

The Impacts of Credit on Village Economies

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Abstract

This paper provides an early evaluation of the impact of Thailand's 'Million Baht Village Fund' program. The program, introduced in 2001, is the largest scale government microfinance initiative in the world to date – costing about 1.5 percent of GDP. We use both pre- and post-program panel data, and quasi-experimental variation stemming from the way credit was given to different villages, to evaluate the short run impacts on the villages receiving the program. We find that the village funds have increased total short-term credit, consumption, and income growth but decreased asset growth. Credit increased for agricultural investment and consumption, and interest rates increased, as did default rates and informal borrowing in the year after loans. Agricultural investment increased, while business investment did not. Nonetheless, business income increased (especially in female-headed households) as did labor income. We view the impact on labor income and interest rates as important general equilibrium effects of the programs.

Imagine villages in Thailand as small economies. They are open economies, but not identical, and not entirely integrated with one another and the rest of the broader economy (nearby provinces, regions, etc). It matters where a person lives. There is substantial variation in institutional and market arrangements across villages.¹ Certainly informal borrowing and lending within the village is most common, and there is cross village variation in interest rates and the amount of credit.² Even labor markets are not entirely integrated with local

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¹Kaboski and Townsend (2005) describe variation in existing village-level financial institutions.

²The ratio of loans to relatives within vs. outside of the village is 2:1, for non-relatives this ratio is 3:1 and interest rates are much lower on within-village loans. Small loans are less likely between households in different villages. (Kaboski and Townsend, 1998)

wages varying considerably across villages.³ **(XX insert risk sharing).**

In the context of these villages, we study the impacts of Thailand’s Million Baht Village Fund Programme, a large-scale government intervention that acted as an exogenous injection of potential funds into each of these 77,000 heterogeneous village economies.⁴ The program was among the largest scale government microfinance initiative of its kind. Each transfer of one million baht (about \$24,000) was used to form of an independent village bank for lending within the village. Every village, whether poor or wealthy, urban⁵ or rural, was eligible, and all sixty four villages of the villages for which we have panel data did indeed receive the funds. The size of the transfers were substantial. Across our sample, the transfers averaged twelve percent of total annual income in the village economies, and forty-one percent of total short term credit.

We view each of these transfers as a smaller, though substantial, version of the broader increases in financial intermediation, which have been well studied at the macro-level.⁶ A strong criticism of this literature has been the endogeneity of financial intermediation. These small transfers have an important degree of exogeneity making them “test tube”-like experiments for studying phenomena important to macro-economies, including general equilibrium effects. Two crucial elements of the structure of the Million Baht Programme gave the transfers this (plausibly) exogeneity. First, the program was a rapidly introduced “surprise” policy initiative. In November 2000, the Thai Parliament was dissolved and by January 2001 the populist Prime Minister Thaksin was elected. Thaksin had been an extremely prominent businessman, but until then a political outsider in Thailand. The new policy was implemented quite rapidly. None of the survey villages had the village banks in the 2001 data, but all had it by the 2002 data. Second, there is strong variation intensity of the credit injection in the cross-section of villages. Specifically, each village received the same amount – one million baht – regardless of the population of the village, so smaller village economies received a relatively more intense injection of credit.

³Among the four provinces (*changwats*) we examine, the within-county coefficient of variation in average daily wage in a village ranges between 23 and 41 percent.

⁴The Thai program involves approximately \$1.8 billion in initial funds, or about 1.5 percent of Thai GDP in 2001. This injection of credit into the rural sector is much smaller than Brazilian experience in the 1970s, which saw a growth in credit from about \$2 billion in 1970 to \$20.5 billion in 1979. However, in terms of a government program implemented through village institutions and using micro-lending techniques, the only comparable government program in terms of scale would be Indonesia’s KUPEDDES village bank program, which was started in 1984 at a cost of \$20 million and supplemented by an additional \$107 million in 1987. (World Bank, 1996)

⁵The village (*moo ban*) is an official political unit in Thailand, the smallest such unit, and is under the county (*changwat*), district (*amphoe*), and sub-district (*tambon*) levels. Thus, “villages” can be thought of as just small communities of households that exist in both urban and rural areas.

⁶Important astructural cross-country studies include King and Levine (1993) and Rajan and Zingales (1996). In the context of Thailand, Gine and Townsend (2001) and Jeong and Townsend (2003) apply Lloyd-Ellis and Bernhardt (1999)’s growth model of credit-constrained occupational choice, while Townsend and Ueda apply Greenwood and Jovanovic (1990)’s model of endogenous financial intermediation to aggregate Thai data. Simulations from these estimated models are shown to be remarkably consistent to the Thai experience.

For example, the average transfer was twelve percent of estimated total annual income, but the injection averaged 27 percent for the lowest quintile (i.e., smallest) village economies, and less than 2.5 percent for the top quintile (i.e., largest) village economies.

Thus, we have important variation in the injection that is not the result of the decisions of either the banks or the households, but an artifact of the program design. Before the introduction of the program, village size is not significantly related to credit, but afterwards the relationship is highly significant and strongly predictive. We use an interaction of the year of the program introduction and the number of households in a village as instruments for the amount of credit received and the probability of receiving credit.

Furthermore, a microfinance initiative is a natural financial intervention to examine because of its policy relevance. Over the past twenty years, “microfinance” has become a key word among both researchers and policymakers in development economics. Microfinance programs are poverty-fighting programs that make small loans to poor people, typically without collateral. Initiatives are sponsored by a variety of organizations, including the World Bank, United Nations, USAID, national governments and many charitable NGOs. There are estimated more than 120,000 microfinance initiatives worldwide, and the number is growing.

