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Research Paper No. 2008/52

Vulnerability, Trust and Microcredit

The Case of China's Rural Poor

Calum G. Turvey¹ and Rong Kong²

May 2008

Abstract

This paper investigates the economic conditions of rural households in China. Historical survey data indicate that over 80 per cent of rural households earn less than 4,500 yuan in net disposable income each year, that for the vast majority of rural households disposable income is insufficient to meet food consumption needs, and that in terms of economic growth rural households are receiving an ever decreasing percentage of China's growing economy with rural household incomes being only 31 per cent of urban household income in 2004.

To reduce vulnerability and food insecurity, this paper investigates the role of microcredit in China. It is argued that in China the conventional wisdom is to provide credit using traditional means, but we provide a model that shows how a microcredit market based on trust can co-exist with a commercial collateral-based market. This

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Keywords: equilibrium, game theory, rural, credit, China

JEL classification: O13, O16, O19

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model is developed in detail and certain propositions are supported using dominant strategies in a trust-honour game based on the prisoner's dilemma. The theoretical model is then applied to the case of microlending in China. It explains why, in the absence of trust, rural credit corporations do not make loans to the very poor. Furthermore, the model explains how Central party policies on rural credit can actually crowd out micro finance institution (MFI) and NGO microlending in China, and also explains why moneylenders dominate in many of the poorer regions of the country.

From a policy point of view, the theoretical model indicates that trust-based lending, coupled with certain incentives, can go far in supporting growth opportunities in rural China. It is argued that Chinese policy should be flexible enough to permit trust-based microlending to the poor, regardless of how counterintuitive this must appear to the conventional wisdom. Indeed, in the absence of flexible credit strategies, China's rural poor will remain in a persistent food-insecure poverty gap.

Acronyms

MFIs microfinance institutions
NGOs non-governmental organizations
RCCs rural credit cooperatives
VCC village credit committee

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1 Introduction

The vulnerabilities of peoples in developing countries to economic subterfuge are both persistent and degrading. The direct consequence is that hundreds of millions of households, mostly in rural areas, suffer from chronic economic hardship, and languish in a perpetual state of poverty and food insecurity. The root causes of economic suffrage are many but it is well understood that the most vulnerable of populations, those in a persistent poverty trap, are those who lack physical and financial resources. Physical resources imply the economic resources, land, buildings, inputs, etc., from which livelihoods are derived, and financial capital implies the capital with which to acquire the physical resources. The stock of physical resources and the financial wherewithal to acquire those resources are inextricably linked. To many, the root cause of the poverty trap is not the constraint on physical resources but the financial constraints or credit constraints that prohibit the acquisition of those resources to poverty-escaping scale.

This is particularly true in China where rural poverty is endemic, food insecurity wide spread, and the income gap between rural and urban households is increasing. Table 1 and Figure 1 provide a summary of income class frequencies between 1995 and 2004. The actual frequencies are found in the first three columns and the cumulative frequencies in the last three columns. In 2004, 12.54 per cent of rural households had net (disposable income) of less than 1,200 Yuan per year and nearly 50 per cent had net incomes of less than 2,000 yuan per year. Only 19 per cent of households had net income in excess of 4,500 yuan in 2004. Figure 1 illustrates the cumulative effect. The figure shows that significant improvements in rural household income have taken place over the past few years, but despite these gains poverty and insecurity are still wide-spread.

Table 2 refines the breakdown between various groups. Note that the first column for low-income households refers to about 80 per cent of all households (as per Table 1) with the remaining four categories representing only about 20 per cent of households.

Figure 1
Cumulative index of rural household net income

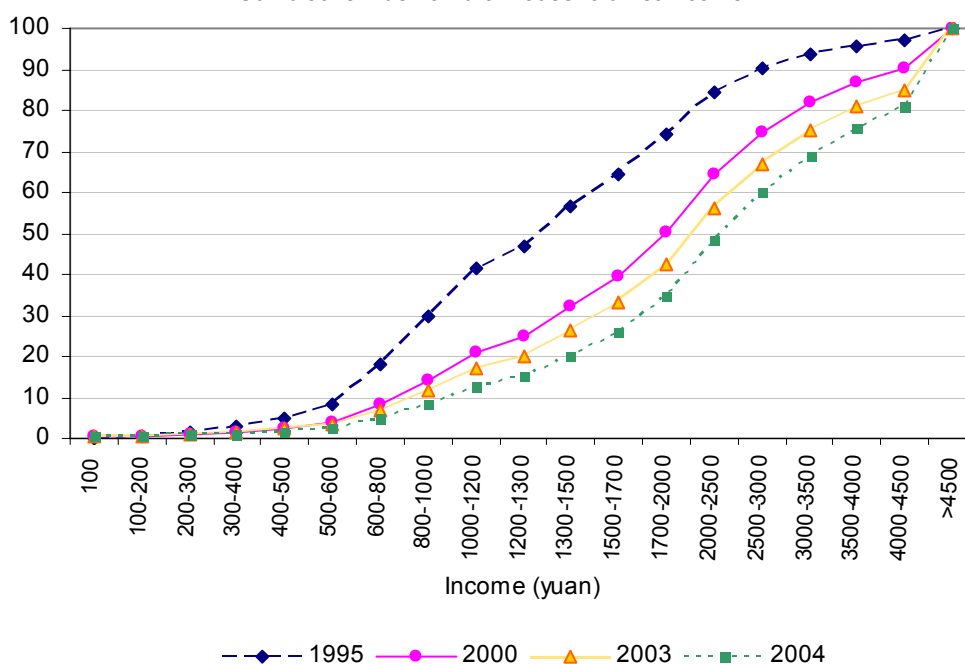


Table 1
Distribution of rural household income in China

	Frequencies				Cumulative frequencies			
	1995	2000	2003	2004	1995	2000	2003	2004
Below yuan 100	0.21	0.31	0.49	0.40	0.21	0.31	0.49	0.40
100-200	0.36	0.20	0.18	0.13	0.57	0.51	0.67	0.53
200-300	0.78	0.43	0.31	0.21	1.35	0.94	0.99	0.74
300-400	1.47	0.69	0.52	0.31	2.82	1.63	1.51	1.05
400-500	2.30	1.01	0.78	0.53	5.12	2.64	2.29	1.58
500-600	3.37	1.37	1.19	0.85	8.49	4.01	3.48	2.43
600-800	9.54	4.44	3.25	2.43	18.03	8.45	6.73	4.86
800-1000	11.63	5.72	4.87	3.64	29.66	14.17	11.60	8.50
1000-1200	11.83	6.75	5.52	4.04	41.49	20.92	17.13	12.54
1200-1300	5.38	3.75	2.97	2.51	46.87	24.67	20.10	15.05
1300-1500	9.74	7.42	6.39	5.11	56.61	32.09	26.49	20.16
1500-1700	7.92	7.48	6.45	5.69	64.53	39.56	32.93	25.85
1700-2000	9.39	10.45	9.39	8.57	73.92	50.01	42.32	34.42
2000-2500	10.29	14.54	13.79	13.69	84.21	64.56	56.11	48.11
2500-3000	5.89	10.29	10.81	11.76	90.10	74.85	66.92	59.87
3000-3500	3.49	7.11	8.02	8.85	93.59	81.95	74.95	68.72
3500-4000	1.95	4.76	5.84	7.09	95.54	86.71	80.79	75.81
4000-4500	1.34	3.44	4.20	5.25	96.88	90.15	84.99	81.06
>4500	3.12	9.85	15.01	18.94	100.00	100.00	100.00	100.00

