

Project I: The Effect of Merger and Acquisition of Microfinance Institutions on Loan Provision

Objective and methodology of the study

We aim to empirically estimate the effect of merger and acquisition (M&A) cases of Microfinance institutions (MFIs) on loan amount and size, the total number of borrowers, and the ratio of female borrowers. For this purpose, we use a difference-in-difference approach whereby we exploit the variation in loan provision across MFIs and periods. To investigate the M&A effect, we employ MFIs data from the National Bank of Cambodia (MFI-NBC).

Dependent variables

Our dependent variables include the loan amount, total number of borrowers, loan size (ratio of the loan amount to the total number of borrowers), and ratio of female to the total number of borrowers. We take the logarithm form of all the outcome variables in our regression analysis.

Policy variables

The policy variables include indicators for M&A cases of MFIs. To empirically examine the effect of M&A, we employ three dummy and one share (fraction) indicators. [We generate a dummy variable \(MA0\) with a value of 1 for MFIs in which foreign countries participate as shareholders based on the data from MFIs' webpages and financial reports.](#) Further, we construct two dummy indicators (MA1 and MA2), one taking 1 if the foreign share is non-zero and the other if the foreign share equals or exceeds 50 percent based on MFI-NBC data. Additionally, we take the ratio of foreign share directly as an alternative measure of M&A cases (MA3).

Covariates (factors of loan provision)

Equity to asset ratio

We control for the resilience of MFIs by including the ratio of paid-up capital and retained or current profit/loss to total assets.

Cash on hand to asset ratio

Further, we control for the short-term liquidity effect of the MFIs by adding the ratio of cash and balance with NBC and other banks to the total assets.

Funding price (interest expense to liability ratio)

Additionally, we include funding price in our regression as the ratio of interest expense to liability. We can find interest income directly from MFI-NBC data. However, because we do not find liability separately from shareholders' equity, we subtract the sum of shareholders' equity from the total liability and equity to get the amount of liability separately.¹

Population size and density

Moreover, we add the interactions of the log of population size and density with M&A indicators in our regression. We compute population density as the ratio of the number of male and female persons in the district to the land area.

Disaster indicators

Also, we control for natural disasters commonly affecting Cambodia including storms, floods, and droughts. The original indicators represent the number of families in the district affected by each of the disasters. However, we generate a dummy, taking a value of one if at least one family is affected by either storm, flood, or drought in the district. We include its interaction with M&A indicators in our regression.

.

¹ The shareholders' equity include the paid-up capital, the premium on share capital, hybrid capital investment, reserves and appropriations, and retained and current profit or loss.

Descriptive Statistics

Figure 1.1 and Table 1.2 show that loan provision is higher for MFIs with M&A cases (foreign share), irrespective of the period and indicator for M&A. Further, loan amount increases faster across period among those MFIs with M&A experience.

Figure 1.2 and Table 1.3 present that foreign share is decreasing for the MFIs in Cambodia. The possible reasons require further investigation.

Table 1.1 reports the summary statistics for a loan, M&A, and the covariates. On average, the loan amount provided by MFIs is approximately 1645 KHR, and 19 KHR per person. The number of borrowers is about 200, and most of them are females, about 64 percent.

The average foreign share among the MFIs in Cambodia is about 45 percent. Those MFIs with non-zero foreign shares are about 54 percent of our sample. Those MFIs having 50 or more percent of foreign share are about 47 percent.

