightly stronger shock-mitigating effects when we use *mf_individual* (Panel B, Appendix Table 2). When we distinguish member households within such COs by whether *mf_individual* = 0 or 1, we obtain the results that actual credit recipients were more able to mitigate the ill effects of aggregate shocks (Panel C, Appendix Table 2). It is striking is that members who did not receive PHKN microcredit were also able to mitigate the ill effects. Indeed, the spillover effect is about one third to half as strong as the direct effects and is statistically significant for *dtot_exp*, *dexp_pc*, and *dexp_food*. Furthermore, the null hypothesis that the spillover effect is the same as the direct effect was not rejected. These findings suggest that access to credit matters; thus, the past provision of PHKN microcredit benefitted not only the recipient households, but also their peers in the same CO who did not receive the microcredit. In other words, this is evidence that CBD interventions with microcredit enhance the bonding social capital.

The results in Tables 5 and 6 thus show evidence that female COs that are smaller, are older, implement micro infrastructure projects, and implement microfinance projects are effective in mitigating the ill effects of aggregate shocks. One problem with this inference is the correlation of these CO characteristics and activities (Khan et al. 2011). In the Appendix, we describe how we distinguish the independent impacts of these five factors (Appendix Tables 3–6). Our preliminary conclusion is that the provision of microfinance and the combination of smaller and older COs each had an independent shock-mitigating effect. Distinguishing the independent effects more clearly is left for further research.

4.4 Robustness Check

To examine the robustness of our results thus far, we implemented a series of checks. The results of using different control groups are shown in Table 8, where we report only the DID parameters of interest (b_{12} and b_{22}). Panel A of Table 8, which is extracted from Table 4, shows the absence of shock-mitigating effects of membership when the comparison group includes both non-member households in CO villages and households in non-CO villages.

When we restricted the comparison group to include non-member households in CO villages only, the results remain similar (Panel B of Table 8). In sharp contrast, when we restricted the comparison group to include households in non-CO villages only, we found strong shock-mitigating effects of membership (Panel C of Table 8). This is as expected from our initial comparison of Tables 4 and 5. The results in Table 8 thus confirm the possibility of strong spillover effects. It is also theoretically possible that non-CO villages are systematically more vulnerable to aggregate shocks. However, we judge that this possibility is highly unlikely, as PHKN targets villages that are poorer and more vulnerable (Khan and Kurosaki 2013). With the presence of strong spillover effects in CO villages from member households to non-member households, however, the result of the robustness check in Table 8 is not powerful enough to justify our identifying assumptions. Identifying the membership effects more cleanly is left for further research.

<Table 8. Robustness Check with Respect to the Choice of Control Group>

As another direction of robustness checks, we replaced the dependent variable with the first difference in log consumption. The results are qualitatively the same, although the statistical significance level becomes slightly weak (see Appendix Tables 7–10). In this aspect, the findings reported in this paper are robust.

5. Conclusion

In this paper, we empirically investigated whether a community-based development (CBD) approach is effective in mitigating the ill effects of aggregate shocks. For the analysis, we used unique panel data for approximately 600 households in rural Pakistan, which were collected in three years when regional shocks brought negative income growth in two consecutive years and in areas in which a local women-focused NGO has implemented CBD interventions. Our results showed that the mitigating effect was absent when the control group included both non-member households in villages under CBD intervention and households in villages without such interventions. On the other hand, a strong spillover effect within the former types of villages from member to non-member households was found, which mitigated the ill effects of aggregate shocks. Furthermore, CBD interventions implemented through smaller and older COs that were accompanied by micro infrastructure construction or microcredit provision were found to be effective in mitigating the ill effects. In the case of micro infrastructure, the shock-mitigating effects were realized in a cumulative way after two years of bad shocks and spread to non-members in the village. In the case of microfinance, the shock-mitigating effects were realized immediately after the aggregate shocks and spread to non-borrowing members in the same CO.

The study area is characterized by geographically isolated, underdeveloped credit markets, especially through formal financial institutions and in terms of women's credit. As a result, intertemporal smoothing becomes difficult when a community is hit by disasters (Kurosaki and Khan 2011, Kurosaki 2013b). The finding of shock-mitigating effects of microcredit provision and infrastructure projects is not surprising in this context. In other words, our results suggest the possibility that whether a CBD approach mitigates aggregate shocks depends on the type of intervention and the nature of market failures.

Our finding of a lack of overall impact on the mitigation of aggregate shocks confirms the general observation noted in the introduction that it is difficult to mitigate such shocks when the community's total resources are reduced. At the same time, the detailed pattern we found in this paper is consistent with our hypothesis that households under CBD interventions are better able to cope with aggregate shocks through the enhancement of the bonding social capital and the bridging social capital. It is likely that CBD interventions carried out through older COs with fewer members were more effective in making members more interactive among them, enabling more opportunities for relatively affluent households to support relatively poor households during bad times. The existence of strong spillover effects within microcredit COs from borrowing members to non-borrowing members is also consistent with this. It is likely that micro infrastructure enables households to migrate outside the region temporarily to supplement their income or make credit/transfer exchanges with households/institutions outside the region. These are only speculations, however. As we have data on informal transactions among sample households regarding transfers, credit, and migration, it is left for further study to model and empirically examine a mechanism in which CBD interventions enhance social capital and then improve household resiliency against aggregate shocks.

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Table 1. Characteristics of the Sample Households (2010)

Variable name	Description	Mean	Std. Dev.	Median	Min	Max
Membership status						
member	Dummy for a CO member household	0.44	0.50	0	0	1
neighbor	Dummy for a non-member household in a CO village	0.41	0.49	0	0	1
Household demography						
hhsize	Number of household members	6.17	2.68	6	1	16
hh_age	The age of the household head	49.65	14.01	50	20	90
hh_lite	Household head's literacy dummy	0.73	0.44	1	0	1
hh_edu	Household head's years of education	5.90	4.37	5	0	16
Household asset and income indicators						
cellphone	Dummy for cellphone ownership	0.88	0.33	1	0	1
area_hh	Area of the house (in *marlas*)	9.60	6.13	8	1	40
tot_area_ol	Size of landholding (area in *kanals*)	6.39	11.39	1	0	100
remittance	Remittance receipt (Rs 1,000)	52.55	155.85	0	0	1800
Household consumption						
tot_exp	Total expenditures (Rs 1,000)	229.93	124.70	209.23	28.19	1356.67
exp_pc	Per-capita expenditures (Rs 1,000)	39.70	17.07	35.55	11.96	142.58
exp_food	Food expenditures (Rs 1,000)	163.11	75.21	151.98	21.42	648.67
exp_nonfd	Non-food expenditures (Rs 1,000)	66.82	64.87	50.50	2.50	763.00
exp_kindfd	In-kind food expenditures imputed using village prices (Rs 1,000)	21.85	30.26	4.59	0	167.28
Crop-income loss due to wild boar attacks						
estloss_wba	Income loss due to WBAs (Rs 1,000)	2.74	5.52	0	0	50

Source: Prepared by the author (same as the following tables and figures).