Proper evaluation of these programs requires exogeneity and has consequently been limited.⁷ There has been even less examination of general equilibrium impacts of credit at the micro-level, or the micro-mechanisms behind macrotheory. The Townsend Thai dataset we use has unique advantages for doing precisely this. It contains seven years (1997-2003) of panel data on 960 households across 64 villages in four rural and semi-urban provinces of Thailand. These data include information on education, assets and investment, income, borrowing and saving through various forms, consumption, occupation, and household composition, for example. The first five years of data give us a “before” picture of the environment, while the final two years give us the ability to look at the effect of the program on levels and growth rates of relevant outcome variables. The short “after” horizon gives us a window for examining the impacts of credit on villages, at a time when these impacts are still localized. (Indeed, neighboring village controls constructed using GIS techniques do not greatly affect our results.)

Our regressions use short-term village fund credit as our measure of treatment and assess its impacts on households. The major impacts we examine are the effect of the village institutions on credit, saving and investment decisions, and household outcomes, such as consumption, asset growth, income and income sources, and business enterprise. We run two-stage regressions with household-specific fixed effects using both levels and changes in levels as the dependent variables. Additionally, we control for observable household characteristics (i.e., household composition, age and education of household head,

⁷Important contributions include Aportela (1998), Banerjee and Duflo (2003), Burgess and Pandy (2005), Coleman (1999), Gertler, Levine and Moretti (2003), Pitt and Khandker (1998), and Pitt et al (2003).

assets, and income) and add year-specific dummy variables. A brief summary of the findings and their importance:

1. The availability of credit increased total borrowing, and so crowding out of or substitution away from other sources was not a major issue. Indeed, it appears that credit increased by more than the amount of the injections, though we cannot reject the null hypothesis that credit increased one-for-one with the injection of available credit. At the same time, average interest rates on short-term credit did not fall, but actually rose slightly. Among the types of credit that increased were credit for consumption, credit for agricultural investment, and credit from the agricultural bank and perhaps commercial banks as well.
2. Credit increased total consumption substantially. Grain, tobacco, ceremony, and educational expenditures were stable, but credit increased expenditures on household and auto repair, fuel, dairy, and alcohol.
3. Village fund credit has caused assets to fall, but incomes to rise. Business income and, even moreso, market labor income became relatively more important sources of income.
4. Although business income increased, total business investment and the number of new businesses starts did not respond to credit.
5. Conversely, small agricultural investments increased, but agricultural income did not. Indeed, farming income, especially from crops other than rice, may have even decreased.
6. The amount of household credit in default rose. Initially the credit injection may have decreased the use of informal credit, but informal credit increased in the following year, perhaps because households needed to borrow from informal sources to pay back the injected loans.
7. Female-headed households responded similarly to male-headed households in their borrowing and investment. They differed in the response of their consumption and income patterns. Female-headed households responded by spending more on meat, auto repair, clothing and alcohol consumed in the home, while men increased alcohol consumption outside of the home. Female-headed households had a somewhat stronger tendency to increase business income than male-headed households did.

XX insert some analysis. My ideas: 3 and 4 may indicate that fixed costs seem to be less important for business income, and credit seems to affect the intensive margin rather than the extensive. LEB and GJ have both margins, but Banerjee/Newman has only an extensive margin. It may indicate that credit offers consumption-smoothing and/or cashflow management, which can change portfolio decisions in terms of income sources a la GJ and

Braverman and Stiglitz. 2 may indicate that consumption elements with an intertemporal component (like repairs) are those that respond most to credit. 5 may indicate that many of the investments are labor-saving rather than augmenting (free of time for market labor?). 8 may indicate that female households respond differently more because of differences in resources than in differences in expenditure preferences.

The rest of the paper is organized as follows. **My suggested outline:** Section 2 discusses the program and data in more detail. Section 3 **describes our methods, gives support for the exogeneity of the instrument, GIS and interpretation of GE effects on the village economy.** Section 4 presents the results. (**table 1: effect on credit, interest rates, default, table 2: consumption and components, table 3: investments, income, and source of income, table 4: differences between male and female households**). Section 5 concludes and gives direction for future research.

1 Description of Program and Data

We provide a brief overview⁸ of the Million Baht Village Fund program itself, and then describe the data. While the program description helps to understand the structure of these funds, both the program details and details of the data were important in motivating our identification strategy and methodology.

1.1 Overview of Million Baht Program

Prime Minister Thaksin's official stated objective for the program is to enhance the learning and self-dependency process of the village, and to develop initiatives for improving the economic and social potentials of people in the villages. It is also promoted as an attempt to reach the underprivileged, develop a decentralized grass roots approach to growth, and link communities with government agencies and the private sector. The primary hope is that the money will be a revolving, self-sustaining fund to be used for investments in occupational development, employment creation and income generating activities.

The transfers were given to the villages with both carrot and stick provisions. The stick involved telling villages that if the funds were abused or failed, they would be offered no further assistance, and even other sources of government funding would be cut off.⁹ The carrot was the promise to turn the successful

⁸This information is based on data from the institutional panel data set, as well government materials and informal interviews of village funds committee members, Community Development Department (CDD) officers, and Bank for Agriculture and Agricultural Cooperatives (BAAC) officers and administrators in March, 2002. BAAC administrators were interviewed in Bangkok, while three branch officers, a CDD officer, and six village fund committees were interviewed in Buriram, Chachoengsao and Chiangmai.

⁹This threat was not completely credible, but based on interviews it seemed to at least be an important issue to villagers.

village funds into true village banks. That is, the Thai Bank for Agriculture and Agricultural Cooperatives (BAAC) later offered loans to villages that receive their highest rating. Their hope is that the funds will assist them in providing financial access to rural communities. These additional loans were made available after the period of study in this paper, however.