Table 2
Household consumption expenditure of rural households by level of income (2004)

	Household level of income:				
	Low	Lower middle	Middle	Upper middle	High
Persons per household	4.60	4.34	4.10	3.86	3.50
Per capita annual income (yuan)	8,182.71	11,576.04	14,494.61	18,469.91	31,114.69
Per capita annual net income (yuan)	4,631.60	7,994.24	10,571.81	13,925.61	24,257.28
Consumption expenditure	5,742.14	6,861.51	8,000.97	9,493.87	14,451.91
Food	3,194.11	3,650.44	4,043.05	4,506.68	5,652.06
All other goods and services	2,548.03	3,211.07	3,957.93	4,987.19	8,799.84
Cash consumption expenditure	3,935.56	4,991.19	6,147.24	7,713.41	12,986.94
Food	1,501.88	1,902.67	2,314.40	2,850.31	4,275.44
All other goods and services	2,433.68	3,088.52	3,832.84	4,863.09	8,711.50
Food consumption deficit (cash expenditures on food - food expenditures)	-1,692.23	-1,747.77	-1,728.65	-1,656.37	-1,376.63
Total deficit (cash - consumption expenditure)	-1,806.58	-1,870.32	-1,853.73	-1,780.47	-1,464.97
% Deficit on food	0.94	0.93	0.93	0.93	0.94
Approximate % of population	0.80	0.20			

Income is heavily skewed towards poverty. The table indicates household income. Net income is measured by household income less household expenses including production inputs. The values under consumption expenditures indicate a discrepancy between expenditures made and expenditures in cash, indicating that in all classes there is a deficit in cash available for consumption purposes. Deficits range from -1,747.77 to -1,376.63. Even the high-income households face food consumption shortfalls. In the absence of a pure measure of food insecurity, the total deficit is also provided as the difference

between cash and total consumption expenditures. The second last row in the table indicates that the deficit in consumption expenditures related to food purchases is about 94 per cent. In other words, while rural households are able to cover fixed costs and general household/farm expenditures, there is insufficient income remaining to meet food consumption requirements. Food insecurity to this extent will result in a persistent poverty trap, from which farm households are unlikely to escape in the absence of growth opportunities.

Table 3 provides an historical summary of the urban rural income gap in China. Of importance is the last column which provides the ratio of rural to urban household income. In 1978 rural households had only 38 per cent of urban household income. This improved substantially between 1980 and 1990, but since reforms in 1991, the gap has widened again. By 2004 rural income was only 31.2 per cent of urban income. The widening gap is indicative of the rapid growth found in China's industrial sectors.

As indicated by Table 3, rural poverty in China is widespread. Not only are households food insecure, but their position relative to urban households is rapidly diminishing. This paper examines the potential role of microcredit as a means to reduce income and food vulnerabilities by providing the means for production expansion, income enhancement, a reduction in the poverty gap, and a step towards sustainability. However, it is also noted in this paper that unlike other nations, China does not have a well established mechanism for microcredit and a general unwillingness of traditional lenders such as the rural credit cooperatives (RCCs) to lend in the absence of collateral. From an implementation and policy point of view, the paper argues for microlending on the basis of trust, and indeed through various modelling approaches, we show that not only is lending on trust viable with suitable incentives, but also consistent with microlending in other jurisdictions such as in Bangladesh, India, South America and Southeast Asia.

Table 3
Per capita annual income and Engle coefficient of urban and rural households

Year	Annual net income of RURAL households (per capita)		Annual disposal income of URBAN households (per capita)		Rural/urban household income ratio
	Value (yuan)	Index	Value (yuan)	Index	
1978	133.6	100.0	343.4	100.0	0.389
1980	191.3	139.0	477.6	127.0	0.401
1985	397.6	268.9	739.1	160.4	0.538
1989	601.5	305.7	1373.9	182.5	0.438
1990	686.3	311.2	1510.2	198.1	0.454
1991	708.6	317.4	1700.6	212.4	0.417
1992	784.0	336.2	2026.6	232.9	0.387
1993	921.6	346.9	2577.4	255.1	0.358
1994	1221.0	364.4	3496.2	276.8	0.349
1995	1577.7	383.7	4283.0	290.3	0.368
1996	1926.1	418.2	4838.9	301.6	0.398
1997	2090.1	437.4	5160.3	311.9	0.405
1998	2162.0	456.2	5425.1	329.9	0.399
1999	2210.3	473.5	5854.0	360.6	0.378
2000	2253.4	483.5	6280.0	383.7	0.359
2001	2366.4	503.8	6859.6	416.3	0.345
2002	2475.6	528.0	7702.8	472.1	0.321
2003	2622.2	550.7	8472.2	514.6	0.310
2004	2936.4	588.1	9421.6	554.2	0.312

2 Microlending and economic development

Until the past 20 or so years credit has been rationed to the poor because it is believed that the poor are not creditworthy, have limited or no collateral, and do not generate sufficient income with which to repay a loan. This applies not only to the acquisition of fixed resources such as land and buildings which could contribute to economies of size, but the purchase of variable inputs (seed, feed, fertilizer) which could enhance economies of scale. Given the ill-effects of credit constraints, it is no wonder that these constraints above all hold the greatest shadow price, and the more vulnerable the household the greater this shadow price will be.

More recently the traditional view of credit worthiness has been challenged. Nowhere has this been more apparent than the activities of Bangladesh's Grameen Bank that in 1978 started providing microcredit to poor households in rural areas. The escalation of microcredit and microfinance institutions (MFIs) throughout the developing world has resulted in a burst of growth in some rural communities providing benefits in terms of rural entrepreneurship, growth, income enhancement, poverty reduction and increased food security and livelihoods (see reviews by Hartarska and Holtmann 2006; Meyer and Nagarajan 2006; Zeller 2006). While it is understood that microcredit provides a counter-model for a non-collateral economy that is juxtaposed to the collateral based credit-rationing model of, say, Stiglitz and Weiss (1981: 393), little formality has been given to microcredit. The purpose of this paper is to provide such a framework, and as a starting point the principles of Grameen-type lending since this type of no-collateral lending, together with incentive mechanisms such as self-help groups that embolden trust, has in many instances proved to be successful.