Notes: All statistics are taken from the 2010 benchmark survey dat. The number of observations is 569. The means and standard deviations are unweighted ones using the 569 observations. One *kanal* is approximately 1/8 acre and 1 *marla* = 1/20 *kanal* .

Table 2. Consumption in the Three Years by Membership Status

Survey year	Total (*n* =569)	Member households (*n* =248)	Non-member households (*n* =321)
(A) Total expenditures (*tot_exp*)			
2010	229.93	224.75	233.93
	(124.70)	(111.48)	(134.05)
2011	163.28	163.07	163.45
	(89.95)	(92.64)	(87.97)
2012	135.28	131.49	138.20
	(73.84)	(62.67)	(81.39)
(B) Per-capita expenditure (*exp_pc*)			
2010	39.70	39.05	40.19
	(17.07)	(16.94)	(17.19)
2011	27.75	27.43	28.00
	(12.98)	(12.56)	(13.30)
2012	23.56	22.84	24.12
	(12.32)	(9.21)	(14.26)
(C) Food expenditures (*exp_food*)			
2010	163.11	158.71	166.51
	(75.21)	(68.03)	(80.27)
2011	109.67	105.88	112.60
	(58.44)	(58.11)	(58.62)
2012	94.04	91.26	96.19
	(57.37)	(44.04)	(65.83)
(D) Nonfood expenditures (*exp_nonfd*)			
2010	66.82	66.04	67.42
	(64.87)	(58.18)	(69.68)
2011	53.61	57.19	50.85
	(40.74)	(42.42)	(39.24)
2012	41.24	40.24	42.01
	(29.58)	(23.76)	(33.41)

Note: Figures in parentheses are standard deviations. All monetary variables are in Rs 1,000 in 2010 prices.

Table 3. Characteristics of Community Organisations (COs) for the Sample Member Households (2010)

Variable name	Description	Mean	Std. Dev.	Median	Min	Max
CO's compositional characteristics						
co_male	Dummy for a male CO (ref.=female CO)	0.28	0.45	0	0	1
co_age	CO's vintage measured by the number of months since its establishment	47.63	41.79	32	0	126
co_size	CO's size measured by the number of members	23.66	5.57	23	16	40
CO's activities						
hrd_num	Number of HRD trainings	6.19	2.66	6	1	15
hrd_var	Varieties of HRD trainings, distinguishing 8 categories of livestock, poultry, plant nursery, kitchen gardening, agro-based cottage industry, traditional birth attendant, income earning skills, and non-conventional	3.87	1.53	4	1	7
mip	Dummy for a CO implementing micro infrastructure projects	0.46	0.50	0	0	1
mf	Dummy for a CO implementing microfinance schemes	0.24	0.43	0	0	1

Notes: All statistics are taken from the 2010 benchmark survey data. The number of observations is 248. The means and standard deviations are unweighted ones using the 248 observations.

Table 4. Impact of Membership on Household Consumption (Basic Specifications)

	Dependent variable: First difference in household consumption (PKR 1,000 in 2010 prices)			
Explanatory variables:	*dtot_exp*	*dexp_pc*	*dexp_food*	*dexp_nonfd*
Aggregate shocks				
Follow-up (b_{10})	-71.860***	-12.334***	-54.820***	-17.040***
	[9.286]	[1.634]	[5.304]	[5.462]
Follow-up*member (b_{11})	9.602	0.666	1.582	8.020
	[7.838]	[1.382]	[4.990]	[4.977]
3rd_round (b_{20})	-26.257***	-3.982**	-17.094*	-9.163***
	[9.568]	[1.779]	[8.592]	[3.054]
3rd_round*member (b_{21})	-5.784	-0.650	2.109	-7.894**
	[7.133]	[1.289]	[5.768]	[3.470]
Idiosyncratic shocks				
Livestock loss due to death (Rs 1,000)	-0.049	-0.010	-0.002	-0.047
	[0.110]	[0.020]	[0.049]	[0.077]
Dummy for health shocks to hh members	9.030	0.927	5.773	3.258
	[7.740]	[1.069]	[5.940]	[4.148]
Initial hh characteristics (standardized by its mean and s.d.: unit=s.d.)				
hhsize	-17.403***	1.004**	-11.797***	-5.606***
	[2.253]	[0.454]	[1.744]	[1.969]
hh_edu	-1.988	-0.414	-1.229	-0.759
	[1.983]	[0.342]	[1.245]	[1.112]
tot_area_ol	-8.422***	-1.072**	-3.290**	-5.132**
	[2.900]	[0.464]	[1.616]	[2.119]
area_hh	-4.651*	-0.750	-3.166**	-1.484
	[2.708]	[0.481]	[1.384]	[1.667]
R-squared (overall)	0.290	0.277	0.339	0.096
F-statistics for zero slopes (F(4,40))	*45.90****	*46.98****	*68.10****	*12.69****
F-stat for b_{11}=b_{21}=0 (F(2,40))	*0.79*	*0.15*	*0.23*	*2.93**
F-state for b_{11}+b_{21}=0 (F(1,40))	*0.24*	*0.00*	*0.46*	*0.00*

Notes: The empirical model is equation (1), estimated by OLS with the number of observations at 1,138 (2 time differences x 569 households). Robust standard errors clustered at the village level are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
The mean (standard deviation) of the livestock loss due to death (Rs 1,000) was 1.396 (11.187) and the mean of the dummy for health shocks to household members was 0.107.