1.1.1 Organization and Founding

The program was jointly administered by multiple government agencies. Government owned banks received the initial money transfer and held both the lending and savings accounts for the village funds.¹⁰ In the rural and semi-urban areas we study, the BAAC plays this role. Officers from the Community Development Department provided oversight and guidance, as they do with other village funds, and the Ratchapat Institutes are reportedly administering audits¹¹ of the village funds as well as an evaluation of the funds and member households. These audits are in addition to the BAAC's own fund ratings¹²

Although a federal program, the "million baht" funds themselves are only quasi-formal, in the sense that they have no building or facility and no employees.¹³ They are administered at the village level by a committee¹⁴ elected by the

¹⁰Each village fund holds two accounts, the first for receiving the million baht transfer and the second for holding member savings.

¹¹Each village has a graduate of a teachers' college, who typically lives in the village, responsible for "auditing" the fund. The audit includes reports or surveys on: 1) the village background, history, education level, infrastructure, household assets, etc.; 2) the strength of the community strength; 3) goals for improving the strength of the community; 4) attitudes toward the fund; 5) the initial meeting of the fund committee; 6) the initial meeting of the borrowers; and interviewing individual households; 7) the village economy including small businesses and plan for one tambon, one product ; 8) the financial status of the fund; and 9) a "master plan" for the village's future. In addition, the undergraduates file monthly status reports on the fund and interview individual members about the fund. They are required to interview every household for villages with less than 100 total households and fifty percent of the villages with 100 households or more.

For each fund, a "supervisor teacher" files a short 4-page report containing : a summary of the fund establishment; a summary of the process of setting regulations; a list of the committee members as well as the number of males and females, the members positions and their expertise; a summary of the regulations including membership, savings, interest on savings, loan criteria, supervision and follow-up of loans, and the distribution of profits; details on the bank where the fund is held, the date of transfer of the million baht; membership; amount of loan disbursement by loan purpose; member participation; transparency of fund management; and member satisfaction.

¹²We, the authors, assisted BAAC officials in the development of this rating system.

¹³According to the sample regulations, committee members were by regulation allowed to divide ten percent of the fund profits among themselves as compensation for their work and many funds interviewed adopted this policy and said it was a required policy.

¹⁴While a general meeting of fund members is required to take place at least once a year, only 85 percent of the funds interviewed reported having these general meetings. The committee plays the primary administrative role in the fund and typically reported meeting one to two times a year to evaluate loan applications.

The accountant/bookkeeper is fairly involved and all explained in a booklet of about 50 pages. There are several similar, but not identical, accounting schemes provided in booklets by the CDD, the GSB, and the BAAC. The groups noted that the accounting was tedious, complicated and difficult, but none claimed that it was unmanageable. Many groups were

village and by occasional meetings of all villages. Such quasi-formal village institutions are typical in Thailand (see Kaboski and Townsend (2005)). In order to receive funds, villages needed to form committees, develop policies¹⁵, submit an application/proposal for the village fund, and have the proposal evaluated¹⁶ and accepted. The vast majority of village households became members of the village funds and village funds averaged 94 members.¹⁷ The committees were selected democratically by the villagers at a village meeting, with regulations set up to ensure fairness of these elections.¹⁸

The founding of the funds was extremely rapid. As discussed in the introduction, parliament was dissolved in November 2000 and the new party was elected in January 2001. Funds were first available in June 2001 and all of the villages we study had received the transfer by April 2002, the time of the 2002 survey. Although all of the villages we study received the transfer in the same year, a key point for the purpose of this paper is that each village received the same amount of funds (one million baht) regardless of the size of the village. Thus, the average amount of funds received by a household in any given village was inversely proportionate to the number of households in the village. The resulting relationship between village fund credit and the inverse number of households in a village is shown visually in Figure 1.

1.1.2 Policies

Some savings and lending policies were stipulated while others were set by the villages themselves, often based on the suggestions from printed materials or suggestions from CDD officers.

assisted by the village auditors from the Ratchapat Institute.

¹⁵Villagers received manuals describing the goals, procedures and regulations of the village funds. In addition, the appendix contained an example of the policies of a village fund. Although these policies were shown as an example, from interviews, it appears that many committees felt that these suggested policies were fixed regulations for all funds. In addition to these sample regulations, the CDD and the tambon sub-committees also made suggestions on how to organize funds.

¹⁶The applications were submitted to the BAAC (or GSB) and evaluated first by an amphoe level sub-committee with final approval from the national fund committee. The evaluation or readiness appraisal evaluated: the selection of the fund committee, the qualification of the fund committee including its knowledge, experience and management ability, the policies and regulations of the fund, the extent of participation of villagers and members in the funds management, and the compliance with fund regulations.

¹⁷Any adult could be a member, so many households had multiple members. The primary membership criteria for most institutions was to live in the village. For those households that weren't members, they typically did not want to borrow and two reasons were often given: either the households were wealthy and did not need the money or wanted to leave the funds for poorer households, or the households were poor and did not want to get into more debt.

¹⁸The village meeting required 75 percent of households in the village for a quorum. By regulation, the committee needs to consist of 9 to 15 villagers, with half of them women. Requirements were that committee members be at least 20 years old, have lived in the village for at least two years, be a person of good character (e.g. no gamblers or drug users), not be bankrupt, never have been imprisoned or have violated position or property, not have been evicted from the government or a state enterprise, have maintained the right to vote, and never have been evicted from the fund committee. Committee members can serve a maximum of two years with half of the committee members being replaced each year.

Seventy percent of the village funds offered savings services, with most of these requiring that members save and offering pledged savings accounts. Members' savings are jointly held in a separate BAAC account for savings. One suggested set of savings regulations that was often followed was that all members must pay an application fee, and buy at least one, but not over 1/5 of shares in the fund. Another suggestion was pledged savings funds with the following policies: deposits are made on a given date, pledged amounts varying from 10 to 500 baht across members, and pledge amounts able to be changed once a year. The average interest rate was 7 percent. The total amount of initial savings averaged about 4000 baht across funds.