3 Economics and trust

Yunus (1999) argues that the poor are creditworthy because they are trustworthy.¹ Yet the role of trust in an economic system is not well understood and the idea that trust can substitute for the conventional metrics of profitability, liquidity, leverage and repayment capacity found in conventional credit scoring or risk rating models (e.g., Turvey 1991; Turvey and Brown 1990) is foreign to the conventional lender. For this reason the conventional economic models, including the lending models of Stiglitz and Weiss, have excluded vulnerable populations. But why should trust-based microlending work? Is trust induced by economic circumstance, or are incentives to make one trustworthy required to induce trust, suggesting that one is innately trustworthy? Or is trust simply innate? Consider the rational description provided by James (2002: 291) that is deciding on whether agent A should trust another agent B, the economic approach is for A to investigate the incentives that B has either to honour or dishonour the trust offered by A. If B has an incentive to be trustworthy, then A will trust B. Rabin (1993) considers a 'fairness equilibrium' in which people like to help those who are helping them but are willing to hurt those that do not, even if the cost of the latter exceeds all possible benefits. James (2002) argues that such thinking assumes that all agents are rational utility maximizers, and that people are honest only to the extent that the appearance of honesty or honesty itself pays more than dishonesty. In other words, one is trustworthy if he does not have the incentive to exploit others.

¹ See also Turvey and Kong (2006).

This is, of course, a depressing view of human behaviour, but it is endemic. The use of credit scoring models, for example, assumes dishonesty first; only experience brings about trust. And the economic justification for this presumption is that inherent in any economy some numbers of unidentifiable individuals are, for whatever reason, dishonest. There is also evidence that trust-based economies outperform other economies in terms of economic growth (Fukuyama 1995; Beugelsdijk, deGroot and van Schaik 2004) and trust plays an integral part in the reduction of transactions costs (Chiles and McMackin 1996). In terms of credit, the number of loan defaults or arrearages will far exceed the number of dishonest players for it is true that an honest person, by circumstance rather than sloth, may at one time or another be unable to meet the obligation. The problem is that what is ultimately observed is the default ex post rather than the probability of default ex ante.

But in repeated experiments such as the Grameen Bank lending based on trust appears to work. To a large extent this may be based on the use of self-help groups which act as a collective to enforce trust. The recurring question, from an economic point of view, is how and why this works. It appears perhaps that there are two separate but not mutually exclusive games at play. First, if the borrower is a group, then there is a game of mutual enforcement within the group to ensure equal effort. Thus the group becomes trustworthy. Second there is the game between the borrower (individual or group) and the lender (an NGO or MFI).

The game within the group is a simple one based lightly on the prisoner's dilemma. Here a group member can take action to reduce effort (the free rider effect) but must consciously absorb the fact that the remaining members can individually or as a group take an opposing action against him. Kandell and Lazear (1992) introduce a 'peer pressure' function that integrates with utility to affect behaviour. Here the function $P(e_i; e_j, e_k, \dots, e_n, a_i, a_j, a_k, \dots, a_n)$ captures the pressure that is felt by participant i , which depends on his own effort, e_i , and the efforts of others, e_k, \dots, e_n , as well as the joint actions that he and group members can take $a_i, a_j, a_k, \dots, a_n$. There are n separate games played out, each with imperfect information about the actions of the remaining members of the group or the collective action of the group itself. If agent i is dishonest, the collective response of the group could do more harm than good. The same applies to all agents. Consequently none will reveal themselves and the group will act as one. In other words, it may be the case that all group members are dishonest and would enjoy a free ride, but in the absence of information about other members' intentions, all individuals behave with honesty and the group becomes trustworthy (James 2002).

Now consider the game between a lender and a borrower. Unless the group members conspire, the lender will look upon the group more favourably than an individual. Consider the following lender-borrower version of the trust-honour game (Figure 2).

Figure 2
Prisoner's dilemma payoff matrix to trust-honesty game

		Honour	Exploit
Lender	Trust	$iD, C(D) - (1+i)D$	$-D(1+i), C(D)$
	Distrust	$0, C(0) - C(D) < 0$	$0, 0$

If the lender trusts the borrower and the borrower is honourable, then a loan is made raising the consumption of the borrower by $C(D) - (1+i)D$ and returning revenue to the lender of iD . If the borrower is dishonest and wants to exploit the trust and not repay the loan, then the lender loses principal plus interest, $D(1+i)$, while the borrower benefits to the gross value of $C(D)$. If the lender distrusts the borrower, then no loan is offered resulting in no gain or loss to the lender but an opportunity cost to the borrower of $C(0) - C(D) < 0$. The final pair is 0,0 for the distrust-exploit pair.

The borrower has a dominating strategy trust-exploit. If $\frac{C(D)}{D} - 1 = i$ then gains in trust-honour are equal and the lender then has no dominant strategy. In this situation, the lender, having knowledge of the borrower's exploitive possibility, will make no loan and a Nash equilibrium occurs at distrust-exploit. If $\frac{C(D)}{D} - 1 < i$, then the lender has a dominating strategy in honour-trust. But this also means that if the borrower exploits the trust, the lender has more to lose. Again the Nash equilibrium is distrust-exploit. Ultimately, what this suggests is that in the presence of exploitive nature by a borrower, no loans would be made.

But in microcredit, loans are made, which suggests that to many pairs, trust-honour is a Nash equilibrium. How can this be? The trust-honour game provides no incentive for good behaviour. For example, if the lender knows that the borrower would not default, then clearly trust-honour is an equilibrium. But borrowers represent an adversely selected group so there is no way that an exploiter can be identified a priori. Consequently the lender will provide the incentive that if the borrower honours the obligation, then there will be a second opportunity to borrow but if there is default, then all opportunity for future borrowing ceases. In this case the trust-honour cell will accumulate over two periods as $(2iD, C(2D) - (1+i)2D)$ whereas the remaining cells will remain as is. The borrower's exploit choice will dominate the honour choice under the lender's trust only if $i > \frac{C(2D) - C(D)}{2D} - 1$. In other words, if the lender is non-exploitative in interest rates then the likelihood of default diminishes and trust-honour is a Nash equilibrium. Obviously if the borrower incorporates the loss of all future borrowings then for some T it will be true that $i < \frac{C(TD) - C(D)}{TD} - 1$ and again trust-honour becomes a Nash equilibrium. Interestingly if we consider two individuals such that $C_i(D) > C_j(D)$, then the incentives for i to exploit the trust of the lender will be lower than j . It is on this basis that we proceed with the model of the microcredit market.

4 A microcredit equilibrium

To keep the model simple we stick to the two major assumptions implied by the Grameen model. These are (i) that the poor place a higher value on money than the rich and (ii) that the poor have a higher probability of loan repayment than the rich. We define the loan value function as a measure of utility $V(\omega)$ where the dependent variable is measured as a per cent and the independent variable is measured as income, ω . The value

function can be viewed as a schedule representing a willingness to pay for credit and it is assumed, quite reasonably, that $V'(\omega) < 0$ that is the value placed on the next dollar available, and hence the willingness to pay for that next dollar, is decreasing in income. In other words, the poor are willing to pay a higher interest rate than the rich. The supply of funds is measured by the loan default function $L(\omega)$ as an increasing function of income (e.g., $L'(\omega) > 0$) with the dependent variable representing a percentage cost (expectation) of loss and the independent variable is again income. This function is unusual and is based on the premise, as expressed by Yunus, that the poor are more trustworthy than the rich. However, since most applications of microcredit involve the poor with little or no collateral, much of the lending decisions of microcredit revolve around trust. Hence, $L(\omega)$ can be viewed as a schedule for the trust in repayment and assumes that in the absence of collateral that the rich are more likely to default than the poor.

