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Agricultural Microcredit and Household Vulnerability in Rural Malawi

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Abstract

This paper evaluates the impact of agricultural microcredit on household consumption and vulnerability. Empirical analysis based on our paired-site sampling survey in rural Malawi reveals that, while the credit uptake leads to an increase in non-food consumption, it does not significantly affect food consumption. The analysis also shows that shocks with adverse effects such as health-related shocks and agricultural shocks reduce household consumption, although food consumption is insured. The households who have taken credit better cope with health-related shocks in terms of consumption smoothing. It thus seems that participation in the agricultural microcredit program strengthens coping capability with idiosyncratic shocks. In contrast, the agricultural microcredit program appears to be unable to ameliorate the adverse effects of agricultural shocks, which implies that for co-variant shocks different types of mitigating institutions such as microinsurance programs may be more desirable.

Keywords : microcredit, risk, consumption smoothing, household vulnerability

JEL codes: D12, H31, I38

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Microfinance institutions, and particularly microcredit, by providing capital to limited-asset and low-income households for investing in self-employment activities such as agriculture or micro-enterprises, are believed to increase household income and thus result in decreased poverty through increased expenditures on household needs and increased consumption (Khandker, 2000; Armendariz & Morduch, 2005). The growing number of studies have examined the validity of these assumptions in various countries and provided empirical evidence (Pitt and Khandker, 1998; Khandker, 2005; Banerjee et al., 2010; Imai et al., 2010; Deininger and Liu, 2013a). Nonetheless, the findings are not universally consistent. In particular, studies in sub-Saharan Africa are still very scant and the validity of these assumptions has not been confirmed yet. Thus, more studies, particularly rigorous impact evaluation, are required.

In Malawi, access to formal credit for smallholders had been limited until the late 1980s. Beginning in 1987, the Ministry of Agriculture offered agricultural production credit for hybrid maize to small farmers through the Smallholder Agricultural Credit Administration (SACA). However, because of severe droughts and credit defaults in the early 1990s, SACA collapsed in 1994. Microfinance programs were introduced in the late 1980s, one of the earliest being the Malawi Mudzi Fund supported by IFAD and based on the Grameen model (Hulme 1991; Chirwa 1998). The Malawi Rural Finance Company (MRFC) was established in 1993 by the Government of Malawi with financial and technical assistance from the World Bank and began operations in 1994. MRFC inherited the SACA agricultural loan program and the Mudzi Fund. MRFC provides both individual and group credit to smallholders, and it is the group microcredit program that seeks to reach low-income and asset-poor households. There are two types of group loans: seasonal (for agricultural production) and business (for micro-enterprises). The majority of MRFC clients belong to agricultural groups or clubs, and therefore the agricultural microcredit program has played an important role for smallholders in rural Malawi.

Diagne and Zeller (2001) implemented an impact evaluation of the MRFC microcredit program and found limited and even negative effects of credit programs on household welfare (expenditures, income, and nutritional status). They argue that such results can be attributed to socio-economic conditions in rural Malawi. Moreover,

for impact evaluation how counterfactuals or comparison groups are constructed is very crucial to obtain unbiased estimates for causal program effects (Ravallion, 2001). Diagne and Zeller (2001) argue that without any appropriate comparison group their estimation results might be suffering from biases caused by unobservable household heterogeneity. In this paper, therefore, we examine program impact: whether or not agricultural credit uptake leads to higher consumption levels by utilizing a paired-site sample survey design so that we can have an appropriate comparison group.

The second theme in this paper is household vulnerability. Risk is a central issue for poor communities and poor households. Co-variant and idiosyncratic shocks with economic effects, such as crop failure, sickness, or death, are devastating for chronically poor communities and households. The insufficient capability of coping with risk itself causes persistent poverty (Dercon, 2006). Microcredit can reduce poverty and vulnerability by providing income and/or savings to smooth over the adverse effects of shocks (Islam and Maitra, 2012). The hypothesis we explore is whether households with access to credit have less recourse to “bad” coping mechanisms such as reducing food consumption in response to shock. Our questionnaire explicitly asked about such shocks and our data include occurrence and types of economic shocks over the last 3 years, and also coping strategies utilized by households in response to each shock and effects on household welfare. Such information enables us to examine the vulnerability hypothesis.

Seasonal loans provided by MRFC are mainly in kind: seeds and fertilizer to grow hybrid maize, tobacco, soybean, and other cash crops. The majority of loans in rural areas are for cash crop production, particularly export burley tobacco.¹ Agricultural credit is distributed annually and in kind, and thus households cannot directly and flexibly use it as an ex-post coping device. However, credit uptake may relax liquidity constraints through increased income and thus increased savings and liquid assets stocks. In this paper, we test if the actual agricultural credit uptake mitigates the negative effect of shocks when households experience adverse shocks. Although a growing number of studies have investigated whether or not microcredit strengthens the capability of coping with risk (Garikipati 2008, Swain and Floro 2012), evidence in sub-Saharan Africa is still scarce. Therefore, this paper looks into it in rural Malawi and attempts to draw essential policy suggestions for consumption insurance.