For lending, the fund was typically divided into two portions: 900,000 baht for investment, and 100,000 baht for an emergency fund.¹⁹ In order to ensure equal access to the funds, regulations stipulated a maximum loan size of 20,000 baht.²⁰ Loans above this amount require approval by all members of the fund, but loans cannot be greater than 50,000 baht (about \$1100) regardless. The repayment period could not be set longer than one year. In addition, villagers claim that they were required to charge a positive rate of interest on loans. Another suggested policy²¹ that was generally adopted was the use of two guarantors for loans, though the number of guarantors required ranged from one to eight across the sixty-four institutions. Only eleven of these institutions required collateral, and only three had fully collateralized loans. According to the household data, default rates in the initial year were about six percent. We define default as loans that are more than three months late.

Committee members typically decide who receives loans. The evaluation of the loans included the members' ability to repay, the appropriateness of the investment, and the amount requested. Given the small loan sizes, most or in some cases all of the people who applied for loans received them²².

Other policies that varied across institutions include the interest rate (ranging between two and twelve percent annually, with an average of seven percent) on borrowing, and potential loan funds were limited to the initial transfer, or also included member savings.

1.2 Data

As stated in the introduction, the data we use is a panel survey from the Townsend Thai dataset²³. We utilize five years (1997-2001) of data before the onset of the program and two years (2002-2003) of post-program data. We

¹⁹Many funds claimed this was a requirement of the program, but again it appeared to only have been an element of the sample village fund regulations.

²⁰About 35 percent of all loans are of this maximum size.

²¹Other suggested policies that were often adopted: a late payment penalty of 0.5 percent per day and a duration for emergency loans that was less than one year.

²²In the villages we study, loans are received through the BAAC. All members must have their own individual savings account with the BAAC. When a loan is granted by the village fund, the member takes a form signed by committee members to the BAAC, and the loan amount is transferred from the fund account to the individual account.

²³See Townsend, et al. (1997).

focus on two components of the survey (the household data and the institutional data), and supplement the data with information gathered in informal interviews conducted in the field.

The household panel data set is a stratified, clustered, random sample²⁴, including 15 households in each of 64 villages distributed across four provinces (*changwats*) of Thailand - the semi-urban changwats of Chachoengsao and Lopburi in the Central region relatively near Bangkok, and the more rural Sisaket and Buriram in the poorer Northeast region. The attrition rate from year to year averaged only three percent annually so that, of the 960 households surveyed annually, 800 of them were followed for the full seven years.

The household data set has several strengths. First, it is the only panel data from Thailand that spans across the pre- and post-program years. Second, the data is exceptional in its breadth and level of detail. These data include information on education, assets²⁵ and investment, income and expenditures in production, borrowing and saving through various forms, consumption, occupation, businesses operated, and household composition, for example. Using lending as an example of the detail in the data, for every year we have a record of all loans, both formal and informal, that a household has taken. These loans include the amount of the loan, date of the loan, duration, amount to be repaid, interest rate, lender, reason for borrowing²⁶, collateral used, value of collateral, whether the loan has been repaid, and the consequences for defaulting on the loan. The lending environment in these villages is very rich, with the BAAC, commercial banks, family, relatives, money lenders, and other quasi-formal village institutions in addition to the village funds all playing significant roles.²⁷

The panel data also includes an institutional component which surveyed all of the quasi-formal micro-financing institutions encountered in the survey villages over the seven years of data. The data includes details of: the founding; membership, saving, lending, and default policies; and the organizational structure and financial relationships of the institutions. The survey data also includes the record books of the institutions themselves, and is used to identify institutional policies and the relationship between these policies and the growth or failure of the institutions. The 64 million baht village funds were first in the survey

²⁴The survey design was based in part on the results of prior field research in the Northern region (see Townsend, 1995).

²⁵The initial 1997 value of real assets is found by depreciating the purchase price of the asset (in 1997 baht) from the time of purchase to what it would have been worth six years ago. We assume that the depreciation rate for all household and agricultural assets is 10 percent per year. One exception is land, the value of which we do not depreciate over time.

The retrospective wealth levels are incomplete in (at least) two respects. The first issue is that we only have information on household and agricultural assets that the household still owns. The second concern is that we do not have any information on past financial assets and liabilities. Fortunately, financial assets and liabilities tend to make up a small fraction of current household wealth, and so were probably also a small fraction of past wealth.

Subsequent asset levels were found using current investment data and a depreciation rate of ten percent.

²⁶Variables measuring the amount of credit borrowed for different purposes are based on these reported reasons for borrowing.

²⁷See Kaboski and Townsend (1998)

in 2001. In addition, another 213 institutions including other existing village funds, production credit groups, rice banks, buffalo banks, poverty alleviation programs, education funds, and women’s groups were found over the course of the seven years. Many of these institutions were founded during these periods and many of these institutions also failed. (See Kaboski and Townsend, 2005).

Table 1 gives summary statistics for the relevant variables used in this paper.

2 Methods

In dealing with the data, we focused on the effects of village funds on short-term credit (defined as loans of one year or less). The vast majority of village fund credit was short-term, and so we wanted to see its impact on the short-term credit market and abstract away from other credit markets. Otherwise, credit variation caused by one household taking out a long-term mortgage on a large home might swamp any effects of village fund credit that could otherwise be observed.

The dependent variables we focus on are divided into four categories:

- First, we look at the impact of the village fund credit on the short-term credit market, including its effects on total short-term credit, borrowing from other sources (i.e., the BAAC, commercial banks, and informal sources), the stated reasons for borrowing (i.e., business investment, agricultural investment, fertilizer/pesticides, and consumption), interest rates, and default.
- Second, we look at the effect of village fund credit on consumption and its different components. Specific components include grains, dairy, meat, fuel, clothes, home repair, vehicle repair, eating out, tobacco, alcohol (consumed both in and out of the home), ceremonies, and education.
- Third, we assess the impact on the income and productive decisions of households. In particular, we look at overall asset and income growth, the sources of both net income (agriculture, business, and wages/salaries), investment (agricultural and business), input use (fertilizer/pesticides), and sources of gross agricultural revenues.
- Fourth, we look at differential impacts on the above variables in female headed households. Microcredit is often targeted toward women, and theory (e.g., Bourignon, et al, 1994, Browning and Chiappori, 1998) and evidence (e.g., Pitt and Khandker, 1998, Kaboski and Townsend, 2003) suggest that impacts may differ across men and women.