The general form of welfare is given by:

$$W = \max \int_0^{\omega^*} [V(\omega) - L(\omega)] d\omega \quad (1)$$

Where ω^* represents the barrier between $[V(\omega) - L(\omega)] \geq 0$ and $[V(\omega) - L(\omega)] < 0$.

We further define:

$$V(\omega) = A\omega^{-\beta_1} \quad (2)$$

and

$$L(\omega) = B\omega^{\beta_2} \quad (3)$$

where β_1 is the marginal value of the next dollar of income and β_2 is the marginal propensity to default. Equation (2) can be viewed as a *vulnerability* schedule in that it places a much higher value on the marginal dollar for the poor, while a low value is given to the rich. Equation (3) in contrast might be viewed as a *corruptibility* schedule which associates greater moral hazard of loan default and bad debts with the rich rather than the poor.

The slopes of $V()$ and $L()$ measure the rate of change in V or L as income increases. Thus:

$$\begin{aligned} \frac{\partial V(\omega)}{\partial \omega} &= -\beta_1 A \omega^{-\beta_1-1} < 0 \\ \frac{\partial^2 V(\omega)}{\partial \omega^2} &= \beta_1 (\beta_1 + 1) A \omega^{-\beta_1-2} > 0 \end{aligned}$$

and

$$\begin{aligned} \frac{\partial L(\omega)}{\partial \omega} &= B\beta_2 \omega^{\beta_2-1} > 0 \\ \frac{\partial^2 L(\omega)}{\partial \omega^2} &= B(\beta_2 - 1)\beta_2 \omega^{\beta_2-2} = 0 \end{aligned} \left. \begin{array}{l} > 0 \\ = 0 \\ < 0 \end{array} \right\} \begin{array}{l} \beta_2 > 1 \\ \beta_2 = 1 \\ \beta_2 < 1 \end{array}$$

In other words, we characterize vulnerability as a decreasing function of income that decreases at an increasing rate. This suggests that the poorer one becomes in terms of income the greater the value of money.

The $L()$ function is always increasing. In other words the model assumes a corruptible population in which higher income leads to a lower value of money and hence with less 'respect' for money, a higher chance of default. This is of course a broad generalization and should not suggest that the wealthy will default as a matter of course but rather that the propensity to default will be higher for the wealthy. The slope of the default curve is determined by the elasticity. If $\beta_2 > 1$, then the function increases at an increasing rate. In the figures we present this is the assumption made. However if $\beta_2 = 1$, the default function is constant indicating that the propensity to default is linearly related to income. Finally if $\beta_2 < 1$, the propensity to default is, on margin, higher for lower-income people than higher income people. Higher-income people will still default more than lower-income people but the increase in the propensity to default gets incrementally smaller as income rises.

The coefficients β_1 and β_2 represent the respective elasticities, or the percentage change in $V()$ or $L()$ with respect to a percentage change in income. In other words if β_1 is 0.5, then a 1 per cent increase in income will reduce the utility value of money by 0.5 per cent and if β_2 is 0.5 then a 1 per cent increase in income will increase the propensity to default by 0.5 per cent.

The welfare maximizing level of income is given by the intersection of the value and loan default curves $V(\omega) = L(\omega)$ or

$$A\omega^{-\beta_1} = B\omega^{\beta_2}. \quad (4)$$

From (4) the level of income that maximizes welfare is given by:

$$\omega^* = \left[\frac{A}{B} \right]^{\frac{1}{\beta_1 + \beta_2}} \quad (5)$$

According to the rule, any loans below ω^* will be made using microcredit while loans above ω^* will be denied and the borrower will be required to seek credit elsewhere.

Comparative statics yield

$$\frac{\partial \omega^*}{\partial \beta_1} = \frac{\partial \omega^*}{\partial \beta_2} = -\frac{\omega^* \ln\left(\frac{A}{B}\right)}{(\beta_1 + \beta_2)^2} < 0. \quad (6)$$

In other words, if the marginal value of money increases, the wealth threshold decreases. Likewise if the marginal propensity to default increases the wealth threshold decreases. The results in (6) hold because the derivatives are anchored by A and B . However, if A changes then:

$$\frac{\partial \omega^*}{\partial A} = \frac{\omega^*}{(\beta_1 + \beta_2)A} > 0 \quad (7)$$

And if B changes:

$$\frac{\partial \omega^*}{\partial B} = -\frac{\omega^*}{(\beta_1 + \beta_2)B} < 0. \quad (8)$$

The welfare maximizing interest rate to be charged on loans is found by substituting (5) into (2).

$$V^* = V(\omega^*) = A \left[\frac{A}{B} \right]^{\frac{-\beta_1}{\beta_1 + \beta_2}} \quad (9)$$

We refer to this rate, at least theoretically, as the Grameen rate because it applies to all loan applicants below ω^*

However, there are a number of variants of this model. The interest rate charged in (9) is not determined by market rates but by the value to the holder so it may well be that $V^* > r$ where r is the commercial loan rate. Suppose further that a government observing the spread between the microcredit rate and the commercial rate decides to impose by fiat a maximum rate on microloans so that $V^* > r^* \geq r$. At r^* ,

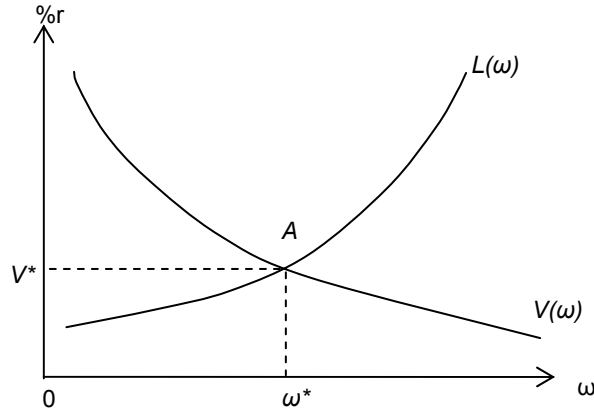
$$\omega(r^*) = \left[\frac{r^*}{A} \right]^{\frac{1}{\beta_1}} > \omega^* \quad (10)$$

So that the threshold for loans widens, more loans are accepted, and loan risks increase. That is

$$L(\omega(r^*)) = B \left[\frac{r^*}{A} \right]^{\frac{\beta_2}{\beta_1}} > L(\omega^*) \quad (11)$$

The basic structure is illustrated in Figure 3 with the borrower's valuation curve $V()$, downward sloping and the lender's loss curve $L()$ increasing. The equilibrium is at ω^* and V^* . To the right of ω^* , $L() > V()$ indicating that losses exceed the willingness to pay. Hence loans to the right of ω^* are denied microcredit loans and forced into the commercial market. Loans to the left of ω^* are considered for microcredit at the rate V^* . In this model V^* applies to all microcredit loans regardless of how poor the borrowers are. The social benefits to the poor are defined by the area above V^* and below the $V()$ schedule, while benefits to the NGO or MFI that provides these loans is measured by the area below V^* and above $L()$.