The organization of this paper is as follows. Section I provides the relevant literature review. Section II investigates shocks with economic effects that smallholders in rural Malawi frequently experience. Section III explains our estimation methodologies based on our paired-site sampling survey. Section IV presents the estimation results, and in Section V we summarize our findings and provide some policy discussions.

I. Literature Review

The impact evaluation of microfinance programs has been extensively implemented in various countries. Pitt and Khandker (1998) examine the impact of microfinance program in Bangladesh by employing a quasi-experimental method and find increased consumption expenditures. Morduch (1998) criticizes their study by pointing out the invalid use of exogenous eligibility conditions. Correspondingly, Khandker (2005) with panel data in Bangladesh shows that the estimation bias caused by the methodological deficit is not very critical for the estimation result and confirms a significant impact on poverty reduction.² In India, Imai et al. (2010) investigate the impact of microfinance with cross-sectional data, but by addressing the selection bias due to endogenous binary treatment. Deininger and Liu (2013a) also evaluate economic and social impacts of microfinance based on women's self-help groups in India by utilizing a pipeline survey design. Moreover, Deininger and Liu (2013b) estimate the longer-term impacts of the same microfinance programs by using panel data and conclude that the longer exposure to the microfinance program has a positive impact on household consumption and asset accumulation. Their finding is also supportive for a significant impact of microfinance on reducing poverty, whereas Banejee et al. (2010) with a randomized evaluation find no impact of microcredit access on average expenditure per capita.

While microfinance seems to be a little more successful in South Asia in term of increasing income and consumption expenditures, evidence in sub-Saharan Africa is very weak. The number of studies is still scarce, and thus the potential benefit of microfinance has not been confirmed yet. One study that Diagne and Zeller (2001) implemented in Malawi found limited and even negative effects of credit programs on household welfare (expenditures and income). They argue that such results can be

attributed to the lack of market, infrastructure and other related socio-economic conditions. They also argue that their estimation results might suffer from selection bias due to non-random participation in credit programs, even although they employed a weighting scheme to address the issue. From their study, therefore, it is not clear whether or not credit programs had any significant impact on household welfare.

The studies mentioned above investigate the impact of microfinance mainly on household income, consumption expenditures, and thus poverty reduction. On the other hand, in less developed countries, poor rural households face various risks and they are the most vulnerable to shocks with adverse economic effects. Accordingly, vulnerability of such households is recognized as a serious concern (Dercon, 2006). The concept of vulnerability ranges widely. Alwang et al. (2001) provide various views on vulnerability from different academic disciplines. In economics, consumption smoothing is one of the most common approaches. Consumption smoothing is the theoretical prediction about household's optimal choice of consumption under the perfect credit market and a consequence of saving behavior with imperfect credit market (Deaton, 1991).

Morduch (1995) characterizes two stages in risk-coping strategies: income smoothing and consumption smoothing. First, households can smooth income by making conservative production and employment decisions or by diversifying income-generating activities. Second, households can smooth consumption by reducing saving, accessing credit, and/or by selling asset stocks. Thus, he argues that simply observing consumption smoothing does not tell any detailed mechanism behind the smoothed consumption. As concrete risk-management and risk-coping strategies, Dercon (1996) provides evidence in Tanzania that with missing credit and insurance markets households have to cultivate low-risk and low-return crop. Dercon (1998) also show that in Tanzania poor households cannot make profitable, but lumpy investments under risky environment and without perfect credit markets. Furthermore, Kurosaki and Fafchamps (2002) investigate how rural households in Pakistan make a decision on crop choice to stabilize income. These studies have provided evidence that poor households have to take some options of ex-ante risk-coping strategies in order to reduce income variability.

Utilizing saving or accessing credit is an ex-post risk-coping strategy (Paxson,

1992; Udry, 1994; 1995) and insurance markets may also function (Jacoby and Skoufias, 1998). Along with this line of literature, health-related shocks have been one of the most major focuses among other shocks (Wagstaff, 2007; Wagstaff and Lindelow, 2013). Islam and Maitra (2012) examine if microcredit against health shocks contribute to the consumption smoothing in Bangladesh. Gertler and Gruber (2002) and Genoni (2012) also investigate if consumption is insured against illness in Indonesia.

Practical coping mechanisms, both ex-ante and ex-post, in fact are very diverse. Some studies show that by selling livestock or liquidity assets households attempt to smooth out consumption (Rosenzweig and Wolpin, 1993; Fafchamps et al., 1998; McPeak, 2004). Moreover, Kochar (1995) argues that households adjust labor supply facing idiosyncratic income shocks, while Beegle et al. (2006) find an increase in child labor in the face of agricultural transitory income shocks. Jacoby and Skoufias (1997) also show that households respond to income shocks by reducing human capital investment. While these ex-post coping strategies are self-insurance mechanisms, other studies show that risk are shared within households (Dercon and Krishnan, 2000) and could be shared by communities (Townsend, 1994) or social net-works (DeWeerd and Dercon, 2006; Fafchamps, 1992; Fafchamps and Lunds, 2003). There seem to be a variety of risk-bearing systems within communities (Townsend, 1995). In sub-Saharan Africa, living arrangements may work against adult mortality because wealthier households are more likely to adopt orphans (Yamano et al., 2006). Furthermore, flexible arrangements of household structure seem to be active under the African extended family system (Akresh, 2009). The increasing number of studies have explored risk-management and risk-copying strategies in low-income countries.