Table 5. Impact of Membership on Consumption Allowing for Spillover

	Dependent variable:			
DID parameter estimate	*dtot_exp*	*dexp_pc*	*dexp_food*	*dexp_nonfd*
A. Using households in non-CO village as the control				
Follow-up*member (b_{11})	26.936	3.263	1.964	24.972**
	[16.988]	[2.884]	[8.914]	[11.104]
Follow-up*neighbor (b_{12})	23.906	3.581	0.532	23.374**
	[17.326]	[2.876]	[9.074]	[11.042]
3rd_round*member (b_{21})	2.918	0.920	15.108	-12.190**
	[12.296]	[2.305]	[8.980]	[6.018]
3rd_round*neighbor (b_{22})	11.974	2.160	17.881	-5.907
	[14.160]	[2.578]	[12.110]	[6.094]
F-stat for b_{11}=b_{21}=0 (F(2,40))	*1.70*	*1.06*	*2.16*	*3.59***
F-stat for b_{11}+b_{21}=0 (F(1,40))	*3.25**	*2.08*	*3.63**	*1.34*
F-stat forb_{12}=b_{22}=0 (F(2,40))	*2.01*	*1.74*	*1.49*	*2.30*
F-stat for b_{12}+b_{22}=0 (F(1,40))	*4.03**	*3.48**	*2.78*	*2.58*
F-stat for b_{11}=b_{12} & b_{21}=b_{22} (F(2,40))	*0.68*	*0.91*	*0.08*	*1.61*
B. With restriction of the same effect for member and neighbor (full spillover effect)				
Follow-up*(member+neighbor) (b'_{11})	25.466	3.416	1.270	24.196**
	[16.706]	[2.798]	[8.593]	[10.888]
3rd_round*(member+neighbor) (b'_{21})	7.310	1.521	16.453	-9.143
	[12.638]	[2.334]	[10.040]	[5.794]
F-stat for b'_{11}=b'_{21}=0 (F(2,40))	*1.92*	*1.43*	*1.93*	*2.95**
F-stat for b'_{11}+b'_{21}=0 (F(1,40))	*3.80**	*2.84*	*3.48**	*1.95*

Notes: The empirical model is equation (2), estimated by OLS. Coefficients on the follow-up dummy, the 3rd_round dummy, idiosyncratic shocks, household initial characteristics, R2, etc. are not reported, to save space. See Table 4 for other notes.

Table 6. Heterogeneous Impact According to COs' Compositional Characteristics

	Dependent variable:			
DID parameter estimate	*dtot_exp*	*dexp_pc*	*dexp_food*	*dexp_nonfd*
A. Female CO vs. male CO				
Follow-up*member (b_{11})	13.926	1.541	6.913	7.014
	[9.533]	[1.769]	[6.527]	[4.967]
Follow-up*member*co_male (b_{12})	-15.570	-3.149	-19.214**	3.644
	[15.655]	[2.795]	[9.041]	[9.351]
3rd_round*member (b_{21})	-3.481	0.172	0.755	-4.236
	[7.810]	[1.520]	[6.182]	[3.263]
3rd_round*member*co_male (b_{22})	-8.281	-2.956	4.881	-13.162*
	[13.362]	[2.402]	[8.703]	[7.612]
F-stat for $b_{12}=b_{22}=0$ (F(2,40))	*1.10*	*2.76**	*2.52**	*1.54*
F-stat for $b_{12}+b_{22}=0$ (F(1,40))	*2.21*	*5.38***	*2.90**	*1.01*
B. Heterogeneity according to the CO's vintage				
Follow-up*member (b_{11})	9.815	0.495	1.466	8.349
	[7.321]	[1.303]	[4.427]	[5.446]
Follow-up*member*(co_age-32) (b_{12})	-0.011	0.012	0.009	-0.020
	[0.207]	[0.039]	[0.139]	[0.097]
3rd_round*member (b_{21})	-10.050	-1.645	-0.086	-9.964**
	[9.134]	[1.646]	[7.373]	[3.961]
3rd_round*member*(co_age-32) (b_{22})	0.277	0.065	0.143	0.134
	[0.246]	[0.044]	[0.186]	[0.086]
F-stat for $b_{12}=b_{22}=0$ (F(2,40))	*2.29*	*5.07***	*2.37*	*1.60*
F-stat for $b_{12}+b_{22}=0$ (F(1,40))	*4.57***	*10.14****	*3.79**	*1.80*
C. Heterogeneity according to the CO's membership size				
Follow-up*member (b_{11})	8.627	0.536	0.958	7.669
	[8.001]	[1.402]	[5.278]	[4.800]
Follow-up*member*(co_size-23) (b_{12})	1.450	0.192	0.929	0.521
	[1.031]	[0.186]	[0.680]	[0.692]
3rd_round*member (b_{21})	-3.544	-0.152	3.521	-7.065**
	[8.413]	[1.467]	[6.957]	[3.116]
3rd_round*member*(co_size-23) (b_{22})	-3.396*	-0.755**	-2.140*	-1.256*
	[1.713]	[0.300]	[1.176]	[0.639]
F-stat for $b_{12}=b_{22}=0$ (F(2,40))	*1.97*	*3.24***	*1.66*	*1.96*
F-stat for $b_{12}+b_{22}=0$ (F(1,40))	*2.52*	*4.96***	*2.24*	*1.17*

Notes: The empirical model is equation (3), estimated by OLS. Coefficients on the follow-up dummy, the 3rd_round dummy, idiosyncratic shocks, household initial characteristics, R2, etc. are not reported, to save