Figure 3
General model of microcredit market



There are three artifacts of the model that require theoretical foundation. First, the value function $V(\omega)$ is decreasing in ω , Second, $L(\omega)$ is increasing in ω and third an equilibrium at ω^* exists below which microcredit is made and above which microcredit is denied.

For the first proposition we apply expected utility defined over the variables C, D, ω ; $U(C(\omega(D)))$ and applying the quotient rule get

$$\frac{\partial U(\cdot)}{\partial C(\cdot)} \frac{\partial C(\cdot)}{\partial \omega(\cdot)} \frac{\partial \omega(\cdot)}{\partial D(\cdot)} > 0 \rightarrow \frac{\partial V(\cdot)}{\partial \omega(\cdot)} \frac{\partial \omega(\cdot)}{\partial D(\cdot)} < 0. \quad (12)$$

The first part of (12) holds by monotonicity of the utility function whereas the second part emerges from the convexity of utility. Here, $\frac{\partial V(\cdot)}{\partial \omega(\cdot)} < 0$ represents the change in the marginal utility $\frac{\partial U(\cdot)}{\partial C(\cdot)} \frac{\partial C(\cdot)}{\partial \omega(\cdot)} > 0$, and $\frac{\partial \omega(\cdot)}{\partial D(\cdot)} > 0$ by assumption of the leveraging effect of credit.

The second proposition is more difficult. First assume two individuals with different income endowments such that $\omega_i < \omega_j$. We further assume a point of satiation in consumption exists such that the marginal benefit of additional consumption units leveraged by an additional unit of debt is zero, i.e., $\frac{\partial C_k(D^*)}{\partial D} = 0 \rightarrow C_{\max}$. A consumption relation $\frac{\partial C_i(D)}{\partial D} > \frac{\partial C_j(D)}{\partial D}$ states that the marginal increase in consumption of a poor individual will be higher than the marginal increase in consumption of the wealthier individual. By concavity of the consumption function it must be true that $C_j > C_i$ and $C_{\max} - C_j < C_{\max} - C_i$. We introduce the concept of a reneging temptation and define the following function $\Gamma(C_{\max} - C_k)$ and its shape by $\frac{\partial \Gamma(\cdot)}{\partial (C_{\max} - C_k)} < 0$. In other words, the smaller the value of $C_{\max} - C_k$, the greater will be the temptation to default. Thus, when considering the dominating trust-exploit strategy in Table 1 (e.g., $(-D(1+i), C(D))$)

then we can state that because $C_j > C_i$, then the rich agent j will have a greater propensity to exploit than the poorer agent i .

We can take this a step further by assuming that T , the number of periods for which future microloans will be desired decreases as ω increases. In other words $T = T(\omega)$,

$\frac{\partial T}{\partial \omega} \leq 0$ and $\frac{\partial^2 T}{\partial \omega^2} \begin{cases} < 0 \\ = 0 \\ > 0 \end{cases}$ are reasonable properties of the game that suggest not only the

existence of a reneging temptation but also its various forms. In terms of Figure 1, as ω increases, the welfare benefits from microcredit decrease quite rapidly (i.e., $\lim_{\omega \rightarrow \omega^*} V(\omega) - L(\omega) \rightarrow 0$) and $T(\omega) \rightarrow 0$.

Interestingly, if there is no information passed between the microcredit market and the commercial market (beyond ω^*) then most surely the reneging temptation will be high. However if credit reports are passed from the microcredit market to the commercial market then most likely the reneging temptation will be diminished.

Finally, the value function $V(\omega)$ is decreasing in ω , $L(\omega)$ is increasing in ω then an equilibrium at ω^* exists below which microcredit is made and above which microcredit is denied.

5 Preliminary findings assessment of rural credit cooperatives in China

In this section we examine rural credit in China as it relates to efforts by the rural credit cooperatives (RCCs) to provide microcredit to rural farms and households.

RCCs in China are regulated formal financial institutes which provide microcredit to farmers. Basically RCCs classify farmers in their precincts by different credit levels firstly and then according to the credit level to decide upon the sum of loans given to farmers in range 1,000 to 20,000 yuan. Considering sustainability and profitability, RCCs usually prefer to choose as principal clients those farmers who are in the middle class in terms of income. Farmers with lower income have great difficulty in obtaining loans from RCC. Moreover, loans can be used only in producing rather than consuming. More generally, the Chinese central government sets a regulated policy for microcredit lending and the interest rate on RCC loans is considerably lower than the rate offered by MFIs or NGOs and cannot be exceeded. A ceiling limitation on the lending rate legislated is set but RCC rates can fluctuate within a scale under the ceiling limitation.

This is illustrated in Figure 4 which maps the RCC rate schedule onto Figure 1. Note that the RCC discriminates between borrowers, with higher rates charged to the poor. Note also that the RCC rate everywhere is below the MFI rate defined by point A. Several things are suggested by this market. First because the RCC offers a lower rate, it is attractive to borrowers between ω^* and ω_1 . If the RCC views income as a metric, it will prefer these loans and incur losses. In fact, under the model assumptions the RCC will profit only for loans below ω_2 . The policy implications are important. First, by offering low interest microcredit loans the RCC is crowding out microcredit from NGOs or MFIs who, by recognizing risk will charge a higher rate.

A variant of Figure 4 is provided in Figure 5. Here, the upper end of the allowed flexible rates exceeds the equilibrium rate of the MFI/NGO. Here we find incomplete crowding out. The RCC crowds out the MFI to the right of ω_3 . To the left of ω_3 , borrowers would prefer the lower MFI rate suggesting that even in the presence of a central credit policy in China, there is some room for MFIs and NGOs to make microcredit loans.

Unfortunately, this is not what is observed in China. An examination of the history of microcredit suggests a market more closely resembled by Figure 6.