Lastly, there are some studies that examine how poverty alleviation programs such as a conditional cash transfer (CCT) program work for reducing household vulnerability. Skoufias (2007), for example, examines if the replacement of the existing subsidy program by a conditional cash transfer program in Mexico affects the pre-existing risk-coping mechanisms and find no significant change. Although the literature relating to the issue has rapidly expanded, few studies have examined the impact of microfinance on household vulnerability. Dercon (2004) suggests that combining both qualitative and quantitative studies would benefit this understanding.

In this paper, we examine this impact by using our original data set to determine to what extent the agricultural microcredit program in Malawi can strengthen rural household's capability of coping with risk.

II. Shocks with Economic Effects and Coping Strategies in Rural Malawi

In this section, we explore what kinds of shocks with economic effects rural households face and how often smallholder farmers residing in rural areas experience the shocks, utilizing the data set we collected in rural areas in 2006.³ Because the microcredit program we focus on in this paper is the agricultural credit program provided by MRFC, the sampled villages were purposively chosen from the high concentration areas of MRFC clients. As a result, we have two Extension Planning Areas (EPAs)⁴ in each region (North, Central and South), totaling six EPAs as a whole. In each EPA, we implemented a paired-site sampling strategy, i.e., credit program and non-program villages, so that we can construct appropriate comparison groups. The sampled households were then chosen randomly in each village.

Table 1 provides detailed information about the sample size in each EPA and also shows how often rural households experience shocks with economic effects. The most frequent shocks were death, injury, or serious illness of adult member and reduced agricultural returns due to crop failure, crop destruction, or sharp drop of crop prices.⁵ We thus focus on these two types of shocks: health-related shocks and agricultural shocks. Most households reacted to these shocks by reducing food consumption, looking for wage work, using savings, selling off livestock, or obtaining help from family and friends.

In both program and non-program villages, 4-20 percent of the households experienced health-related shocks over the last 12 months and 26-62 percent did over the last 3 years. Health-related shocks can be regarded as an idiosyncratic shock and it seems that each household face the shocks with similar probabilities, although there is slight variation across regions. Regarding agricultural shocks, 8-32 percent of households experienced the shocks over the last 12 months and 38-60 percent of households had the shocks over the last 3 years. Compared to health-related shocks, agricultural shocks tend to be concentrated in specific areas when we look at the figures over the last 12 months, and thus can be regarded as a common shock at the

Table 1: Shocks with Economic Effects and Agricultural Credit in Rural Malawi

Extension Planning Area	Last 12 Months (Sep.2005-Aug./Sep.2006)				Last 3 Years (Sep.2003-Aug./Sep.2006)			
	Program households			Non- Program households	Program households			Non- Program households
	MRFC Clients ^(a)	Non- Clients	All	All	MRFC Clients ^(b)	Non- Clients	All	All
<i>No. of obs.</i>	80	168	248	248	104	144	248	248
Mhuju	18	17	35	35	20	15	35	35
Zombwe	4	35	39	40	11	28	39	40
Nsipe	13	36	49	49	18	31	49	49
Mayani	5	45	50	49	8	42	50	49
Lirangwe	10	15	25	50	11	14	25	50
Mombezi	30	20	50	25	36	14	50	25
<i>Health-related shocks (%)</i>	10.0	13.1	12.1	13.7	30.8	47.9	40.7	40.3
Mhuju	11.1	11.8	11.4	11.4	25.0	40.0	31.4	40.0
Zombwe	50.0	11.4	15.4	20.0	63.6	60.7	61.5	42.5
Nsipe	7.7	22.2	18.4	12.2	44.4	54.8	51.0	40.8
Mayani	20.0	6.7	8.0	14.3	50.0	40.5	42.0	38.8
Lirangwe	0.0	20.0	12.0	16.0	18.2	35.7	28.0	42.0
Mombezi	6.7	10.0	8.0	4.0	16.7	50.0	26.0	36.0
<i>Agricultural shocks (%)</i>	35.0	12.5	19.8	15.7	63.5	43.8	52.0	46.8
Mhuju	33.3	5.9	20.0	22.9	75.0	40.0	60.0	51.4
Zombwe	25.0	8.6	10.3	17.5	54.5	39.3	43.6	37.5
Nsipe	30.8	13.9	18.4	14.3	55.6	41.9	46.9	42.9
Mayani	20.0	11.1	12.0	8.2	50.0	50.0	50.0	38.8
Lirangwe	20.0	40.0	32.0	20.0	54.5	50.0	52.0	60.0
Mombezi	46.7	5.0	30.0	12.0	69.4	35.7	60.0	52.0

Note: Health-related shocks are death, injury, or serious illness of adult member and agricultural shocks are reduced agricultural returns due to crop failure, crop destruction, or sharp drop of crop prices.