Correlation/regression results

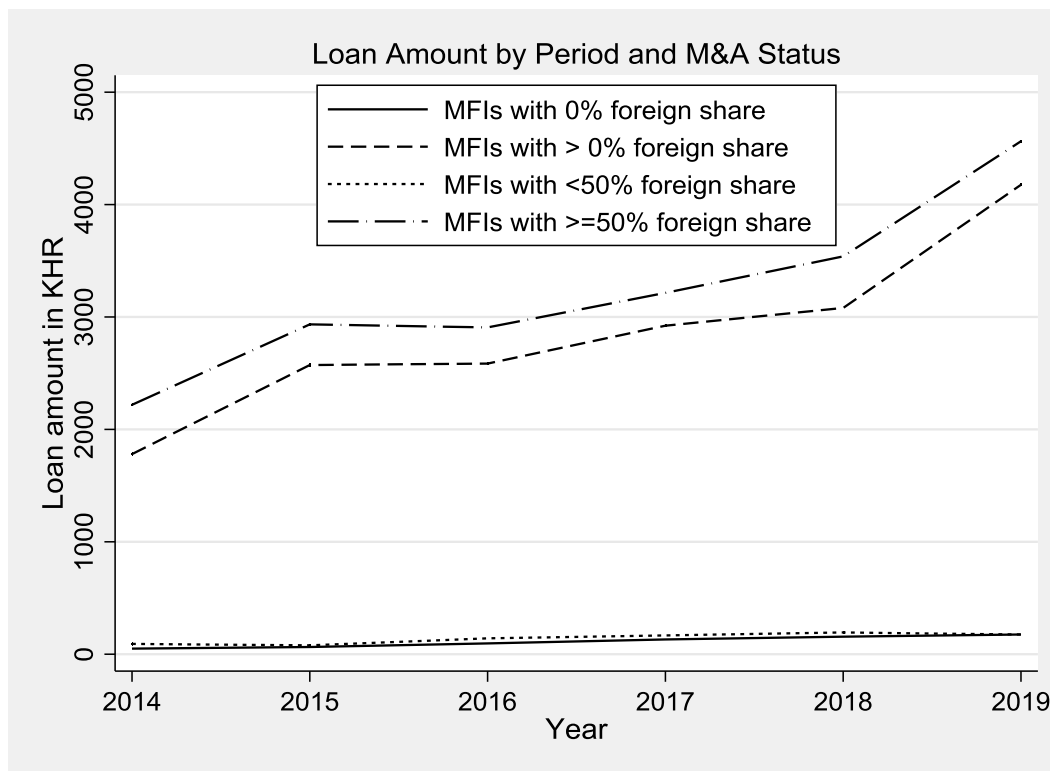


Figure 1.1 Loan Amount by Year and Merger and Acquisition Status

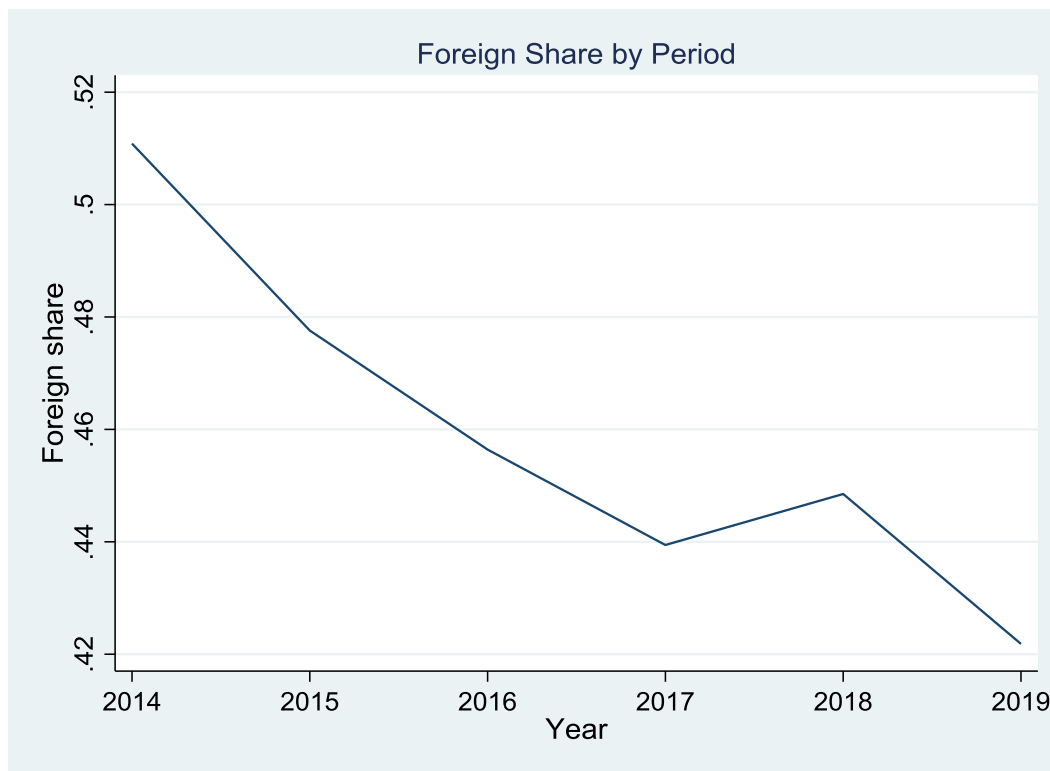


Figure 1.2 Foreign Share of Microfinance Institutions by Year

Table 1.1: Summary Statistics for Loan, Merger and Acquisition, and Covariates

	Mean	Std. Dev.	Min	Max	Obs
Loan (Dep. vars)					
Amount of loan	1645.41	7077.54	0	275972.6	47,477
Total number of borrowers	199.58	635.42	0	13919	47,336
Ratio of female borrowers	0.64	0.29	0	1	14,894
Loan size (=loan/borrowers)	19.88	51.18	0	1500.15	15,546
Merger and acquisition (Policy var.)					
MA0= 1 (Any foreign country from MFIs' webpage)	0.29	0.45	0	1	47,477
MA1= 1 (if foreign share > 0% from MFI-NBC)	0.54	0.50	0	1	47,477
MA2 = 1 (if foreign share >= 50% from MFI-NBC)	0.47	0.50	0	1	47,477
MA3 (foreign share from MFI-NBC)	0.45	0.45	0	1	47,477
Covariates					
Population size	4856009	4357980	124008	20800000	47,477
Population density	30.11	129.81	0.00921	1657.57	47,477
Disastor					
Any disaster = 1 (if at least one family affected by either storm, flood, or drought)	0.65	0.48	0	1	47,477
Asset, liability, and liquidity					
Equity-asset ratio (=paid-up capital + retained or current profit/total assets)	0.40	0.29	-1.17203	1.215303	47,280
Cash-asset ratio (=cash+balance on NBC and other/total assets)	0.15	0.14	0.008428	0.791101	47,280
Interest expense to liability ratio (funding price)	0.07	0.24	-0.01825	3.643756	47,083
Year	2016.61	1.77	2014	2019	47,477

Note: Funding price is the ratio of interest expense to liability. Interest expense is directly taken from MFI-NBC data. To get the amount of liability separately, we subtract the sum of shareholders' equity from the total liability and equity. The shareholders' equity in the data include the paid-up capital, premium on share capital, hybrid capital investment, reserves and appropriations, and retained and current profit or loss.