Figure 4
Conceptual model one of rural micro credit market in China

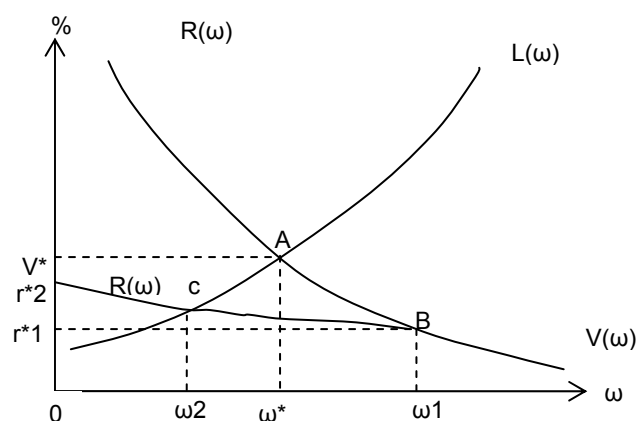


Figure 5
Conceptual model two of rural micro credit market in China

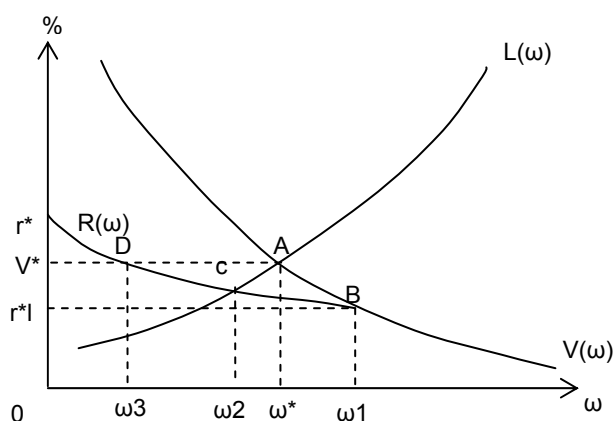
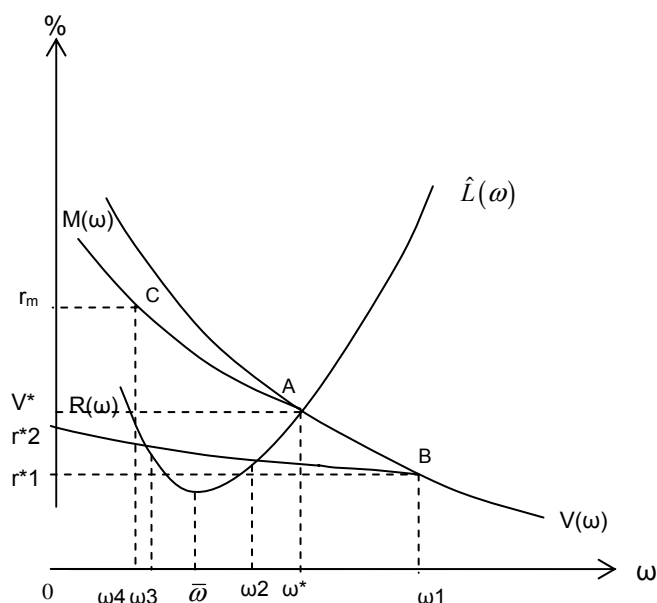


Figure 6
Expanded model of rural microcredit market in China



In Figure 6 the $L(\omega)$ curve bends back at lower income levels. This need not be associated with trust, but simply a consequence of farmers not having the economic wherewithal to repay loans according to a conventional schedule. As a result neither MFIs nor NGOs will lend below ω_4 and the RCC will not provide microcredit below ω_3 . The market for MFI loans is limited only to the range of income between ω_3 and ω_4 . Borrowers below ω_4 are in fact credit rationed.

In the absence of credit below ω_4 , there exists a market for informal lending through moneylenders who are more willing through usurious rates to exploit the willingness of the poor to pay high rates. The moneylender schedule is described in Figure 4 by the curve $M(\omega)$ and rates to the poor will exceed r_m . Money lenders are crowded out of the market by either the RCC or the MFI/NGO at incomes to the right of ω_4 .

6 Rural credit in China

Much has been written in recent years regarding rural credit in China, but no formality has been placed on the results as we have done in this model. In this section we review the current state of rural finance in China to determine how accurately our theoretical model fits the reality of rural credit. First, Grameen-type lending is not foreign to China and has been in place for about 30 years, but its impact and application have been limited. One observation that appears to bear out in fact is that the rural credit market is not in equilibrium. That is, research suggests that the effective money demand of Chinese farmers is not being met by the effective money supply through formal markets. Consequently farmers are highly reliant on informal types of finance.

7 Microcredit and credit rationing in China

Our theoretical model argues that there exists a non-collateral based microcredit market that is separate and distinct from conventional commercial lending. Existence depends on a number of agents. First, in the absence of microcredit the poor are excluded from credit markets except through family, friends and moneylenders. Here, moneylenders refer to agents of usury. In our model we distinguish between a separate entity called a micro finance institution or NGO and a conventional lender such as the RCC. It was argued that the micro loans can and should be offered at a higher rate to compensate the lender for high transaction costs and credit risk. We argued that the existence of a commercial institution subject to central party policy such as the RCC can crowd out MFIs and NGOs from offering microcredit.

Microfinance in China is relatively new. It was not until 2003 that the Chinese government encouraged the use of foreign and private capital to establish MFIs to provide capital to agriculture. The People's Bank of China started to pilot credit-only MFIs in May 2005 (He 2006a). Interest rates charged on MFI loans were unregulated and ranged from 9.396 per cent to 23.4 per cent for one MFI and 15.66 per cent-22.3 per cent (with an average of 20.05 per cent) for another. In comparison informal credit ranged from 3.5 per cent to 21.6 per cent with a weighted average of 10.53 per cent, while interest rates on RCC loans ranged from 8 per cent-12 per cent. It is likely that in He's (2006a) case study, the informal rate was between friends and family, for he observes that the effective rate for pawnshops averaged 42 per cent with a high of 60 per cent.

In He's case study 60.8 per cent of loans were unsecured. The MFI was also involved in Grameen-style group lending which as discussed earlier could lead to reduced risk, but nonetheless the bulk of the activity was involved in the noncollateral market. Furthermore, as suggested by the model, there is a built-in incentive that as long as the loan is repaid, the borrower will have the opportunity to further borrow higher amounts. The majority of MFI unsecured loans are small and are offered at the higher interest rates. However in the period between He's case, MFI's initiation in April 2006 and August 2006, 100 per cent of 183 loans made were current.

He (2006b) also conducts a study of farm household microlending of RCCs. The role of RCCs is fast increasing in rural China and these are the primary suppliers of microcredit to farm households. As of 2002, 92.64 per cent of RCCs across China provided microcredit facilities and 49.98 per cent developed group lending activities. The microlending facility is based upon the creditworthiness of the borrower but the micro loans are made without mortgage or security. The system of credit rating is based upon past credit history and trust. The credit history is based first on the concept of a credit village or a credit township. These are referred to as financial safety zones where each village is rated on any recorded history of payment and default (above 80 per cent of households in village), public order and control of usury. The trust element is based upon a village or county review panel called the village credit committee (VCC). Once credit worthiness is established, the borrower is provided a letter of credit which states the credit worthiness and the allowable credit limit. This letter is tender at any RCC. The VCC provides input (screens) into individuals' credit worthiness and works to ensure that the loans are used for intended purposes, that borrower households follow best management practices, and encourages repayment of loans. The VCC is an integral part of the system, for it is based on the judgment of the VCC whether any individual

receives a loan. Since collateral and security are not at issue with RCC microloans, the VCC individual recommendation is largely based on trust. Furthermore, while not explicitly mimicking the role of group lending, the VCC screening and monitoring activities provide the requisite social encouragement to repay loans in a timely fashion.