(a) Agricultural credit uptake from Malawi Rural Finance Company (MRFC) at least once from 2005 through 2006.

(b) Agricultural credit uptake from MRFC at least once from 2003 through 2005/06.

village level.⁶ In contrast, the figures over the 3 years are similar to those for health-related shocks. Over the longer period, agricultural shocks can also be regarded as a random shock.

On average, MRFC clients are slightly less likely to experience health-related shocks, which implies that with access to credit MRFC clients might be able to receive better preventive care. On the other hand, MRFC clients are more likely to experience agricultural shocks. The MRFC agricultural credit program encourages smallholder

farmers to adopt tobacco production, which might be more vulnerable to weather variability and/or fluctuations of the price at which they can sell at the auction. In the following sections, we examine whether or not households with credit better cope with the shocks in terms of consumption smoothing. The adoption of tobacco production seems to bring higher risk in agricultural production. Bearing this tendency in our mind, we examine how access to the agricultural credit program affects consumption smoothing behavior.

III. Estimation Methodology

The estimation methodologies we employ, based on our paired-site sampling survey, include (1) propensity score matching and (2) the treatment-effects model. In our analysis, the most serious concerns are self-selection bias (non-random program participation) and placement bias (non-random assignment of the program by the company). Thus, we need to address these potential biases in order to consistently estimate the causal effect of credit program participation. Historically, the program has targeted the poor, thus poorer households were more likely to be in the program. More recently, however, the company may be purposively choosing wealthier households under the recent pressure of privatization and the fear of high default rates.⁷ In the former case, the OLS estimator leads us to underestimate the causal effect of the MRFC credit uptake, whereas the latter tends to inflate the effect, because of the pre-existent differences in household welfare. To address these problems, we utilize both parametric and non-parametric approaches.

Propensity Score Matching (PSM)

Propensity Score Matching is called selection on observables. The critical assumption that Rosenbaum and Rubin (1983) introduced for this methodology is ignorability of treatment given the conditioning variables X

$$(1) \quad Y_1, Y_0 \perp D \mid X$$

where Y_1, Y_0 are the realization of the outcome when $D=1$ (participation) and $D=0$ (non-participation) respectively. Thus, (1) indicates that the outcome is independent from the participation given the covariate X . They also assume

$$(2) \quad 0 < p(X) < 1$$

where $p(X)$ is the probability of the participation, which is called the propensity score.

Under these assumptions, they show

$$(3) \quad Y_1, Y_0 \perp D \mid p(X),$$

which indicates the outcome is independent from the participation given the propensity score, and the effect of program participation is non-parametrically identified.

To apply PSM to our dataset, we first estimate the following participation equation by the Probit model with samples only in the program villages.

$$(4) \quad D_i = 1[X_i\beta_v + u_{vi} \geq 0],$$

where $1[\cdot]$ is the indicator function that takes the value of 1 when household i 's utility exceeds 0 and the household i participates in the program. β_v is a vector of parameters to be estimated, and u_{vi} is an error term. Since we are also interested in the probabilities of participation among the households in the non-program villages if the program were available there, we predict such probabilities by applying the estimate $\hat{\beta}_v$ obtained from the above Probit estimation to the households in the non-program villages. After that, a consistent estimator is non-parametrically constructed with the radius matching method. Note that, to calculate the PSM estimator, we exclude eligible non-participants (ENPs), i.e., non-participants in the program villages because it is known that including ENPs into the matching sample may result in a biased estimator (Heckman, Ichimura and Todd 1997; 1998a; 1998b). For the same reason, we exclude the participants in non-program villages as well. We utilize the PSM methodology whenever it is applicable.

Treatment-Effects Model

The central idea of the treatment-effects model is to control for unobservable effects relating to the underlying selection mechanism (Heckman, 1976). The model consists of two equations: participation equation (5) and outcome equation (6).

$$(5) \quad D_i = 1[X_i\beta_v + Z_i\gamma_v + u_{vi} \geq 0]$$

$$(6) \quad Y_i = X_i\beta_y + D_i \cdot \Delta + u_{yi}$$

The parameter of interest is Δ , which is the effect of the program participation, and vectors of the parameters β_v and β_y are also to be estimated. Z_i is an additional exogenous variable, which should not be included in X_i (exclusion restriction), and γ_v is also a parameter to be estimated. In this study, Z_i is a dummy variable that takes the value of 1 if the household is in a program village and 0 otherwise.⁸ The key issue here

is that D_i is likely to be endogenous because program participation seems to be non-random. To treat this problem, we assume that the error terms u_v and u_y have a bivariate normal distribution. Then, we have the following expression.

$$(7) \quad E[Y \mid D, X, Z] = X\beta_y + D \cdot \Delta + \lambda \cdot \eta$$

where λ is the inverse mills ratio. $\hat{\beta}_v$ and $\hat{\gamma}_v$ can be obtained by estimating the participation equation (5) by the Probit model, and correspondingly the inverse mills ratio also can be estimated. The inclusion of the inverse mills ratio controls for the selection in the outcome equation (7). Therefore, with the inverse mills ratio we can consistently estimate the equation (7) by OLS and identify the causal effect of the program participation.