Table 7. Heterogeneous Impact According to COs' Activities

	Dependent variable:			
DID parameter estimate	*dtot_exp*	*dexp_pc*	*dexp_food*	*dexp_nonfd*
A. Heterogeneity according to the number of HRD trainings				
Follow-up*member (b_{11})	9.553	0.694	1.616	7.937
	[7.986]	[1.399]	[5.063]	[5.076]
Follow-up*member*(hrd_num-6) (b_{12})	0.274	-0.149	-0.180	0.454
	[2.489]	[0.432]	[1.880]	[0.936]
3rd_round*member (b_{21})	-6.053	-0.743	2.030	-8.083**
	[7.152]	[1.285]	[5.855]	[3.426]
3rd_round*member*(hrd_num-6) (b_{22})	1.452	0.490**	0.416	1.037
	[1.342]	[0.229]	[0.965]	[0.679]
F-stat for $b_{12}=b_{22}=0$ (F(2,40))	*1.08*	*3.35***	*0.14*	*1.81*
F-stat for $b_{12}+b_{22}=0$ (F(1,40))	*0.77*	*1.08*	*0.03*	*2.58*
B. Heterogeneity according to the varieties of HRD trainings				
Follow-up*member (b_{11})	9.816	0.670	1.830	7.985
	[7.699]	[1.358]	[4.953]	[4.908]
Follow-up*member*(hrd_var-4) (b_{12})	1.576	0.009	1.919	-0.343
	[3.872]	[0.679]	[2.941]	[2.490]
3rd_round*member (b_{21})	-5.561	-0.565	1.998	-7.560**
	[7.261]	[1.281]	[5.929]	[3.428]
3rd_round*member*(hrd_var-4) (b_{22})	1.616	0.646	-0.925	2.541
	[4.357]	[0.696]	[2.633]	[2.298]
F-stat for $b_{12}=b_{22}=0$ (F(2,40))	*0.44*	*0.64*	*0.22*	*0.80*
F-stat for $b_{12}+b_{22}=0$ (F(1,40))	*0.86*	*1.03*	*0.19*	*0.99*
C. Additional impact for COs implementing micro infrastructure projects				
Follow-up*member (b_{11})	6.031	-0.142	1.308	4.723
	[9.031]	[1.613]	[5.125]	[7.313]
Follow-up*member*mip (b_{12})	7.859	1.777	0.638	7.221
	[11.692]	[2.344]	[8.327]	[7.560]
3rd_round*member (b_{21})	-16.404	-2.757	-4.164	-12.241*
	[13.001]	[2.471]	[9.450]	[6.216]
3rd_round*member*mip (b_{22})	23.231	4.609	13.704	9.527
	[16.106]	[3.089]	[11.483]	[7.182]
F-stat for $b_{12}=b_{22}=0$ (F(2,40))	*3.32***	*3.54***	*2.61**	*2.33*
F-stat for $b_{12}+b_{22}=0$ (F(1,40))	*6.46***	*6.96***	*4.95***	*4.57***
D. Additional impact for COs implementing microfinance projects				
Follow-up*member (b_{11})	-0.264	-1.424	-5.896	5.631
	[8.772]	[1.626]	[4.621]	[6.172]
Follow-up*member*mf (b_{12})	41.561***	8.805***	31.476***	10.085
	[12.181]	[2.407]	[7.951]	[6.833]
3rd_round*member (b_{21})	-6.258	-0.639	3.414	-9.672**
	[8.131]	[1.521]	[5.588]	[4.593]
3rd_round*member*mf (b_{22})	2.252	0.009	-5.296	7.548
	[14.825]	[2.682]	[9.659]	[5.811]
F-stat for $b_{12}=b_{22}=0$ (F(2,40))	*10.55****	*9.13****	*17.10****	*2.79**
F-stat for $b_{12}+b_{22}=0$ (F(1,40))	*14.18****	*12.30****	*20.03****	*5.55***

Notes: See Table 6.

Table 8. Robustness Check with Respect to the Choice of Control Group

	Dependent variable:			
DID parameter estimate	*dtot_exp*	*dexp_pc*	*dexp_food*	*dexp_nonfd*
A. Default (extracted from Table 4)				
Follow-up*member (b_{11})	9.602	0.666	1.582	8.020
	[7.838]	[1.382]	[4.990]	[4.977]
3rd_round*member (b_{21})	-5.784	-0.650	2.109	-7.894**
	[7.133]	[1.289]	[5.768]	[3.470]
F-stat for b_{12}=b_{22}=0 (F(2,40))	*0.79*	*0.15*	*0.23*	*2.93**
F-stat for b_{12}+b_{22}=0 (F(1,40))	*0.24*	*0.00*	*0.46*	*0.00*
B. Using non-member households in CO villages as the Control Group				
Follow-up*member (b_{11})	2.841	-0.340	1.370	1.471
	[7.719]	[1.383]	[5.349]	[3.932]
3rd_round*member (b_{21})	-9.166	-1.249	-2.798	-6.368*
	[7.996]	[1.438]	[6.867]	[3.662]
F-stat for b_{12}=b_{22}=0 (F(2,40))	*0.71*	*0.92*	*0.08*	*1.60*
F-stat for b_{12}+b_{22}=0 (F(1,40))	*0.73*	*1.75*	*0.05*	*1.45*
C. Using households in non-CO villages as the Control Group				
Follow-up*member (b_{11})	27.100	3.222	2.248	24.852**
	[16.903]	[2.875]	[8.900]	[11.041]
3rd_round*member (b_{21})	2.505	0.742	14.876	-12.372**
	[12.401]	[2.277]	[8.879]	[6.083]
F-stat for b_{12}=b_{22}=0 (F(2,40))	*1.66*	*0.95*	*2.03*	*3.56***
F-stat for b_{12}+b_{22}=0 (F(1,40))	*3.09**	*1.82*	*3.35**	*1.31*

Notes: The number of observations is 1,138 (2 differences x 569 hh) for panel A, 962 (2 differences x 481 hh) for panel B, and 672 (2 differences x 336 hh) in panel C. See notes to Table 4 for the list of other explanatory variables.

Appendix: Which CO Characteristics and Activities Mattered More?

The results in Tables 6 and 7 show strong evidence that COs that are smaller, implement a micro infrastructure project, and provide microcredit are effective in mitigating the ill effects of aggregate shocks. The results also show weak evidence that older COs and female COs are effective in mitigating the ill effects.

One problem with this inference is the correlation of these CO characteristics and activities. Appendix Table 3 shows the correlation coefficients for the five potential sources of CO characteristics and activities. Of the ten correlation coefficients, nine are statistically significant. When a CO implements a microfinance project, it is more likely to be a female CO, older, and small in the number of household members, and to have a micro infrastructure project as well. Because of this correlation, the results in Tables 6–7 cannot be interpreted as showing the independent impact of each of the five variables in Appendix Table 3.