We propose the following specification for the impact of short-term village

fund credit (*VFCR*) on outcome measure y of household n :²⁸

$$y_{n,t} = \sum_{i=1}^I \alpha_i X_{i,n,t} + \beta VFCR_{n,t} + u_{n,t} \quad (2)$$

Here n designates the household and t designates the year. The X_i are a set of control variables including number of adult males, number of adult females, number of kids, a dummy for male head of household, age of household head, age of head squared, years of schooling of head, gross assets, gross assets squared, and income.

We felt that village fund credit may have impacts on growth of assets and income because of both the transfer of consumption over time, and the investments that it might facilitate, thus for assets and income $y_{n,t}$ indicates the log growth of assets and income from t to $t + 1$. Similarly, for the two outcome variables that measure borrower's *ex post* ability to repay loans, default and borrowing from informal sources, we use the lagged value of village fund credit, $VFCR_{n,t-1}$.

When estimating the differential impacts of female-headed households, we use an additional interaction term of village fund credit with a dummy variable for female headed households:

$$y_{n,t} = \sum_{i=1}^I \alpha_i X_{i,n,t} + \beta_1 VFCR_{n,t} + \beta_2 VFCR_{n,t} * \chi_{female,n} + u_{n,t} \quad (3)$$

Here we report $\hat{\beta}_2$ as the differential impact of credit on female-headed households.

2.1 Estimation

For the actual estimation of the equations above, we added household- and time-specific fixed effects (θ_n and θ_t , respectively) and used a two-stage instrumental

²⁸Several other specifications were analyzed in an earlier version of this paper. First, we differenced equation (2). Differencing has the disadvantage of shorter panels, but the advantage of allowing for fixed effects on not only levels, but also changes. This specification produced broadly consistent results. Still, for the components of consumption and income where measurement error is greater, results were often no longer significant. Second, we assumed the current level of an outcome variable depended on the history of past credit :

$$y_{n,t} = \sum_{i=1}^I \alpha_i X_{i,n,t} + \sum_{j=0}^{\infty} \beta VFCR_{n,t-j} + u_{n,t}$$

Here we could difference the equations to yield:

$$y_{n,t} - y_{n,t-1} = \sum_{i=1}^I \alpha_i (X_{i,n,t} - X_{i,n,t-1}) + \beta VFCR_{n,t} + (u_{n,t} - u_{n,t-1}) \quad (1)$$

The one variable for which this specification produced interesting results was its lagged version for log assets. These log assets results were consistent with those for equation (2), so it is not presented.

variables approach for village fund credit. The instrument used is the interaction between the inverse number of households in the village and the post-program year dummies. That is, we control for variation across households correlated with the inverse of village size, but use the additional effect of village size in post-program years ($invHH_{t,n} * \chi_{t=t^*}$, where t^* is the relevant program year) as our instrument. This first-stage regression is therefore²⁹:

$$VFCR_{n,t} = \sum_{i=1}^I \delta_i X_{i,n,t} + \theta_t + \theta_n + \lambda_1 invHH_{t,n} + \lambda_2 invHH_{t,n} \chi_{t=2002} + \lambda_3 invHH_{t,n} \chi_{t=2003} + e_{n,t} \quad (4)$$

After adding the household- and time-specific dummies (ϕ_n and ϕ_t , respectively) to the impact equations, sufficient assumptions for assuring consistency are given below:

Error Specification	Orthogonality Assumption
$u_{n,t} = \phi_t + \phi_n + \gamma invHH_{t,n} + \varepsilon_{n,t}$	$\begin{cases} \varepsilon_{n,t} \perp invHH_{t,n} * \chi_{t=2002} \\ \varepsilon_{n,t} \perp invHH_{t,n} * \chi_{t=2003} \end{cases}$

Table 2 gives a sample of the first- and second-stage estimation results from the 2SLS procedure on equations (4) and (2), respectively. I have italicized the variables of greatest interest.

In the first stage estimates on the top of the table one can see that our instrument, inverse village size, is strongly predictive of village fund credit in the years of the Million Baht Program, but not otherwise. The t-statistics are XX and XX in 2002 and 2003, respectively. Second, the magnitude of the interacted instrument in 2002 is XXX,000, which is quite comparable to the XXX,000 that village funds claimed to have lent out on average. Finally, the magnitude of the instrument in 2003 is substantially lower, just XXX,000. This does not mean that less funds were lent out in 2003. The year dummy is much larger in 2003, and so lending was quite comparable in 2002 and 2003 (XX vs. XX). The smaller coefficient in 2003 reflects a weaker relationship between village size and credit, since much of the variation in the second year hinges on the failure or success that a particular village fund experienced in its first year.

The second stage shows that total (i.e., from all sources) village fund credit increased in response to village fund credit, since the $\hat{\beta}$ estimate is XX . Also, of great interest is the fact that village size alone (i.e., $\hat{\gamma}$) is not a significant

²⁹The corresponding equation for default and borrowing from informal sources, where lagged credit is important is:

$$VFCR_{n,t-1} = \sum_{i=1}^I \delta_i X_{i,n,t} + \theta_t + \theta_n + \lambda_1 invHH_{t,n} + \lambda_2 invHH_{t,n} \chi_{t=2002} + e_{n,t}$$

$u_{n,t} = \phi_t + \phi_n + \gamma invHH_{t-1,n} + \varepsilon_{n,t}$ and we make the the orthogonality assumption that $\varepsilon_{n,t} \perp invHH_{t-1,n} * \chi_{t-1=2002}$.

predictor in this regression. This is generally true, and gives us confidence that the predictive power of village size during program years is driven by the program itself, and therefore exogenous.