He's (2006b) commentary is in agreement with the specific utility-trust argument developed above. In particular the VCC activities promote social responsibility in lending while the incentives for further borrowings encourage repayment. Indeed, He shows that for Hongze and Laozishan counties in Jiangsu Province that the RCC microcredit model is working reasonably well with non-performing loans falling from 24.6 per cent and 17.2 per cent in 2001 to 3.4 per cent and 2.9 per cent in 2006. Interestingly, prior to initiating microcredit loans in 2001, around 50 per cent of RCCs incurred operating losses from loan portfolios. Since 2001 the losses fell considerably as microlending increased. For example, prior to 2001 lending to the poor on an unsecured basis was virtually nonexistent among RCCs. By 2006 unsecured loans exceeded 90 per cent in He's study area, operating profits increased from 1.4 per cent to 37.4 per cent of business income, and the cost ratio fell from 96.2 per cent to 59.4 per cent. In terms of this paper's thesis it is suggested that lending to the poor on an unsecured basis will result in lower costs of default and higher profit margins. This seems to be consistent with He's (2006b) findings. The results by He are by no means universal and, as he suggests, not all RCCs are profitable or efficient. Huang and Wen (2006) report on RCCs in Xinyu City that reveal substantial microcredit losses with default rates increasing from 2.3 per cent in 2001 to 16.4 per cent in 2005.

8 Credit rationing

Although microcredit through RCCs has increased substantially between 2001 and 2006, and overall loan performance and profitability have improved, there is still substantial evidence of credit rationing the poor. In a study of farm household demand for credit in Tongren/Guizhou provinces, He and Li (2005) find that 84 per cent of surveyed households (N=720) indicated that they needed loans. The demand increased inversely with income, with 87.8 per cent of poor households, 83.9 per cent of middle-income households and 77.1 per cent of high-income ones demanding credit. Approximately one-third of households (34.5 per cent) had never received a formal loan. Of this group 22 per cent of high income, 31.2 per cent of middle income and 47.5 per cent of lower income had not received loans. In other words nearly 50 per cent of the poorer farm households appear to be credit constrained. It is unclear however if the credit constrained are linked with home economics, for He and Li provide evidence for RCCs that seems to indicate a bias in awarding loans to cooperative members over non-cooperative members. Nonetheless, He and Li provide evidence that not only are large numbers of farm households excluded from formal credit markets entirely but of those that received loans, nearly 59 per cent state that the loan award was insufficient to meet their total credit needs. It is unclear whether this is a result of biased lending by the RCCs or just prudent lending behaviour for unsecured credit. The credit constraints imposed by formal lenders are most likely prudential in that only 47 per cent of total credit needs were for agricultural or other productive uses while 53 per cent was for private use such as tuition, medical, weddings and funerals, etc.

The role of guarantees is critical to the model. In the model it is argued that utility and trust are sufficient to encourage repayment of loans and that collateral may not be important when lending to the poor. Only 8.3 per cent of He and Li's respondents required a mortgage on property leaving 91.7 per cent without collateral. Of this group nearly all (95 per cent) provided no guarantee at all. About 27 per cent of all loans (RCC, family and friends, moneylenders) from respondents were not repaid at maturity. The major reason was that the farm households simply did not have the cash on hand at the time the loan was due. But such results are masked. That a loan was not repaid at maturity does not mean that it was not repaid at all. For example 19.6 per cent of RCC loans were not repaid at maturity, yet the default rate on RCC loans in 2006 was only about 3 per cent. In other words because of the sequencing, timing and risk of cash flow in farm households, the inflexibility of terms may be more of contributing factor than unwillingness to repay.

The theoretical proposition holds that the marginal utility of money for the poor is higher than for the rich and as a consequence, in a repeated game of borrowing the poor will be more creditworthy than the rich. This proposition has not been empirically examined but Shan Liang (2003) argues that RCC lending activities on microcredit is actually less risky than commercial lending because RCCs impose more restrictive covenants on farmer borrowing than non-farm borrowing. Importantly Liang makes the argument that the RCCs are very much aware of the high utility value of money and the need for repeated, cyclical borrowing by farmers. Thus the long-term sustainability of trade is sufficient reason for farmers to accept whatever restrictions the RCCs impose including prompt repayment. According to a survey in Gaozhou city, Guangzhou province, farm households were sorted by credit class into four groups, namely excellent, good, normal and bad. Certificates were delivered to all groups except the bad group, with maximum credit of 8,000 yuan to the excellent group, 5,000 yuan to the good group, and 1,000-3,000 yuan to the normal group and found that credit risk is very low generally, with no evidence of differences between the groups. An investigation by Gaozhou RCC in August 2002 showed that over 31 per cent of borrowers out of 61,929 farmer households repaid loans initially and more than 22 per cent of borrowers returned loans ahead of the due date This suggests that about 47 per cent of borrowers from across the various classes did not repay the loans on schedule, but by the end of 2002, the rate of repayment of micro credit loans in all RCCs in Gaozhou city was as high as 94.5 per cent, the rate of default was only 5.5 per cent but it did not indicate those defaulted loans could not repaid in the future.

Huang and Wen (2006) argue that much of this is due to inefficiencies of the RCCs themselves, including collections. They do not seem to insinuate any dishonesty on the part of borrowers. Huang and Wen provide an interesting anecdote about borrower behaviour and RCC risk rating. They report a situation in which 40.2 per cent of total farmer households (79,687) in Xinyu city received credit certificates while only 9.44 per cent of households were actually worthy of receiving the certificates. An error in lending, perhaps due to insufficient monitoring was no doubt made, but 20 per cent-30 per cent of farmer households repaid loans and interests initially, and about 45 per cent of farmer households returned principals and interests on time. About 15 per cent of households altered original borrowing utilizations (restructured the loans), while only 5 per cent of households cheated RCCs and defaulted on purpose. While Huang and Wen were using this story to illustrate inefficiencies in RCC management, it can also be used to illustrate how Type II error (refusing a loan when the borrower is a good credit risk, see Turvey 1991) can be made. In this case, thousands of farm households were

provided loans when according to the risk rating they should not have. Yet, despite the negative credit rating, the vast majority ultimately repaid the loan.

9 Informal lending in China

The absence of credit according to our proposition is that (i) central policies affecting RCC lending policies crowd out MFIs through low rate lending policies; and (ii) even with limited access to MFI or NGO credit, these organizations are cognizant of agrarian price and yield risks and in the absence of collateral do not lend to the very or ultra poor as a matter of course.

The extent of informal lending in China cannot so easily be measured since many transactions are between friends or relatives rather than through moneylenders. Guo and He (2006) would agree with this assessment, stating that the absence of adequate formal finance would lead to an increase in informal finance. The two are imperfect substitutes, but the inadequacy of supply in the former no doubt gives rise to the latter out of necessity. As Guo and He state (2006: 3), ‘the shackle of rural economic development is the scarcity of capital’. Informal financing includes free credit (amongst friends), illegal private banks (moneylenders), rotating savings and credit associations, pawn-broking, private pooling of funds, private discount, and others. In fact the prevalence of informal finance is not in dispute. Guo and He cite a number of studies indicating that informal finance for farm households in some provinces ranges from 24 per cent to 95 per cent of loans outstanding and that in some districts the percentage of informal borrowing is around 70 per cent of farm households’ total debt. Guo and He’s calculations suggest that the monetary intensity of informal lending to farmers ranges between 1.89 and 2.6 times formal lending which is about the same for self-employed labour or privately run enterprises in rural areas. These proportions were higher, in aggregate, than for all loans in China including those in urban areas. Indeed, so prevalent is informal credit in China that Guo and He call for its legitimization and recommend that formal credit to rural areas should recognize the realities of agriculture.