To identify the independent impact of the five variables in Appendix Table 3, we prepared a pattern table of 248 member households based on dichotomous divisions by the five variables. The result is shown in Appendix Table 4. Potentially, the 248 members may be classified into 32 subgroups when divided by the five dichotomous criteria. Because of the correlation, the actual distribution covered only 15 subgroups. From these, we chose the largest five subgroups, denoted as groups (1), (2), (3), (4), and (5). As these five categories are mutually exclusive by construction, we can include all of them as shifters in equation (3) and cleanly identify the individual impact by the following comparison:

(1) vs. (2): young and large vs. old and small

(2) vs. (3): no micro infrastructure project (mip) vs. mip

(3) vs. (4): no microfinance (mf) vs. mf

(1) vs. (5): female vs. male

By testing the equality of the additional DID parameters in the above comparison pairs, we can identify the independent impact of old and small, micro infrastructure project, microfinance, and male COs. The results are shown in Appendix Table 5. First, the comparison of (1) vs. (2), that is, young and large vs. old and small, results in a statistically significant difference. Therefore, old and small COs have an independent effect of mitigating the ill effects of aggregate shocks. Second, the comparison of (3) vs. (4) results in a statistically significant difference, indicating that microfinance-implementing COs have an independent effect of mitigating the ill effects of aggregate shocks. Third, the other two comparisons result in a statistically insignificant difference. Therefore, the independent positive impact of micro infrastructure-implementing COs and the independent negative impact of male COs are not identified.

Regarding the difference between the age effect and the size effect, we are unable to find an appropriate comparison pair with a sufficient number of households. Therefore, instead of using such comparison pairs, we reclassified all member households into four subgroups according to the size and age of COs. Our comparison uses [young and old] as the reference and tests for the difference if the member belongs to [old and small], [young and small], or [old and large]. If the age matters but the size does not, we will have positive and similar coefficients on [old and small] and [old and large] and a zero coefficient on [young and small]. If both factors matter, we will have positive coefficients on all three, with the one on [old and small] the largest of the three.

The estimation results are reported in Appendix Table 6. For the three dependent variables *dtot_exp*, *dexp_pc*, and *dexp_food*, the coefficient on [old and large] is insignificant, while those on [old and small] and [young and small] are positive with similar magnitudes. This favors the independent effect of small size. On the other hand, when the dependent variable is *dexp_nonfd*, the coefficient on [old and large] is positive and statistically significant. This suggests the possibility that age has an independent shock-mitigating effect. The results in Appendix Table 6 are thus inconclusive.

Therefore, our tentative conclusion is that COs whose size is smaller and that implement a microfinance project are effective in mitigating the ill effects of aggregate shocks, and each of these effects has an independent impact. COs implementing a micro infrastructure project and older COs are also associated with shock mitigation, but the mitigating impact may be realized indirectly through other routes (such as smaller CO size and microfinance projects).

Appendix Table 1. Spillover Effects (extension of equation (2))

	Dependent variable:			
DID parameter estimate	*dtot_exp*	*dexp_pc*	*dexp_food*	*dexp_nonfd*
A. Neighbor dummy interaction only (extracted from Table 5)				
Follow-up*neighbor (b_{12})	23.906	3.581	0.532	23.374**
	[17.326]	[2.876]	[9.074]	[11.042]
3rd_round*neighbor (b_{22})	11.974	2.160	17.881	-5.907
	[14.160]	[2.578]	[12.110]	[6.094]
B. Replace *neighbor* dummy by the number of active COs in a CO village (*num_co*) to make the interaction term				
Follow-up*num_co (b_{12})	2.824***	0.535***	1.113*	1.711***
	[1.005]	[0.170]	[0.640]	[0.569]
3rd_round*num_co (b_{22})	2.321**	0.378*	1.783	0.538
	[1.117]	[0.216]	[1.106]	[0.464]
C. Both interactions terms included				
Follow-up*neighbor ($b_{12,1}$)	5.864	-0.304	-11.002	16.866
	[23.399]	[3.776]	[12.753]	[13.541]
Follow-up*num_co ($b_{12,2}$)	2.548	0.549**	1.629*	0.919
	[1.555]	[0.257]	[0.942]	[0.706]
3rd_round*neighbor ($b_{22,1}$)	-6.635	-0.768	7.886	-14.521*
	[18.218]	[3.154]	[12.815]	[8.123]
3rd_round*num_co ($b_{22,2}$)	2.632*	0.414	1.413	1.219*
	[1.516]	[0.271]	[1.136]	[0.627]
D. Replace *neighbor* dummy by the dummy for a CO village implementing micro infrastructure (*vil_mip*) to make the interaction term				
Follow-up*neighbor*vil_mip (b_{12})	9.963	2.365	-1.964	11.928
	[16.894]	[3.074]	[10.866]	[8.839]
3rd_round*neighbor*vil_mip (b_{22})	34.455**	6.160*	29.216*	5.239
	[15.665]	[3.108]	[15.612]	[5.972]
E. Both interaction terms included				
Follow-up*neighbor ($b_{12,1}$)	24.910	3.031	2.235	22.675*
	[24.127]	[3.999]	[13.089]	[13.229]
Follow-up*neighbor*vil_mip ($b_{12,2}$)	-1.851	0.927	-3.022	1.171
	[22.570]	[4.053]	[14.499]	[10.079]
3rd_round*neighbor ($b_{22,1}$)	-11.066	-1.952	1.257	-12.323
	[16.493]	[2.668]	[9.920]	[8.214]
3rd_round*neighbor*vil_mip ($b_{22,2}$)	39.669*	7.080*	28.620*	11.048
	[19.817]	[3.651]	[16.792]	[8.063]

Notes: See notes to Table 5.

Appendix Table 2. Microcredit Effects (extension of equation (3))

	Dependent variable:			
DID parameter estimate	*dtot_exp*	*dexp_pc*	*dexp_food*	*dexp_nonfd*
A. Microfinance CO dummy (*mf*) to make the interaction term (extracted from Table 7, panel D)				
Follow-up*member*mf (b_{12})	41.561***	8.805***	31.476***	10.085
	[12.181]	[2.407]	[7.951]	[6.833]
3rd_round*member*mf (b_{22})	2.252	0.009	-5.296	7.548
	[14.825]	[2.682]	[9.659]	[5.811]
B. Replace *mf* by the individual level use of microcredit (*mf_individual*) to make the interaction term				
Follow-up*member*mf_individual (b_{12})	55.625**	10.736**	35.534***	20.091
	[22.441]	[4.756]	[10.955]	[12.117]
3rd_round*member*mf_individual (b_{22})	9.761	2.899	0.523	9.238
	[17.318]	[3.275]	[10.152]	[7.547]
C. Distinguishing borrowing and non-borrowing members within a CO with microcredit provision				
Follow-up*member*mf_individual ($b_{12,0}$)	60.655**	11.859**	40.232***	20.423
	[25.111]	[5.363]	[13.313]	[12.871]
Follow-up*member*mf*(1-mf_individual) ($b_{12,1}$)	24.778**	5.537***	23.192***	1.586
	[10.307]	[1.940]	[7.389]	[6.763]
3rd_round*member*mf_individual ($b_{22,0}$)	12.029	3.184	0.627	11.402
	[18.085]	[3.344]	[11.129]	[7.547]
3rd_round*member*mf*(1-mf_individual) ($b_{22,1}$)	11.078	1.368	0.285	10.793*
	[15.046]	[2.610]	[9.902]	[6.053]

Notes: See notes to Table 6.