Shock and Credit Uptake

To test our hypothesis about household vulnerability, the following outcome equation (8) is considered instead of the equation (6).⁹

$$(8) \quad Y_i = X_i\beta_y + D_i \cdot \Delta + shock_i \cdot \alpha + D_i \times shock_i \cdot \delta + u_{yi}$$

where $shock_i$ is a dummy variable that takes the value of 1 if the household experienced a shock. The parameter of interest is δ , coefficient on the interaction term of $D_i \times shock_i$. Because the shocks have an adverse effect, the expected sign of α is negative. And if the sign of δ is positive, its interpretation is that the program participation mitigates the negative effect. For this analysis, we consider both health-related shocks and agricultural shocks experienced in the last 12 months, whereas the agricultural credit uptake corresponds to the last agricultural year. Our survey was carried out in August and September 2006, which was soon after the harvest.

IV. Regression Results

Household Consumption

First, we examine the effect of agricultural microcredit uptake on consumption and expenditures at the household level.¹⁰ Respondents (both head of household and spouse together) were asked to recall how much food was consumed in the past week (both own-produced and purchased), how much was spent on non-food consumer items over the past month, and on durables and services over the past year. Table 2 provides comparisons between MRFC clients and non-clients in the program villages and also between households in the program villages and those in the non-program

Table 2: Household Monthly Consumption and Expenditures on Goods and Services

	Program villages			Non- Program villages
	MRFC Clients ^(a)	Non- Clients	All	All
	mean	mean	mean	mean
Food consumption	6475	6615	6556	6059
Food expenditure	3520	3678	3612	3474
Expenditures on non-food goods and services	2777	2445	2584	2099
Total consumption	9252	9060	9140	8158

Note: Household consumption and expenditures are measured in Malawi Kwacha (MK). 1US\$ = 140MK at time of survey (August/September in 2006). Statistical test (t-test) results do not show any significant difference between MRFC clients and non-clients in program villages in both food and non-food consumption and expenditure. Statistical test results also do not show any significant difference between program and non-program villages.

(a) Agricultural credit uptake from MRFC at least once from 2003 through 2005/06.

villages.¹¹ The average of total consumption for MRFC clients is higher than that for non-clients in the program villages and that for households in the non-program villages. When we look into the composition of the consumption and expenditures on food and non-food items, it seems that MRFC clients do spend more on non-food goods and services, whereas the average of food consumption and expenditures for MRFC clients is a little lower than that for non-clients.¹² These differences, however, can simply be a consequence of sample selection. Therefore, by utilizing more rigorous estimation methodologies, we will test whether these differences can be attributed to the actual causal program impact.

Table 3 gives the estimation results for food consumption and food expenditures. We use the log of consumption and expenditures as our dependent variables so that we can capture the non-linear relationship between consumption (or expenditures) and explanatory variables. With respect to the program effect, neither the PSM estimator nor treatment-effects model estimator indicates any significant increase in food consumption and food expenditure. An explanatory variable that has large positive coefficients is household size (significant at the 1 percent level for food consumption and significant at the 5 percent level for food expenditure), which is to be expected since larger households, other things being equal, consume more. Land size also has large positive coefficients (significant at the 1 percent level for both): a 1 percent increase in land size increases food consumption by 0.26 percent and food

Table 3: Impact of Agricultural Credit on Food Consumption and Food Expenditure

Dependent variable	log (Food consumption)			log (Food expenditure)		
	PSM (A)	OLS (B)	Treatment- effects model (C)	PSM (D)	OLS (E)	Treatment- effects model (F)
MRFC participation						
Credit uptake (=1) ^(a)	0.120 (0.077)	0.077 (0.069)	0.021 (0.126)	0.126 (0.110)	0.118 (0.106)	0.012 (0.194)
Head and Spouse characteristics						
Female headed household (=1)		- 0.118 (0.121)	- 0.128 (0.121)		- 0.327* (0.186)	- 0.346* (0.186)
Age of household head		0.009 (0.011)	0.009 (0.011)		0.015 (0.018)	0.017 (0.018)
Age sq. [$\times 10^{-3}$]		- 0.084 (0.114)	- 0.092 (0.114)		- 0.165 (0.176)	- 0.179 (0.175)
Highest education (grade) completed by male spouse		- 0.006 (0.012)	- 0.006 (0.012)		0.005 (0.018)	0.005 (0.018)
Highest education (grade) completed by female spouse		0.018 (0.011)	0.018 (0.011)		0.021 (0.018)	0.021 (0.017)
Household characteristics						
log (Household size)		0.269*** (0.070)	0.273*** (0.069)		0.231** (0.107)	0.239** (0.106)
Ratio of dependents (15 – and 65 +) to household size		0.034 (0.137)	0.028 (0.136)		0.146 (0.211)	0.134 (0.209)
log (land size in acres)		0.262*** (0.050)	0.264*** (0.049)		0.206*** (0.076)	0.211*** (0.076)
Selection control						
Inverse Mills ratio			0.045 (0.085)			0.086 (0.131)
Region dummies		Yes	Yes		Yes	Yes
R-sq.		0.29	0.29		0.19	0.19
Sample Size	344	496	496	344	496	496

Note: Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

(a) Agricultural credit uptake from MRFC at least once from 2003 through 2005/06.

expenditure by 0.21 percent. Because larger land size implies ability to produce more food and higher income levels among smallholder farmers, these findings also make sense.