In the discussion of impacts, we will primarily focus on significance of $\hat{\beta}$ (and $\hat{\beta}_2$) at the five-percent level, but also point out significance at the ten-percent level, when those results are supported by multiple regressions.

2.2 Outlier Robustness

The data shows a great deal of variability and so the results can be very sensitive to a single or handful of observations. For example, the vast majority of investments and loans are small, so that one major investment or loan in the regressions can swamp all the activity happening at a smaller scale.

We run seven different regressions in order to deal with this problem:

- The first regression is a standard two-stage fixed-effect least squares regression using all of the data.
- The second regression drops the top and bottom one percent of non-zero values of the dependent variable. If there is a mass point greater than one percent at at least one of the endpoints of the distribution, we do not drop any observations at that end.
- The third regression is identical to the second regression, but more stringent. We drop the top and bottom five percent of non-zero values.
- The fourth regression deals with outliers by modifying the dependent variable into a dummy variable. Thus, the dependent variable used in this regression are indicator variable $\chi_{y_{n,t} > 0}$, which is one if the dependent variable is positive, and zero if it is non-positive. For example, the agricultural investment variable would be one if the household made an agricultural investment (regardless of the size of the investment) and zero if it did not. The village fund credit in this regression is similarly an indicator variable, $\chi_{VFCR_{n,t} > 0}$. Except for the problems in interpreting coefficients in a linear probability model, the estimated coefficients can be viewed as the increase in the probability that the dependent variable is positive given a household received a loan from the village fund.
- The fifth regression is similar to the fourth regression, except the indicator variable used is whether the dependent variable is above the panel average for the household, $\chi_{y_{n,t} > \bar{y}_n}$ in levels and $\chi_{\Delta y_{n,t} > \overline{\Delta y}_n}$ in differences. That is, the indicator is one if the dependent variable is higher than average for the household, and zero if it is not. The indicator variable for village fund credit is analogous, $\chi_{VFCR_{n,t} > \overline{VFCR}_n}$ or $\chi_{\Delta VFCR_{n,t} > \overline{\Delta VFCR}_n}$. Again, the loose interpretation of the coefficient on village fund credit would be the increase in the probability that the dependent variable is above average given a household had above average credit from the village fund.

2.3 GIS Robustness

A question of interest is to what extent the impacts of credit spillover to non-borrower households. The specification above assumes that the effects are only on the borrowing household. Of course, viewing each village as a small economy, we might presume that credit injections could affect even non-borrowing villagers, through general equilibrium effects, in particular. In this case, the $\hat{\beta}$ estimates in (2) would not be interpreted as the impact on the impact of borrowing an additional dollar on the outcome the a household's outcome, but the impact of an additional dollar of credit in the village on the outcome. What is important for this interpretation is that households only benefit from credit injection into its own village. That is, any impacts of credit on non-borrowers must be local to the village.

We test whether it is the local injection of credit into the village that drives our results, or whether neighboring village also has important effects. That is, we construct a GIS control variable for the size of neighboring villages. The control variable is a spatial kernel estimate of the inverse village size (number of households) of neighboring villages (e.g., all villages in a 5 kilometer radius). The regressions are therefore of the form:

$$y_{n,t} = \sum_{i=1}^I \alpha_i X_{i,n,t} + \beta VFCR_{n,t} + \mu invHH_{n,t,neighborhood} * \chi_{t \geq 2002} + u_{n,t} \quad (5)$$

The results we present are overwhelmingly robust in to the inclusion of such a neighborhood control variable. The signs of $\hat{\beta}$ estimates from regressions of equation (5) agree with those of equation (2) in XX percent of the regressions, and the magnitudes are generally quite similar. Of course, the reduced independent variation in $VFCR_{n,t}$ often lowers the standard errors of estimates, but XX percent of the $\hat{\beta}$ that were significant in equation (2) were also significant given equation (5). Finally, the $\hat{\mu}$ estimate was not a strong predictor of outcomes and was significant in only XX percent of the regressions. In the Results section that follows, we note any important exceptions.

Together, the robustness of our results to the GIS variable support the claim that in the two years after the programs founding, which we study, impacts remained local to the village, and our view of the experiment on separate village economies appears justified.

3 Results

Table 3 presents estimates of the program's short-term impacts on four key summary variables: credit, consumption, asset growth and income growth. The table reports estimates of β along with standard errors, and significance at the five and ten percent levels is noted. Each of the columns corresponds to a different outcome variable, while the rows correspond the baseline regression (at the top) and the four alternatives for dealing with the problem of outliers (below).

The first column of estimates indicates that total new short-term credit increased. That is, the program was successful in increasing overall credit and did not simply crowd out other sources of credit. There actually is some evidence from the levels regression that the credit injection may have had a multiplier effect, though only the baseline regression is significantly greater than one.

Similarly, the second column shows substantial and significant increase on consumption levels. Indeed, the estimates suggest that the increased value of consumption may be of the same order of magnitude as the credit injection, with the baseline estimate at indicating an additional 2.1 baht of consumption for every baht of village fund credit injected, while the two estimates that drop outliers indicating a numbers closer to one (i.e., 1.1 and 1.0).

The third and fourth columns indicate here that credit lowered the log growth of assets. According to the baseline regression, the log growth rate is 0.000015 percent lower for every baht of credit injected. In 2002, the average credit per household was 9600 baht, which would indicate an average impact of 14 percent lower asset growth from 2002 to 2003. Though this impact is sizable it is driven by several outlier households with low initial assets. The impact is substantially smaller and insignificant when the 1% and 5% tails are removed. Still, the estimates from the dummy variable regressions in the bottom two rows show that credit significantly lowered asset growth of households. Although, interpretation of linear probability models is necessarily problematic, the coefficients would indicate that households with loans were 38 percent less likely to have positive asset growth (row 4), and 28 percent less likely to have asset growth above the household's average asset growth (row 5). Of course, these interpretations also implicitly assume that the impacts flow only to borrowers.