Appendix Table 3. Correlation Coefficients among Selected CO Characteristics and Activities

	co_male	co_age	co_size	mip	mf
co_male	1.000				
co_age	-0.374	1.000			
co_size	0.137	-0.469	1.000		
mip	-0.302	0.699	-0.570	1.000	
mf	-0.347	0.409	-0.333	0.416	1.000

Notes: See Table 3 for these variables. The number of observations is 248. The Spearman correlation coefficients are reported, caulculated unweighted.

Appendix Table 4. Pattern Table of CO Characteristics and Activities among Member Households

Dichotomous classification					Number of households	Distribution (%)	Largest 5 subgroups
co_male	1*(co_age>32)	1*(mem_no>23)	mip	mf			
0	0	0	0	0	0	0.00	
0	0	0	0	1	5	2.02	
0	0	0	1	0	0	0.00	
0	0	0	1	1	10	4.03	
0	0	1	0	0	45	18.15	(1)
0	0	1	0	1	5	2.02	
0	0	1	1	0	0	0.00	
0	0	1	1	1	0	0.00	
0	1	0	0	0	20	8.06	(2)
0	1	0	0	1	0	0.00	
0	1	0	1	0	45	18.15	(3)
0	1	0	1	1	29	11.69	(4)
0	1	1	0	0	5	2.02	
0	1	1	0	1	0	0.00	
0	1	1	1	0	5	2.02	
0	1	1	1	1	10	4.03	
1	0	0	0	0	4	1.61	
1	0	0	0	1	0	0.00	
1	0	0	1	0	10	4.03	
1	0	0	1	1	0	0.00	
1	0	1	0	0	45	18.15	(4)
1	0	1	0	1	0	0.00	
1	0	1	1	0	0	0.00	
1	0	1	1	1	0	0.00	
1	1	0	0	0	0	0.00	
1	1	0	0	1	0	0.00	
1	1	0	1	0	5	2.02	
1	1	0	1	1	0	0.00	
1	1	1	0	0	5	2.02	
1	1	1	0	1	0	0.00	
1	1	1	1	0	0	0.00	
1	1	1	1	1	0	0.00	
Total					**248**	**100.00**	

Appendix Table 5. Distinguishing Independent Impacts of Key CO Characteristics and Activities

	Dependent variable:			
DID parameter estimate	*dtot_exp*	*dexp_pc*	*dexp_food*	*dexp_nonfd*
Follow-up*member	17.108	2.871	7.279	9.830
	(18.318)	(2.851)	(12.937)	(7.036)
Follow-up*member*				
(1)[Female&young&large&no_mip&no_mf]	1.090	-1.954	2.426	-1.336
	(23.370)	(4.081)	(18.235)	(7.775)
(2)[Female&old&small&no_mip&no_mf]	-44.332	-6.866	-10.741	-33.591
	(49.381)	(8.455)	(19.821)	(38.575)
(3)[Female&old&small&mip&no_mf]	-16.982	-4.510	-18.680	1.698
	(19.688)	(2.963)	(16.395)	(6.357)
(4)[Female&old&small&mip&mf]	13.154	2.650	9.484	3.670
	(17.795)	(2.771)	(15.038)	(5.529)
(5)[Male&young&large&no_mip&no_mf]	-13.711	-4.228	-16.278	2.567
	(25.684)	(4.113)	(16.292)	(13.169)
3rd_round*member	7.346	1.007	7.157	0.189
	(13.033)	(2.194)	(8.376)	(5.219)
3rd_round*member*				
(1)[Female&young&large&no_mip&no_mf]	-44.287**	-8.210**	-30.705**	-13.583*
	(20.113)	(3.557)	(14.172)	(6.791)
(2)[Female&old&small&no_mip&no_mf]	10.129	6.040***	7.715	2.414
	(13.663)	(2.116)	(10.728)	(3.816)
(3)[Female&old&small&mip&no_mf]	14.128	4.687**	17.011*	-2.882
	(10.380)	(2.037)	(8.517)	(3.528)
(4)[Female&old&small&mip&mf]	-17.696*	-2.447	-14.741*	-2.954
	(8.792)	(1.717)	(7.408)	(2.416)
(5)[Male&young&large&no_mip&no_mf]	-34.470	-6.543*	-7.601	-26.869**
	(26.060)	(3.858)	(15.982)	(13.009)
F-stat. for (1)=(2) (F(2, 40)): vintage & size impac	*4.87***	*11.60****	*7.61****	*3.24***
F-stat. for (2)=(3) (F(2, 40)): mip impact?	*0.80*	*0.26*	*1.55*	*2.69**
F-stat. for (3)=(4) (F(2, 40)): mf impact?	*9.91****	*7.53****	*34.78****	*0.08*
F-stat. for (1)=(5) (F(2, 40)): co_male impact?	*0.49*	*0.52*	*3.14**	*1.07*

Notes: The empirical model is an extended version of equation (3), estimated by OLS. See table 5 for the explanatory variables not reported, to save space.

Appendix Table 6. Distinguishing Independent Impacts of CO Age and Size

	Dependent variable:			
DID parameter estimate	*dtot_exp*	*dexp_pc*	*dexp_food*	*dexp_nonfd*
Follow-up*member	17.033*	1.089	4.571	12.463
	(9.945)	(1.952)	(6.662)	(8.178)
Follow-up*member*				
(I)[old and small]	-17.389	-1.536	-9.592	-7.797
	(15.118)	(2.854)	(8.554)	(11.745)
(II)[young and small]	3.269	1.342	5.061	-1.792
	(16.645)	(3.199)	(8.589)	(10.395)
(III)[old and large]	-8.279	0.456	2.505	-10.784
	(25.110)	(4.069)	(14.046)	(12.992)
3rd_round*member	-32.410*	-6.404**	-12.287	-20.124***
	(16.595)	(2.692)	(11.854)	(7.162)
3rd_round*member*				
(I)[old and small]	44.966**	10.227***	26.898**	18.068**
	(19.941)	(3.308)	(13.233)	(8.605)
(II)[young and small]	47.515**	8.575***	26.704**	20.811**
	(19.230)	(3.056)	(11.387)	(8.820)
(III)[old and large]	31.553	6.818	5.549	26.005***
	(23.570)	(4.210)	(15.496)	(9.196)
F-stat. for (I)=(II)+(III) (F(2, 40))	*2.45**	*2.05*	*2.37*	*4.38***

Notes: The empirical model is an extended version of equation (3), estimated by OLS. See table 5 for the explanatory variables not reported, to save space.