Table 1.2: Average loan amount by period and M&A status

Year	Mean			
	MA1=0	MA1=1	MA2=0	MA2=1
2014	49.79	1780.19	91.83	2218.82
2015	64.21	2572.56	79.36	2934.43
2016	96.26	2585.71	141.39	2907.23
2017	131.55	2922.82	167.47	3214.66
2018	156.29	3080.34	193.78	3539.23
2019	175.69	4176.35	175.51	4563.73

Notes: MA1 and MA2 represent MFIs' merger and acquisition indicators using non-zero and 50 percent or more foreign share, respectively.

Table 1.3: Foreign Share by Period

Year	Mean	SD	Min	Max
2014	0.51	0.44	0	1
2015	0.48	0.45	0	1
2016	0.46	0.45	0	1
2017	0.44	0.46	0	1
2018	0.45	0.45	0	1
2019	0.42	0.45	0	1

Table 1.4: Merger and Acquisition Effect on Loan Amount

	Log of loan amount							
	MA0	MA1	MA2	MA3	MA0	MA1	MA2	MA3
MA	0.328*** (0.039)	0.515*** (0.109)	-0.017 (0.101)	0.363*** (0.106)	-2.437*** (0.713)	-3.730*** (0.733)	-4.357*** (0.740)	-4.327*** (0.817)
Log pop. size*MA					0.173*** (0.049)	0.284*** (0.051)	0.280*** (0.051)	0.311*** (0.057)
Log pop. dens*MA					0.062*** (0.023)	-0.048* (0.028)	-0.031 (0.026)	-0.056* (0.029)
Disaster*MA					0.056 (0.112)	0.017 (0.121)	0.183 (0.115)	0.085 (0.119)
Equity to asset ratio	-0.931*** (0.103)	-0.902*** (0.112)	-1.165*** (0.112)	-0.979*** (0.106)	-0.910*** (0.103)	-0.899*** (0.113)	-1.170*** (0.113)	-0.960*** (0.107)
Cash to asset ratio	-1.219*** (0.254)	-1.145*** (0.252)	-1.159*** (0.255)	-1.194*** (0.252)	-1.281*** (0.254)	-1.159*** (0.252)	-1.176*** (0.255)	-1.231*** (0.251)
Funding price	0.018 (0.114)	0.158 (0.115)	0.027 (0.120)	0.124 (0.115)	0.028 (0.114)	0.165 (0.115)	0.036 (0.119)	0.135 (0.114)
MFIs FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes
District by year FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Adjusted R-squared	0.632	0.632	0.631	0.631	0.633	0.633	0.633	0.633
Observations	15,350	15,350	15,350	15,350	15,350	15,350	15,350	15,350