Using similar interpretations, the fifth column indicates that households were (26 percent) more likely to have rising income, and (35 percent) more likely to have an increase in income that exceeded the household's average increase.

To summarize, we see a substantial increase in credit on the order of the size of the injection, a comparable increase in consumption, and a higher preponderance of low asset growth, and high income growth. We analyze each of these impacts more closely below.

3.1 Impact on the Credit Market

In Table 3, we delve more deeply into the impacts of the program on the credit market. For the purpose of comparison, the first column reproduces the results for the impact on total new short-term credit. The next three columns show the impacts of village fund credit on credit from other sources, namely, the BAAC/agricultural cooperatives, commercial banks, and informal credit. In the full sample, village fund credit increased borrowing from both the BAAC (0.45 baht per baht of village fund credit) and commercial banks (0.25 baht per baht of village fund credit). These impacts show up in the full sample, but are fall as outliers are removed. In contrast, informal credit increases in the year following village fund credit, but only when eliminating outliers by looking at outcomes of whether credit was positive (row 4) or whether it was higher than average

(row 5). Interpreting the coefficients, households with loans were 24 percentage points more likely to be borrowing from informal sources the following year, and 23 percentage points more likely to be borrowing above average amounts for those households.

One interpretation of the impacts on agricultural lenders and commercial banks is that the lenders piggy-backed on the monitoring, enforcement, or screening efforts of the village funds (see Jain and Mansuri, 2003). Using multiple sources of credit is not uncommon for households in these villages (See Gine, 2005). Another possibility is that the million baht fund was implicitly leveraged as collateral to expand credit. The impact on future credit of informal sources is not likely households relending funds (household's own lending did not respond), but instead likely households borrowing to repay loans that are due. The fact that the effects on agricultural lenders and commercial banks only show up in the full sample, while the impacts on informal credit only show up in the most filtered data is consistent with the fact that the former lenders make large but infrequent loans, while informal sources, such as money lenders, relatives, neighbors, and stores, make a larger number of loans, but constitute a smaller fraction of credit (see Kaboski and Townsend, 1998). Indeed, it emphasizes the advantages of looking at these different cuts of the data.

The middle columns of the table show the impacts on households' reasons for borrowing. We estimate no significant impact on borrowing for business investment, but an increase in small loans for agricultural investments. That is, village fund borrowers are eleven percent more likely to borrow for agricultural investment, and about ten percent more likely to borrow more than the average for the household. Despite this effect on agricultural investment, the biggest impacts of the program are on credit for fertilizer and consumption. Depending on the regression, the increase in fertilizer borrowing is 0.27 to 0.87 baht for every baht of village fund credit borrowed. The increase in borrowing for consumption is even more salient, with the top three rows estimates indicating that 0.35 to 0.81 baht of consumption credit is taken for every baht borrowed from the village fund. Households are 33 percentage points more likely to borrow for consumption, and 42 percent more likely to borrow more than they borrow on average for consumption.

Clearly, the reason for borrowing is a little ambiguous, since money is fungible across uses. We will see, however, that the investment and consumption borrowing patterns are reflected by actual levels of investment and consumption, while fertilizer usage is not. Fertilizer and pesticide usage may simply be a fallback reason that households give for borrowing, since a large share of loans from the BAAC in the past were given for such use.

Finally, the last two columns of Table 3 focus on other indicators of the credit market. The average short-term interest rate rose in response to the program. The effect is only significant when outliers are included in the sample, and indeed it may be driven somewhat by loans from commercial banks or from informal sources such as money lenders, stores, or neighbors, all of whom charge higher interest rates than relatives and the BAAC. Using the average credit per household of 9600 baht, the full sample estimate would imply 2.2 points higher

interest rates. In 2003, the average nominal interest rate on short-term credit is 6.9 percent, so the effect is non-negligible.

The final column shows the increased fraction of short-term credit in default. Default is defined as loans that are more than three months past due. In 2002, about 10 percent of all credit was in default by this definition. The larger rates of default would be consistent with the interpretation that borrowing from informal sources increased as a result of difficulties in repaying loans from village funds. Indeed, default fell in the first year of the program, but rose in the second year. Kaboski and Townsend (2006) show in a bufferstock model with investment and a borrowing constraint linear in permanent income, that households who borrow to consume should be theoretically more likely to default than households that borrow to invest.

3.2 Impact on Consumption

Table 3 showed a substantial impact on consumption, and Table 4 showed that borrowing for consumption was impacted in a similar fashion. We analyze here the impacts on different components of nondurable consumption. The total consumption is imputed from a weighted basket of the twelve components listed in Table 5. (Because of the weights, the component impacts do not simply sum to the total impact which is reproduced in the first column.) A first observation from the table is that the consumption of several components are unaffected by the credit program. The fact that “necessities” like grains, meat and tobacco do not increase is perhaps not surprising, but other components such as ceremonies, eating out and educational expenditures are also not significantly affected. Our result of no measured impact on educational expenditures should not be construed as evidence against credit constraints in educational investment, since an increase in the opportunity cost of going to school may have offset the reduced cost from credit constraints.

The components with the largest responses to the credit programs are housing repair and vehicle repair, which are investment-like in the sense that they have a durable aspect to them. Housing repair expenditures are sizable but infrequent, and so only show up as significant in the baseline regression. The estimate indicates that a baht of village fund credit led to 0.61 baht of expenditures on household repair and 0.15 baht on vehicle repair. Vehicle repair expenditures also increased significantly in frequency with households 23 percentage points more likely to have spent money on vehicle repair, and 19 percentage points more likely to spend more than the average for the household.