Appendix Table 7. Impact of Membership on Household Consumption (Basic Specifications)
(Robustness check of results in Table 4 with respect to the definition of the dependent variable)

	Dependent variable: First difference in log household consumption			
Explanatory variables:	*dl_tot_exp*	*dl_exp_pc*	*dl_exp_food*	*dl_exp_nonfd*
Aggregate shocks				
Follow-up (b_{10})	-0.354***	-0.380***	-0.409***	-0.207***
	[0.045]	[0.045]	[0.052]	[0.057]
Follow-up*member (b_{11})	0.010	0.013	-0.036	0.111*
	[0.043]	[0.041]	[0.048]	[0.062]
3rd_round (b_{20})	-0.154***	-0.142**	-0.137*	-0.187***
	[0.055]	[0.053]	[0.077]	[0.040]
3rd_round*member (b_{21})	-0.012	-0.018	0.037	-0.107
	[0.048]	[0.049]	[0.049]	[0.065]
Idiosyncratic shocks				
Livestock loss due to death (PKR100,000)	-0.035	-0.026	-0.032	-0.016
	[0.040]	[0.037]	[0.037]	[0.072]
Dummy for health shocks to hh members	0.012	0.011	0.004	0.007
	[0.044]	[0.049]	[0.051]	[0.060]
Initial hh characteristics (standardized by its mean and s.d.: unit=s.d.)				
hhsize	-0.019*	-0.014	-0.015	-0.041***
	[0.011]	[0.011]	[0.013]	[0.014]
hh_edu	0.000	0.000	-0.003	0.003
	[0.010]	[0.009]	[0.009]	[0.016]
tot_area_ol	-0.022	-0.022	-0.011	-0.040
	[0.014]	[0.013]	[0.009]	[0.027]
area_hh	-0.014	-0.015	-0.016*	-0.004
	[0.011]	[0.012]	[0.009]	[0.023]
R-squared (overall)	0.323	0.338	0.372	0.119
F-statistics for zero slopes (F(4,40))	*45.04****	*47.11****	*83.26****	*15.07****
F-stat for b_{11}=b_{21}=0 (F(2,40))	*0.03*	*0.07*	*0.32*	*1.99*
F-state for b_{11}+b_{21}=0 (F(1,40))	*0.00*	*0.02*	*0.00*	*0.00*
Sample mean of the dependent variable	-0.253	-0.261	-0.273	-0.196
Standard deviation	0.410	0.419	0.437	0.597

Notes: See notes to Table 4.

Appendix Table 8. Impact of Membership on Consumption Allowing for Spillover
Robustness check of results in Table 5 with respect to the definition of the dependent variable

	Dep. Var.: First difference in log household consumption			
DID parameter estimate	*dl_tot_exp*	*dl_exp_pc*	*dl_exp_food*	*dl_exp_nonfd*
A. Using households in non-CO village as the control				
Follow-up*member (b_{11})	0.018	0.010	-0.099	0.237**
	[0.079]	[0.079]	[0.084]	[0.098]
Follow-up*neighbor (b_{12})	0.011	-0.004	-0.087	0.173*
	[0.073]	[0.074]	[0.081]	[0.096]
3rd_round*member (b_{21})	0.027	0.030	0.138	-0.198**
	[0.083]	[0.084]	[0.093]	[0.093]
3rd_round*neighbor (b_{22})	0.054	0.065	0.138	-0.126
	[0.083]	[0.080]	[0.109]	[0.084]
F-stat for $b_{11}=b_{21}=0$ (F(2,40))	*0.22*	*0.16*	*1.10*	*3.95***
F-stat for $b_{11}+b_{21}=0$ (F(1,40))	*0.44*	*0.31*	*0.37*	*0.12*
F-stat for$b_{12}=b_{22}=0$ (F(2,40))	*0.38*	*0.42*	*0.82*	*2.35*
F-stat for $b_{12}+b_{22}=0$ (F(1,40))	*0.72*	*0.65*	*0.49*	*0.17*
F-stat for $b_{11}=b_{12}$ & $b_{21}=b_{22}$ (F(2,40))	*0.17*	*0.27*	*0.09*	*0.84*
B. With restriction of the same effect for member and neighbor (full spillover effect)				
Follow-up*(member+neighbor) (b'_{11})	0.014	0.003	-0.093	0.206**
	[0.073]	[0.074]	[0.079]	[0.092]
3rd_round*(member+neighbor) (b'_{21})	0.040	0.047	0.138	-0.163*
	[0.079]	[0.078]	[0.097]	[0.083]
F-stat for $b'_{11}=b'_{21}=0$ (F(2,40))	*0.32*	*0.29*	*1.02*	*3.61***
F-stat for $b'_{11}+b'_{21}=0$ (F(1,40))	*0.62*	*0.50*	*0.46*	*0.15*

Notes: See notes to Table 5.