Next, we examine the program impact on expenditures on non-food goods and services. Table 4 gives the estimation results. It is obvious that the effect of MRFC agricultural credit uptake on expenditures is accounted for by consumer goods and services (such as health and education) rather than food. The PSM estimator indicates that non-food expenditures increase by 47.6 percent (significant at the 1 percent level) and the estimator based on the treatment-effects model suggests an increase by 47.2

Table 4: Impact of Agricultural Credit on Non-Food Expenditures and Total Consumption

Dependent variable	log (Food consumption)			log (Food expenditure)		
	PSM (A)	OLS (B)	Treatment- effects model (C)	PSM (D)	OLS (E)	Treatment- effects model (F)
MRFC participation						
Credit uptake (=1) ^(a)	0.476*** (0.117)	0.364*** (0.095)	0.472*** (0.175)	0.166** (0.082)	0.128* (0.073)	0.083 (0.133)
Head and Spouse characteristics						
Female headed household (=1)		- 0.377** (0.168)	- 0.358** (0.167)		- 0.174 (0.128)	- 0.182 (0.128)
Age of household head		0.029* (0.016)	0.027* (0.016)		0.015 (0.012)	0.015 (0.012)
Age sq. [$\times 10^{-3}$]		- 0.346 (0.159)	- 0.332 (0.158)		- 0.157 (0.121)	- 0.163 (0.121)
Highest education (grade) completed by male spouse		- 0.005 (0.016)	- 0.005 (0.016)		- 0.005 (0.012)	- 0.005 (0.012)
Highest education (grade) completed by female spouse		0.038** (0.016)	0.038** (0.016)		0.022* (0.012)	0.022* (0.012)
Household characteristics						
log (Household size)		0.505*** (0.097)	0.498*** (0.096)		0.293*** (0.074)	0.296*** (0.073)
Ratio of dependents (15 – and 65 +) to household size		- 0.024 (0.190)	- 0.012 (0.188)		0.030 (0.145)	0.025 (0.144)
log (land size in acres)		0.310*** (0.069)	0.305*** (0.068)		0.263*** (0.053)	0.265*** (0.052)
Selection control						
Inverse Mills ratio			- 0.087 (0.118)			0.036 (0.090)
Region dummies		Yes	Yes		Yes	Yes
R-sq.		0.45	0.45		0.34	0.34
Sample Size	344	496	496	344	496	496

Note: Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

(a) Agricultural credit uptake from MRFC at least once from 2003 through 2005/06.

percent (significant at the 1 percent level). Eventually, the magnitude of the estimates from two different methodologies is very similar. Female-headed households consume less non-food items by 35.8 percent (significant at the 5 percent level). The other variable that has a positive impact, in addition to household size and land size, is female spouse's education (significant at the 5 percent level): achieving one more year of female spouse's education increases non-food expenditure by 3.8 percent.

Table 4 also shows the estimation results for total consumption. The PSM estimate indicates that MRFC agricultural credit uptake increases total consumption by 16.6 percent, which is significant at the 5 percent level. However, the estimate by

the treatment-effects model indicates insignificant impact on total consumption. Because the share of non-food expenditure is not very large compared to food consumption (Table 2), the significant increase in non-food expenditure seems to be diluted in total consumption. It appears that, while agricultural credit uptake does not have a significant effect on food consumption, the more important effect can be found on expenditures on non-food goods and services.

Vulnerability

Next, we test our hypothesis on household vulnerability. The estimation results are shown in Table 5. The dependent variables are the log of food consumption, food expenditure and non-food expenditure. Health-related shocks reduce non-food expenditure by 20.2 percent (significant at the 10 percent level). In contrast, the reductions in food consumption and food expenditure are not significant.¹³ The coefficients on the interaction term between health-related shock and credit uptake are positive and significant for food expenditure and non-food expenditure (at the 10 percent level and at the 5 percent level respectively) and the magnitudes are very large. Further investigation into the data set suggests that, in the face of health-related shocks, MRFC clients purchase more food items such as maize, milk and meat from the market and also increase non-food expenditures, particularly for health treatment. It thus seems that food consumption is insured, while non-food expenditure is susceptible, and credit uptake strengthens the capability of smoothing out non-food expenditure against idiosyncratic shocks.