Notes: ***, **, * indicates significance at the 1, 5, and 10 percent significance level.

Table 1.5: Merger and Acquisition Effect on Number of Borrowers

	Log of number of borrowers							
	MA0	MA1	MA2	MA3	MA0	MA1	MA2	MA3
MA	0.088*** (0.037)	0.062 (0.121)	-0.106 (0.080)	0.04 (0.098)	-2.231*** (0.574)	-4.039*** (0.710)	-4.299*** (0.698)	-4.689*** (0.773)
Log pop. size*MA					0.144* (0.039)	0.272*** (0.047)	0.269*** (0.047)	0.310*** (0.053)
Log pop. dens*MA					0.080*** (0.020)	-0.052* (0.027)	-0.03 (0.027)	-0.043 (0.029)
Disaster*MA					-0.004 (0.095)	-0.003 (0.119)	0.136 (0.113)	0.049 (0.118)
Equity to asset ratio	-0.217*** (0.083)	-0.247** (0.117)	-0.330*** (0.098)	-0.258** (0.108)	-0.200*** (0.083)	-0.235** (0.116)	-0.330*** (0.097)	-0.240** (0.108)
Cash to asset ratio	-0.14 (0.219)	-0.123 (0.219)	-0.084 (0.226)	-0.129 (0.222)	-0.199 (0.217)	-0.155 (0.217)	-0.111 (0.224)	-0.168 (0.220)
Funding price	-0.249*** (0.084)	-0.230*** (0.086)	-0.275*** (0.087)	-0.235*** (0.085)	-0.241*** (0.084)	-0.227*** (0.085)	-0.269*** (0.085)	-0.223*** (0.083)
MFIs FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes
District by year FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Adjusted R-squared	0.68	0.68	0.68	0.68	0.681	0.681	0.681	0.682
Observations	15,284	15,284	15,284	15,284	15,284	15,284	15,284	15,284

Notes: ***, **, * indicates significance at the 1, 5, and 10 percent significance level.

Table 1.6: Merger and Acquisition Effect on Loan Size

	Log of loan size							
	MA0	MA1	MA2	MA3	MA0	MA1	MA2	MA3
MA	0.239*** (0.019)	0.427*** (0.099)	0.077 (0.076)	0.294*** (0.095)	-0.242 (0.305)	0.482 (0.404)	0.093 (0.395)	0.526 (0.434)
Log pop. size*MA					0.033 (0.021)	-0.002 (0.027)	0 (0.026)	-0.012 (0.029)
Log pop. dens*MA					-0.019 (0.012)	0.004 (0.013)	0.001 (0.012)	-0.012 (0.013)
Disaster*MA					0.043 (0.062)	0.012 (0.065)	0.042 (0.062)	0.032 (0.064)
Equity to asset ratio	-0.743*** (0.086)	-0.699*** (0.107)	-0.870*** (0.103)	-0.765*** (0.105)	-0.743*** (0.086)	-0.708*** (0.109)	-0.876*** (0.104)	-0.765*** (0.107)
Cash to asset ratio	-1.146*** (0.181)	-1.089*** (0.173)	-1.137*** (0.189)	-1.130*** (0.179)	-1.150*** (0.181)	-1.072*** (0.173)	-1.125*** (0.189)	-1.127*** (0.180)
Funding price	0.270*** (0.051)	0.385*** (0.060)	0.302*** (0.060)	0.355*** (0.059)	0.272*** (0.051)	0.387*** (0.060)	0.304*** (0.060)	0.353*** (0.059)
MFIs FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes
District by year FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Adjusted R-squared	0.648	0.647	0.647	0.647	0.649	0.648	0.647	0.647
Observations	15,250	15,250	15,250	15,250	15,250	15,250	15,250	15,250

Notes: ***, **, * indicates significance at the 1, 5, and 10 percent significance level.