The other components which increase are spending on dairy (0.04 to 0.07 bahts per baht of credit), alcohol consumed both at home (0.02 to 0.05) and outside of the home (about 0.02), fuel (0.07 to 0.08), and clothing (0.01). Among these only fuel and alcohol consumed outside of the home showed up significant in the regressions for positive consumption, or for above average consumption.

XX Rob, any chance that the fuel expenditures are people commuting to wage earning jobs in other labor markets?

An earlier version of this paper produced mixed reactions toward the measured increase in consumption among policy makers in Thailand. One intention of the program was to use the funds for productive purposes, so some viewed the increase in consumption (together with the increased default) as evidence that villagers had “wasted” the funds. The breakout of consumption shows however that the components that policy makers might particularly associate with waste (e.g. tobacco, alcohol, or clothing) show relatively small increases, while again the repair services, which have an aspect of investment to them, show the largest response.

We turn to now to actual effects on productive activities.

3.3 Impact on Productive Activities

Table 6 shows the impact estimates for outcomes such as income, investment and input use. In Table 1, we saw that income growth increased as a result of the village fund credit. In the first three columns, we examine the effect of credit on the fraction of income generated from the three most important sources of earned income: net agricultural income/profits, net business income/profits, and wage/salary labor income.

The strongest result is that income shifted toward wage and salary income, which is evident in the baseline regression, and also the regressions that drop the extreme one and five percent of outliers, respectively. Given the average credit per household in the data of 9600 baht, the coefficient of 4.9e-6 implies about a five percent increase in the fraction of income from labor market earnings. It is interesting that credit did not significantly increase the fraction of households with labor market earnings, implying that the impact is not running through the extensive margin, but instead the intensive margin of hours worked or through the wage. (Our indirect measures of wage earnings in villages did not pick up significant effects on the wage, but these are very imperfect measures.) There is weaker evidence that the fraction of income from agricultural income (net of expenses) decreased, and that the fraction of income from business profits (net of expenses) increased. **XX Rob, I’m trying to extract the data on household’s purchase of market labor for inclusion here.**

These results are consistent with the aim of the programs to promote income generation outside of agriculture. The income results are also consistent with predicted effects of credit in models of credit constrained entrepreneurship (e.g., Banerjee and Newman, 1993, Lloyd-Ellis and Bernhardt, 2000, Gine and Townsend, 2003), in which credit promotes entrepreneurship and investment, and in turn raises wages by increasing the demand/productivity of labor. On the other hand, the results in the middle columns on measures of investment and input use do not support a story in which credit is needed for either start-up costs or business investment. Indeed, over half of the new businesses started in the seven year panel reported no start-up costs, and 75 percent of new businesses required less than the 9600 baht/household of average credit injected by the program. It is possible that credit plays a more important role as working capital for businesses than for investment.

The column for agricultural investment does show a significantly higher probability of investing (22 percent more likely) and of investing more than the household's average (17 percent more likely) when village fund loans are taken. Again, the agricultural investments funded by microloans tend to be small investments and so they do not show up in the overall investment regressions, which are driven by relatively few but large investments.

Input usage in agriculture is also interesting, since there is evidence that spending on fertilizer, pesticides, seeds, etc. actually fell as a result of the credit program. This is in striking contrast to the increase in reported borrowing for this use (recall Table 3). Of course, village fund loans are fungible, so the reason for borrowing may be less relevant. We can think of at least three possible reasons for the reduced expenditure on agricultural inputs. First, as we have seen agricultural income declined, so that this may simply reflect a shift of resources toward other activities. Second, there is a compositional change in agricultural activities. Looking at the last three columns of Table 5, we see that the fraction of gross farming income from crops other than rice decreased. The estimate in the fourth row indicates that households were 20 percentage points less likely to report income from non-rice crops.

Third, village fund credit is more fungible than fertilizer loans from the BAAC, which are denominated in currency, but practically they're often distributed in kind. In the absence of other sources of credit, households with no need of fertilizer may borrow from the BAAC, then resell the product, and use the funds for different purposes. This could drive down the price for fertilizer on the secondary market within the village, and increase fertilizer usage. (Analysis of our soil samples indicates that fertilizer usage may be excessive. **XX Rob, I remember this from my last trip several years ago, and talking to the professors and Chiangmai university. Do you have anything to cite?**) In this case, the easier fungibility of village fund loans could drive up the price of fertilizer, and reduce its usage.

3.4 Differential Impact on Women

We examined whether the impacts of credit were significantly different for female-headed households using all of the outcome measures. Overall, perhaps the most surprising result that female-headed households behave similarly to households headed by males. The only significant differential impacts were on the sources of income, and the distribution of consumption. We summarize these results in Table 7.

Looking at the sources of income, the lone difference significant difference between male- and female-headed households, is that a larger fraction of female-headed households reporting business income as a result of credit. Female-headed households are about ten percentage points more likely to have business income (see the fourth row).

Focusing on consumption, we see differences in the consumption responses of female-headed households, but not in the ways typically argued in the literature. In other countries, the literature (e.g., Pitt and Khandker, 1998, XX)

has found that men tend to spend money on things such as alcohol, while women's spending patterns are directed toward children. Our results in Thailand are quite different. For example, women do not spend more on children's education in response to credit. Indeed, the credit program significantly lowered the probability that a female-headed household would have educational expenditures above average for the household. There is also some evidence that female-headed households shift consumption more toward auto repair and clothing, and especially toward meat consumption. Finally, we do find that female-headed households shift consumption less toward alcohol consumed outside of the home, but surprisingly they instead increase their consumption of alcohol in the home, and this increase actually *exceeds* the decrease outside of the home. From informal discussions, we have learned that drinking outside of the home is less culturally acceptable for women in Thailand than for men.

4 Conclusions