Regression analysis on the effect of credit uptake on food expenditure in the case of agricultural shocks shows that, not surprisingly, agricultural shocks reduce food expenditure by 22.5 percent (significant at the 1 percent level) with decreased income from agriculture, but food consumption is yet insured. Even though most MRFC credit is for cash crops such as tobacco, not for food crops, it is still hoped that credit uptake would smooth consumption patterns in the face of agricultural shocks.¹⁴ The coefficients on the interaction term for food consumption and expenditures are not statistically significant, suggesting that the MRFC microcredit program does not work as a buffer for the shock. For co-variant shocks, the agricultural microcredit program seems to be unable to mitigate the adverse effects.

These results show that food consumption is more insured from idiosyncratic

Table 5: Impact of Shocks with Economic Effects and Agricultural Credit

Dependent variable	log (Food consumption)		log (Food expenditure)		log (Non-food expenditure)	
	OLS (A)	Treatment-effects model (B)	OLS (C)	Treatment-effects model (D)	OLS (E)	Treatment-effects model (F)
Shocks and MRFC participation						
Credit uptake in 2005/06 (=1)	- 0.001 (0.095)	- 0.002 (0.159)	- 0.003 (0.145)	- 0.066 (0.244)	0.284** (0.132)	0.556** (0.222)
Health-related shock (=1) [Sep.2005-Aug./Sep.2006]	- 0.098 (0.089)	- 0.098 (0.087)	- 0.166 (0.136)	- 0.166 (0.134)	- 0.203 (0.124)	- 0.202* (0.121)
Health shock * Credit uptake (=1)	0.281 (0.236)	0.281 (0.232)	0.690* (0.361)	0.686* (0.355)	0.668** (0.328)	0.683** (0.319)
Agricultural shock (=1) [Sep.2005-Aug./Sep.2006]	- 0.116 (0.085)	- 0.116 (0.084)	- 0.223* (0.130)	- 0.225* (0.128)	- 0.076 (0.118)	- 0.068 (0.116)
Agricultural shock * Credit uptake (=1)	0.114 (0.164)	0.115 (0.162)	- 0.041 (0.252)	- 0.031 (0.249)	- 0.088 (0.228)	- 0.129 (0.224)
Head and Spouse characteristics						
Female headed household (=1)	- 0.130 (0.122)	- 0.130 (0.121)	- 0.350* (0.187)	- 0.359* (0.186)	- 0.408** (0.169)	- 0.367** (0.169)
Age of household head	0.010 (0.011)	0.010 (0.011)	0.019 (0.018)	0.020 (0.018)	0.031* (0.016)	0.027* (0.016)
Age sq. [$\times 10^{-3}$]	- 0.100 (0.115)	- 0.101 (0.114)	- 0.207 (0.176)	- 0.216 (0.175)	- 0.371** (0.160)	- 0.333** (0.160)
Highest education (grade) completed by male spouse	- 0.006 (0.012)	- 0.006 (0.012)	0.009 (0.018)	0.009 (0.018)	- 0.005 (0.016)	- 0.006 (0.016)
Highest education (grade) completed by female spouse	0.018 (0.011)	0.018 (0.011)	0.021 (0.017)	0.021 (0.017)	0.039** (0.016)	0.039** (0.016)
Household characteristics						
log (Household size)	0.282*** (0.070)	0.282*** (0.069)	0.251** (0.107)	0.253** (0.106)	0.534*** (0.097)	0.525*** (0.096)
Ratio of dependents (15 - and 65 +) to household size	0.033 (0.137)	0.033 (0.135)	0.148 (0.210)	0.145 (0.207)	- 0.034 (0.191)	- 0.020 (0.189)
log (land size in acres)	0.261*** (0.050)	0.261*** (0.049)	0.200*** (0.076)	0.200*** (0.075)	0.312*** (0.069)	0.308*** (0.068)
Selection control	No	Yes	No	Yes	No	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-sq.	0.29	0.29	0.20	0.20	0.45	0.45
Sample Size	496	496	496	496	496	496

Note: Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

shocks than non-food consumption, which is consistent with the findings in various countries (Skoufias and Quisumbing, 2005). Food insecurity has been a serious problem for Malawi smallholders because of droughts, floods, and the small size of landholdings, among other factors. Therefore, it seems that risk coping and risk sharing mechanisms have also been well established for food consumption. Two possible explanations can be considered. One is that increased income might lead to an

increase in precautionary savings and/or accumulation of assets and through those devices MRFC client households strengthen the coping capability with shocks (Swain and Varghese, 2009). The other one is that there might exist, although it is imperfect, a risk-sharing mechanism within villages (Townsend, 1994). The presence of the MRFC microcredit program might reinforce it, particularly among MRFC group members. With our cross-sectional data, unfortunately, it is not possible to distinguish between these two explanations. Yet, this distinction would have been very critical for its policy implication.¹⁵

V. Conclusion

This paper attempts to estimate the impact of agricultural microcredit on household consumption and vulnerability. While agricultural credit uptake leads to an increase in non-food consumption, it does not significantly affect food consumption. These results are in contrast to the findings of the study by Diagne and Zellner (2001), which showed negative effects for food consumption in the middle of the 1990s. A number of changes, however, had happened to the microcredit program since they conducted their survey. When they implemented their impact evaluation, the main target of the microcredit program was hybrid maize rather than burley tobacco.¹⁶ After the liberalization of tobacco production and the expansion of credit access, an increasing number of smallholder farmers adopted tobacco production (Orr, 2000; 2001), which has led to increased income and thus higher consumption levels.