Table 1.7: Merger and Acquisition Effect on Share of Female Borrowers

	Log of female borrowers							
	MA0	MA1	MA2	MA3	MA0	MA1	MA2	MA3
MA	-0.066** (0.008)	0.013 (0.041)	-0.008 (0.027)	-0.095* (0.051)	-0.173 (0.147)	0.342* (0.185)	0.251 (0.171)	0.139 (0.197)
Log pop. size*MA					0.002 (0.010)	-0.028** (0.012)	-0.022* (0.012)	-0.023* (0.013)
Log pop. dens*MA					0.019*** (0.007)	0.022*** (0.008)	0.018** (0.007)	0.028*** (0.008)
Disaster*MA					0.028 (0.025)	-0.007 (0.037)	-0.007 (0.033)	-0.006 (0.037)
Equity to asset ratio	-0.096*** (0.038)	-0.043 (0.039)	-0.049 (0.038)	-0.072 (0.039)	-0.093*** (0.038)	-0.043 (0.038)	-0.051 (0.038)	-0.074* (0.038)
Cash to asset ratio	0.272*** (0.060)	0.263*** (0.061)	0.266*** (0.062)	0.271*** (0.060)	0.260*** (0.060)	0.258*** (0.061)	0.264*** (0.062)	0.269*** (0.060)
Funding price	0.005 (0.035)	0.005 (0.035)	0 (0.035)	-0.023 (0.034)	0.007 (0.035)	0.008 (0.035)	0.001 (0.035)	-0.019 (0.034)
MFIs FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes
District by year FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Adjusted R-squared	0.424	0.423	0.423	0.423	0.424	0.424	0.424	0.424
Observations	13,426	13,426	13,426	13,426	13,426	13,426	13,426	13,426

Notes: ***, **, * indicates significance at the 1, 5, and 10 percent significance level.

Project II: The Effect of Agricultural Technology on Harvest Amount, Income, and Expenditure

Objective and methodology of the study

We aim to empirically estimate the effect of Agricultural Technology on Harvest Amount, Income, and Expenditure. Agricultural technology includes agricultural equipment type, planting, and harvesting methods. For this purpose, we use Agribuddy data of Cambodia.

Dependent variables

Our dependent variables include the harvest amount, income, and expenditure. We also investigate the effect on food, non-food, and health expenditure separately in addition to total expenditure.

Independent variables

The independent variables include indicators for equipment type, and planting and harvesting method. Equipment includes tiller, tractor, or other. Planting and harvesting methods can be manually or using a machine or other.

Covariates (factors of harvest amount)

Loan type

We control the type of loan by including dummy indicators for individual and group loans.

Land ownership and size

Further, we control for land ownership by including a dummy indicator for owning land. Additionally, we add land size in our regression.

Water source

Further, we include a dummy for the rain to control for water source.

Descriptive Statistics

Table 2.1 reports the summary statistics for harvesting technology, loan type, harvest amount, income, and expenditure. On average, the amount of harvest for the farmers in Cambodia is approximately 4368 kilograms. Almost 80 percent of farmers are faced with COVID-19 related trouble, particularly income reduction. Most farmers use tiller equipment instead of the tractor for plowing, about 55 percent. Further, most of the farmers rely on manual planting, about 85 percent of them.

Correlation/regression results

Table 2.2 presents the results for the agricultural technology effect on harvest amount, income, and expenditure. The findings show that while machine harvesting boosts harvest amount, tiller equipment decreases harvest amount. However, the negative effect of machine planting on harvest amount is unexpected.

Additionally, we observe that the recent pandemic, Covid-19, increases the farmers' expenditure, particularly the health expenditure.