Appendix Table 9. Heterogeneous Impact According to COs' Compositional Characteristics (Robustness check of results in Table 6 with respect to the definition of the dependent variable)

	Dep. Var.: First difference in log household consumption			
DID parameter estimate	*dl_tot_exp*	*dl_exp_pc*	*dl_exp_food*	*dl_exp_nonfd*
A. Female CO vs. male CO				
Follow-up*member (b_{11})	0.031	0.038	0.000	0.101*
	[0.058]	[0.055]	[0.069]	[0.059]
Follow-up*member*co_male (b_{12})	-0.076	-0.088	-0.132	0.036
	[0.091]	[0.089]	[0.102]	[0.098]
3rd_round*member (b_{21})	-0.002	-0.002	0.028	-0.064
	[0.055]	[0.056]	[0.061]	[0.058]
3rd_round*member*co_male (b_{22})	-0.035	-0.057	0.033	-0.152
	[0.079]	[0.075]	[0.084]	[0.101]
F-stat for b_{12}=b_{22}=0 (F(2,40))	*1.30*	*2.34*	*1.59*	*1.15*
F-stat for b_{12}+b_{22}=0 (F(1,40))	*2.59*	*4.61***	*3.04**	*0.90*
B. Heterogeneity according to the CO's vintage				
Follow-up*member (b_{11})	0.017	0.020	-0.029	0.123*
	[0.036]	[0.035]	[0.041]	[0.065]
Follow-up*member*(co_age-32)/10 (b_{12})	-0.004	-0.004	-0.004	-0.007
	[0.015]	[0.014]	[0.018]	[0.010]
3rd_round*member (b_{21})	-0.045	-0.054	0.007	-0.145*
	[0.055]	[0.055]	[0.061]	[0.073]
3rd_round*member*(co_age-32)/10 (b_{22})	0.022	0.024	0.020	0.025*
	[0.015]	[0.015]	[0.020]	[0.013]
F-stat for b_{12}=b_{22}=0 (F(2,40))	*4.57***	*4.71***	*4.79***	*1.95*
F-stat for b_{12}+b_{22}=0 (F(1,40))	*8.90****	*8.71****	*9.34****	*1.86*
C. Heterogeneity according to the CO's membership size				
Follow-up*member (b_{11})	0.003	0.006	-0.044	0.108*
	[0.045]	[0.043]	[0.053]	[0.060]
Follow-up*member*(co_size-23) (b_{12})	0.010	0.010*	0.011	0.005
	[0.006]	[0.006]	[0.007]	[0.010]
3rd_round*member (b_{21})	0.002	-0.003	0.052	-0.096*
	[0.051]	[0.050]	[0.058]	[0.056]
3rd_round*member*(co_size-23) (b_{22})	-0.021**	-0.023**	-0.023**	-0.016
	[0.010]	[0.010]	[0.010]	[0.012]
F-stat for b_{12}=b_{22}=0 (F(2,40))	*2.44*	*2.72**	*2.99**	*0.88*
F-stat for b_{12}+b_{22}=0 (F(1,40))	*3.84**	*3.96**	*4.84***	*0.88*

Notes: See notes to Table 6.

Appendix Table 10. Heterogeneous Impact According to COs' Activities
(Robustness check of results in Table 7 with respect to the definition of the dependent variable)

	Dep. Var.: First difference in log hh consumption			
DID parameter estimate	*dl_tot_exp*	*dl_exp_pc*	*dl_exp_food*	*dl_exp_nonfd*
A. Heterogeneity according to the number of HRD trainings				
Follow-up*member (b_{11})	0.011	0.014	-0.034	0.111*
	[0.043]	[0.041]	[0.049]	[0.062]
Follow-up*member*(hrd_num-6) (b_{12})	-0.008	-0.007	-0.010	0.001
	[0.013]	[0.014]	[0.014]	[0.013]
3rd_round*member (b_{21})	-0.013	-0.020	0.036	-0.107
	[0.048]	[0.049]	[0.050]	[0.065]
3rd_round*member*(hrd_num-6) (b_{22})	0.008	0.012	0.008	0.003
	[0.009]	[0.009]	[0.009]	[0.011]
F-stat for b_{12}=b_{22}=0 (F(2,40))	*0.42*	*1.73*	*0.35*	*0.04*
F-stat for b_{12}+b_{22}=0 (F(1,40))	*0.00*	*0.47*	*0.09*	*0.06*
B. Heterogeneity according to the varieties of HRD trainings				
Follow-up*member (b_{11})	0.010	0.014	-0.036	0.110*
	[0.042]	[0.040]	[0.048]	[0.062]
Follow-up*member*(hrd_var-4) (b_{12})	-0.002	0.003	0.004	-0.009
	[0.021]	[0.022]	[0.026]	[0.033]
3rd_round*member (b_{21})	-0.011	-0.016	0.037	-0.104
	[0.048]	[0.049]	[0.051]	[0.064]
3rd_round*member*(hrd_var-4) (b_{22})	0.008	0.014	-0.001	0.018
	[0.023]	[0.023]	[0.022]	[0.035]
F-stat for b_{12}=b_{22}=0 (F(2,40))	*0.10*	*0.51*	*0.02*	*0.13*
F-stat for b_{12}+b_{22}=0 (F(1,40))	*0.16*	*0.98*	*0.03*	*0.07*
C. Additional impact for COs implementing micro infrastructure projects				
Follow-up*member (b_{11})	0.020	0.022	-0.015	0.097
	[0.046]	[0.045]	[0.054]	[0.075]
Follow-up*member*mip (b_{12})	-0.022	-0.019	-0.047	0.030
	[0.088]	[0.093]	[0.109]	[0.087]
3rd_round*member (b_{21})	-0.079	-0.091	-0.034	-0.155
	[0.078]	[0.081]	[0.083]	[0.107]
3rd_round*member*mip (b_{22})	0.147	0.160	0.156	0.106
	[0.105]	[0.106]	[0.125]	[0.116]
F-stat for b_{12}=b_{22}=0 (F(2,40))	*2.29*	*2.41*	*2.67**	*0.71*
F-stat for b_{12}+b_{22}=0 (F(1,40))	*4.49***	*4.54***	*5.33***	*1.41*
D. Additional impact for COs implementing microfinance projects				
Follow-up*member (b_{11})	-0.052	-0.049	-0.110**	0.084
	[0.045]	[0.047]	[0.042]	[0.077]
Follow-up*member*mf (b_{12})	0.259***	0.261***	0.308***	0.116
	[0.092]	[0.089]	[0.101]	[0.098]
3rd_round*member (b_{21})	-0.005	-0.016	0.059	-0.133
	[0.059]	[0.062]	[0.052]	[0.088]
3rd_round*member*mf (b_{22})	-0.026	-0.009	-0.088	0.110
	[0.095]	[0.093]	[0.102]	[0.092]
F-stat for b_{12}=b_{22}=0 (F(2,40))	*7.71****	*8.01****	*9.73****	*1.94*
F-stat for b_{12}+b_{22}=0 (F(1,40))	*12.16****	*12.54****	*15.03****	*3.86**

Notes: See notes to Table 6.