Our empirical analysis also shows that shocks with adverse effects such as health-related shocks and agricultural shocks reduce household consumption, although food consumption is not affected. The households who have taken credit cope better with the health-related shocks in terms of consumption smoothing. It thus seems that participation in the agricultural microcredit program strengthens coping capability with idiosyncratic shocks. In contrast, the agricultural microcredit program appears to be unable to ameliorate the adverse effects of agricultural shocks, which implies that for co-variant shocks different types of mitigating institutions such as loan programs with weather index-based insurance may be more desirable (Giné and Yang, 2009).

Let us provide a little more discussions on related issues. First, the distinction between the impact of the adoption of tobacco production and that of microcredit is

difficult. Obviously the availability of credit has enhanced the adoption of tobacco production by smallholder farmers by allowing them to purchase an input package for tobacco. Second, the 2005-06 agricultural cycle in Malawi was a good one in the sense that there was sufficient and timely rainfall. Success in terms of income and consumption, therefore, is in good measure due to the good harvest in 2006. We are not certain what the results for income and consumption would be in a bad agricultural year. Third, the future of export tobacco production is uncertain because of volatile world prices. Thus, more efforts to encourage production of other crops and to diversify farm output should be made to reduce risk. In addition, diversifying income sources toward nonfarm enterprises is also a good option (Eillis et al., 2003; Reardon, 1997). Lastly, without subsidies microfinance institutions may not be sustainable (Morduch, 1999). Therefore, every effort to reduce risk would contribute to sustainable development of microfinance institutions and thus rural development.

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Notes

- 1 The adoption of tobacco production necessitates more labor force, particularly by females

- (Peters, 2006).
- 2 There is a reply from M. Pitt (Pitt, 1999) as well.
 - 3 See Shimamura and Lastarria-Cornhiel (2010) for more detailed information about our paired-site sampling design.
 - 4 EPA is the basic administrative unit of the Ministry of Agriculture and Irrigation in Malawi.
 - 5 The information on shocks with economic effects is explicitly solicited in our questionnaire. The other shocks are abandonment, separation or divorce by spouse and theft, fire, flood or destruction of properties, which are infrequent.
 - 6 Morduch (2004) argues that common shocks may not be covariant, but tend to be idiosyncratic. Because of the diversity of landholdings, soil quality and crop choice, even agricultural shocks can be idiosyncratic.
 - 7 This conjecture is based on interviews with MRFC field officers.
 - 8 Even in the non-program villages, there are several MRFC clients. They participate in the program by joining a group in the program villages. A simple test shows that the coefficients on X are not statistically significantly different between the both areas, and thus we assume that the non-program village dummy Z only affects the level difference in the probability of the program participation. We furthermore assume that, because of our sampling design, the non-program village dummy does not appear in the outcome equation, which is our main source of the identification. See more discussion in Shimamura and Lastarria-Cornhiel (2010).
 - 9 The similar approach is employed by Beegle et al. (2006) and Gitter and Barham (2007). More comprehensive literature review on the empirical approaches is provided by Skoufias and Quisumbing (2005).
 - 10 Consumption is measured by the total value of goods and services that are consumed by household members, whereas expenditures are measured by payment for purchasing goods and services including educational and health services. The distinction between consumption and expenditures is important in rural Malawi because a significant share of actual consumption comes from their own production, mostly agricultural.
 - 11 The status of MRFC clients is defined by actual credit uptake from MRFC at least once in the last 3 years in the program villages.
 - 12 Statistical tests (t-test) do not show any significant difference between MRFC clients and non-clients in both food and non-food consumption and expenditure. Statistical tests (t-tests) also do not show any significant difference between program and non-program villages.
 - 13 Our food consumption and expenditure data are extrapolated from one week of data and that may not pick up food shortages/reductions related to health shocks early in the year.
 - 14 Smallholders that grow tobacco always also grow staple food crops such as maize.
 - 15 We can observe neither significant food transfer nor cash transfer among MRFC clients and villagers, which may imply that the risk-sharing mechanism does not really work. However, MRFC clients are forced to save 20% of the total amount of loan when they borrow it and the same group members are jointly responsible for the loans. Thus, there could exit some implicit cash transfer among them when in the extreme case one of the members defaults.
 - 16 When Diagne and Zeller (2001) conducted their survey, credit was for an input package for hybrid maize, which was a drought-sensitive crop, and investment in hybrid maize was less profitable. There was credit for tobacco, but not the majority. They also argue that grouping among those who came from different villages did not provide any joint liability. Finally, their survey was conducted in the agricultural year when rainfall was below average.