Table 2.1: Summary Statistics for Harvesting Technology, Loan Type, Amount of Harvest, Income, and Expenditure

	Mean	Std. Dev.	Min	Max	Obs
<i>Dependent variables</i>					
Harvest amount in kg	4367.558	61562.94	0	5000000	7,560
Food expenditure (KHR annual)	2952513	3719734	0	28600000	7,560
Non-food expenditure (KHR annual)	7007065	13300000	0	261000000	7,560
Health expenditure (KHR annual)	1207301	2953266	0	48000000	7,560
Total expenditure (KHR annual)	9959579	14900000	0	268000000	7,560
Total income (KHR annual)	5398983	14700000	0	540000000	7,560
Covid trouble = 1	0.79795	0.40135	0	1	7,560
Reduced income due to Covid = 1	0.722421	0.44765	0	1	7,560
<i>Loan type</i>					
No loan	0.626257	0.483795	0	1	7,560
Individual loan	0.326587	0.468925	0	1	7,560
Group loan	0.047156	0.211909	0	1	7,560
<i>Equipment</i>					
Tiller equipment	0.555291	0.496767	0	1	7,560
Tractor equipment	0.290079	0.45361	0	1	7,560
Other equipment	0.15463	0.361484	0	1	7,560
<i>Planting</i>					
Manual planting	0.859788	0.347229	0	1	7,560
Machine planting	0.117989	0.322617	0	1	7,560
Other planting	0.022222	0.147415	0	1	7,560
<i>Harvesting</i>					
Manual harvesting	0.25291	0.434633	0	1	7,560
Machine harvesting	0.650926	0.47657	0	1	7,560
Other harvesting	0.096164	0.294723	0	1	7,560
<i>Other covariates</i>					
Family size	4.598685	1.951258	1	18	7,529
Land size	3.357911	18.99408	0	936.62	7,470
Rain =1 (if water source is rain)	0.830622	0.374978	0	1	7,560
Own land	0.900198	0.29959	0	1	7,560
Fertilizer use	0.354034	0.478148	0	1	7,560

Notes: Missing in the amount of harvest are treated as zero.

Table 2.2: Correlation between Loan Type, Agricultural Technology, and COVID trouble with Harvest Amount, Income and Expenditure

	Harvest amount	Total income	Total expenditure	Food expenditure	Non-food expenditure	Health expenditure
			339000*** (80456)	74639*** (23664)	264000*** (70693)	75482*** (17934)
Land size	10.376* (5.499)	7618 (4710)				
Own land	1756 (1151.4)	355000 (700000)				
Rain	1647.7* (861.5)	2320000*** (396000)				
Individual loan	-1216 (1431)	-751000 (372000)	3410000*** (426000)	346000*** (94078)	3070000*** (387000)	-68700 (73303)
Group loan	1691 (2155)	356000 (1080000)	-249000 (630000)	-301000 (191000)	52163 (541000)	-41100 (155000)
Tiller equipment	-5184*** (1055)	-3640000*** (722000)	-1060000*** (407000)	292000*** (108000)	-1350000*** (363000)	37569 (112000)
Tractor equipment	-757 (2306)	-2720000*** (814000)	2040000*** (543000)	135000 (115000)	1910000*** (496000)	131000 (123000)
Manual planting	-768 (1498)	-1400000 (866000)	-6320000*** (1390000)	-1470000*** (213000)	-4850000*** (1280000)	735000** (333000)
Machine planting	-5891*** (2090)	-3770000*** (851000)	-11800000*** (1440000)	-4410000*** (224000)	-7390000*** (1330000)	1620000*** (360000)
Manual harvesting	2458 (1496)	1540000*** (398000)	8520000*** (439000)	2980000*** (108000)	5540000*** (388000)	- (182000)
Machine harvesting	8245*** (2269)	8040000*** (366000)	9440000*** (376000)	3680000*** (80042)	5760000*** (345000)	-636000*** (171000)
Covid trouble	289 (1181)	-80700 (571000)	3970000*** (376000)	824000*** (91700)	3140000*** (332000)	408000*** (91451)
Adj. R-squared	0.002	0.053	0.067	0.149	0.045	0.045
Sample size	7,470	7,470	7,529	7,529	7,529	7,529

Notes: Total expenditure is the sum of food and non-food expenditure. Health expenditure is included in non-food expenditure. ***, **, * indicates significance at the 1, 5, and 10 percent significance level.