China has designated 592 state-level poverty counties which receive loans at approximately 2.88 per cent in comparison to RCC rates of 5.31 per cent plus (40-50 per cent). Survey data, however, indicate that informal lending involves average rates in excess of 45 per cent. The repayment rates on informal lending is not known, however Guo and He (2006) find that poverty loans issued by the Agricultural Bank of China have a repayment rate of only 30 per cent.

He and Li (2005) provide survey data on informal credit in Tongren/Guizhou provinces. Noting that the break point between ‘legal’ and usury interest rates is 40 per cent, only 19.33 per cent of borrowers from informal lenders knew of rates that were below 40 per cent while 80.67 per cent knew rates to be above 40 per cent and 23.1 per cent knew of usury rates above 100 per cent. These seem to be extreme rates and are perhaps linked to local economies. In fact only 13.5 per cent of farm households actually used informal lending at usury rates above 40 per cent but across the various counties in He and Li’s study the variance was high ranging from 1.67 per cent of farm households to 34.17 per cent of farm households. The main reason for accepting loans at usury rates was because no alternative formal finance was available or awarded at the amounts required.

Informal lending of family and friends is far more important than through moneylenders. While nearly 55 per cent of respondents obtained one or more loans from the RCC, nearly 41 per cent obtained non-usurious loans from family and friends. All told, only 5 per cent of loans taken by He and Li's respondents had rates in excess of 22.3 per cent which indicates that for the most part moneylenders have been crowded-out by RCC lending practices and rates and the use of benevolent friends and relatives. The transition in credit use before and after microcredit reform in 2001 has also been noted by Huo and Qu (2005) who conduct a longitudinal survey of farmers between 2000 and 2004. They find that in 2000 only 31 per cent of households in their sample (N=102) held commercial debt but 61.2 per cent held debt by 2003. They also confirm some other findings regarding borrowing activity, namely that borrowing from the Agricultural Bank is minimal (1.29 per cent), rural credit cooperatives moderate (17.2 per cent) while non-usurious informal loans between individuals account for 76.6 per cent of all loans. In fact they find that of informal loans 92.3 per cent required no interest at all with the remaining loans ranging from 39.13 per cent to 60.87 per cent. Interestingly the authors are quite explicit in acknowledging that amongst this group of surveyed households disputes among friends is virtually non-existent and money lending is too rare to have social consequence. These results seem to suggest, at least through 2003, that there exists an excess demand for credit that is satisfied by neither the commercial lenders nor the RCCs. In this community, informal lending between friends and family is very common, and this level of activity crowds-out the moneylenders. It is not entirely clear, however, whether the borrowing from friends at no or little interest is the cultural norm or whether it is a consequence of credit rationing. If it is a cultural norm, then our model may be missing a critical element in that the curve for informal lending which we have rising above the $V(\cdot)$ curves for the RCC, actually lies below it. In this case it is cultural lending that crowds-out RCC and other commercial lending activity. In actuality it appears that informal loans result from an inadequate supply of capital for agricultural and rural investment use. Furthermore it may not be so much that the farmers are credit constrained in the usual sense of constraining credit according to a credit score or evaluation, but that many of the RCCs in the study area are inefficient and the loan repayment is poor. The authors find that in 25 counties in the north area of Wei River, 65.48 per cent of the county-level credit cooperatives have non-performing loans, exceeding 45.50 per cent of the loan portfolio and a large proportion of the credit cooperatives were already insolvent (in 2003, recall the recovery of the RCCs by 2006 discussed above). Similar results have also been reported by Lei and Li (2006) from a survey in Taian city, Shandong province that showed that 107 out of 135 farm households obtained money from informal channels such as borrowing from relatives, friends and moneylenders, while only 47 farm households received loans from the RCC. Based on a survey of 140 farmer households in Xinyu City, 82.6 per cent used informal lending most of which occurred between relatives with no interest or lower interest (Huang and Wen 2006).

10 Conclusions and further work

He (2003) suggests that the rural banking system is irrational from a number of points of view. One of the more obvious functional deficiencies is the reliance on western-style credit rating and intermediary accounting when the majority of borrowers have no property-rights over collective lands. Such a system does not work and, in the context of this paper, it is divisive, separating the credit markets between one that is

collateral-based and receiving the bulk of formal financing and one that is noncollateral based on trust, usury or both. He calls for a more diversified system of credit that is less reliant on state-owned enterprises and inclusive of specialized institutions that meet the vagaries of the agricultural economy. It is unclear whether reports by the Agricultural Development Bank of China that only 30 per cent of poverty alleviation loans are repaid is due to abuse or inability. If it is inability, then all that needs to be done is to re-engineer repayment terms to meet the temporal needs of borrowers. However, trust may also come in to play. Recall the proposition that the rural poor will have higher repayment rates because they place such a high utility on the money borrowed, that to willingly default on such a loan and give-up the option to borrow more money in the future is unlikely. That is, if a loan is provided at 2.88 per cent when the next best alternative is 36 per cent or 45 per cent, it is highly unlikely that default would take place as a matter of course unless there was no recourse. In other words farmers might very well be willing to default if by doing so it did not affect future borrowing, or a renewal of the low-interest poverty alleviation loan was not possible regardless of whether the borrower repaid or not. For a trust-based economy to work, recourse must be real.

Our approach is pedagogical but the model provides an economic structure to microcredit that is fundamentally different from the collateral-based models of lending. For example (2) and (3) illustrate how the Grameen Bank operates its microloans in Bangladesh. In other jurisdictions such as in China, the central policy is to offer low interest rate microcredit to farmers. These rates are below the MFI rate. The consequence is that the Rural Credit Cooperatives that administer the loans accept some loans that would otherwise be untrustworthy and hence the default rate amongst many credit cooperatives in China is high (lower trust loans). In addition, the central rate is below the MFI rate so the number of NGOs or MFIs in China is lower than in other countries. China's cooperative banking system has not fully endorsed either the self-help group model or the notion of trust as a form of capital. Thus in China, the very poor are credit-constrained from the microcredit market. In India, MFIs such as BASIX have made headway into microcredit and other forms of finance. However, commercial banks are also involved in microcredit and both are largely promoted by rural development NGOs. Unlike China, the microcredit lenders in India, largely through the use of self-help groups, lend fundamentally on trust and are focused largely on the poor in rural areas. One variant of the model explains how an MFI can co-exist with subsidized credit from government banks. Here, the MFI does not microlend to the very poor. This created a void which was filled by government bank lending. The model also shows how the emergence of microcredit has affected informal lending and usury rates from moneylenders.

We believe that a credit framework based on trust rather than assets can be used to explain, from an economic point of view, much of what is observed in microcredit lending in agriculture. The pedagogy of the model should be of broad interest to development economists studying microcredit and agricultural finance scholars studying alternative lending models.

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