14.771: How well do credit markets work and why?

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The neo-classical model of the capital market

- Everyone faces the same interest rate, adjusted for risk. i.e. if there is a $d\%$ risk of default then $(1-d)r$ (where r is the gross interest rate) is a constant.
- The interest rate paid to depositors is equal to $(1-d)r$ less some small change for the cost of operating a bank.
- The expected marginal product of capital should be equated to $(1-d)r$.
  - For all firms
- What are the facts?

Fact 1: Big gap between borrowing and lending rates

- Ghatak (1976) reports data on interest rates paid by cultivators in India from the *All India Rural Credit Survey* for the 1951-2 to 1961-2 period
- The average rate varies between a maximum of 18% (in 1959-60) and a minimum of about 15% (in 1961-62).
- In comparison, Ghatak reports that the bond rate in this period was around 3% and the bank deposit rate was probably about the same.
- In another study, Aleem (1990) of professional moneylenders in a semi-urban setting in Pakistan in 1980-1981.
  - The average interest rate charged by these lenders is 78.5%. The opportunity cost of capital to these money-lenders was 32.5%.

Fact 2: Extreme variability within the same sub-economy:

- Aleem (1990) reports that the standard deviation of the interest rate was 38.14% (mean 78.5%).
- Ghate (1992) reports on a number of case studies from all over Asia:
  - In Thailand nterest rates were 2-3% per month in the Central Plain but 5-7% in the north and north-east.
- Gill and Singh (1997) : a survey of 6 Punjab villages
  - The mean rate for loans up to Rs 10,000 is 35.81% for landowning households but 80.57% for landless laborers.
- Fafchamps' (2000) study of informal trade credit in Kenya and Zimbabwe reports an average monthly interest rate of 2.5% while the blacks pay 5% per month in both places.
  - This is the rate for the dominant trading group (Indians in Kenya, whites in Zimbabwe) is 2.5% month while the blacks pay 5% per month in both places.

Fact 3: Low levels of default

- The "Summary Report on Informal Credit Markets in India" attempts to decompose the observed interest rates into their various components
  - Finds that the default costs explain
  - 14 per cent (not 14 percentage points!) of the total interest costs for the Shroffs, a
  - round 7% for auto-financiers in Namakkal and handloom financiers in Bangalore and Karur,
  - 4% for Finance Companies,
  - 3% for hire-purchase companies
  - Essentially nothing for the Nidhis.
- The same study reports that in four case studies of money-lenders in rural India they found default rates explained about 23% of the observed interest rate.
- Aleem gives default rates for each individual lender.
  - The median default rate is between 1.5 and 2% and the maximum of 10%.

Fact 4: Ex ante competition

- Large numbers of lenders in any sub-market
- Aleem (1989) shows that lenders do not earn excess profits on average
- The "Summary Report on Informal Credit Markets in India" (Dasgupta, 1989) claims that only a small part of the interest rate is explained by profits.
- Ghate (1992) echoes the same conclusion.

Fact 5: Credit is for production and trade finance

- Ghatak (1976) concludes on the basis of his study that "the existing belief about the unproductive use of loans by Indian cultivators ... has not been substantiated."
- SRICMI reports that:
  - hire-purchase financiers (interest rates between 28%-41%), handloom financiers (44%-68%), Shroffs (18%-21%) and Finance Corporations (24%-48% for longer term loans and more than 48% on loans of less than a year) focus almost exclusively on financing trade and industry

Fact 6: Lenders favor the rich

- Ghatak (1976) correlates asset category with borrowing/debt in the *All India Rural Credit Survey* data and finds a strong positive relationship.
- SRICMI:
  - Landless laborers paid much higher rates (ranging from 28-125%) than cultivators (who paid between 21 and 40%).
  - The average interest rate declines with loan size (from a maximum of 44% to a minimum of 24%).
  - The second poorest group (those with assets in the range Rs 5,000-10,000) pays the highest average rate (120%) and the richest (those with more than Rs 100,000) pay the lowest rate (24%).
- Gill and Singh (1997) show:
  - Richer people get bigger loans at cheaper rates
  - Bigger loans have lower interest rate after controlling wealth of borrower

QUESTIONS

A simple model of the credit market

- Loan repayment is imperfectly enforceable.
- Suppose k dollars invested yields a gross return $F(k)$ and that the gross interest rate is r. A borrower who has a wealth of w and invests k will need to borrow $k - w$. He is supposed to repay $(k - w)r$ at the end of the period.
- But by expending some resources, which we assume to be proportional to the size of the investment, he can avoid repayment altogether. We denote the constant of proportionality by η and assume that it is less than the cost of capital, ρ.

Credit limits

- Lenders will only provide finance up to the point where the borrower has the incentive to repay: this requires $F(k) - r(k-w) \geq F(k) - \eta k$ which gives us:

$$\frac{k}{w} = \frac{r}{r-\eta} \equiv \lambda(r, \eta).$$

- Firms are credit rationed. They cannot borrow as much as they want.
- The amount you can borrow is increasing in your wealth and your η but decreasing in the interest rate.
- The interest rate is equal to the cost of capital. It obviously does not vary across borrowers.
- This is a handy model but does not fit the facts.

Extending the model: 1

- It is natural to assume that the lender needs to spend resources in order to make the borrower want to repay. In other words, $\eta = 0$ unless the lender spends some resources.
- First let monitoring cost be linear in the amount borrowed: $\phi(k - w)$.
- In this case

$$\begin{aligned} r(k-w) &= \rho(k-w) + \phi(k-w) \\ r &= \rho + \phi \end{aligned}$$

- r will only vary to the extent that ϕ or ρ varies.

Extending the model

- Let the monitoring cost be a fixed cost ϕ
- Then the lender's zero profit condition is

$$r(k-w) = \rho(k-w) + \phi$$

- In the model without default, the borrower's IC constraint is now given by

$$r(k-w) = \eta k$$

which together give us

$$\rho(k-w) + \phi = \eta k$$

- We can rewrite this in the form $k = \frac{\rho w - \phi}{\rho - \eta}$. What if $\rho w < \phi$?Is this necessarily more than w?
- This implies that

$$r = \rho + \frac{\phi(\rho - \eta)}{\eta w - \phi}$$

- Multiplier property.

Implications of the model

- Can explain a large wedge between the cost of capital and the interest rate and by implication a very high monitoring cost.
- The interest rate can be very sensitive to the cost of capital and the monitoring cost, if 1-ϕ is small
- The interest rate will be especially sensitive where the interest rate is high relative to the cost of capital
- However we do not explain equilibrium default.

QUESTIONS

Understanding the mechanisms behind credit constraints

- It is no longer controversial that credit markets are imperfect.
- The question is to understand the exact technology of lending, since policy implications depend on our understanding of this technology.
- The usual explanation is based on borrower misbehavior
  - Ex post moral hazard (as in our model)
  - Ex ante moral hazard
  - Adverse Selection

Testing causal channels: Moral hazard and adverse selection (Karlan-Zinman)

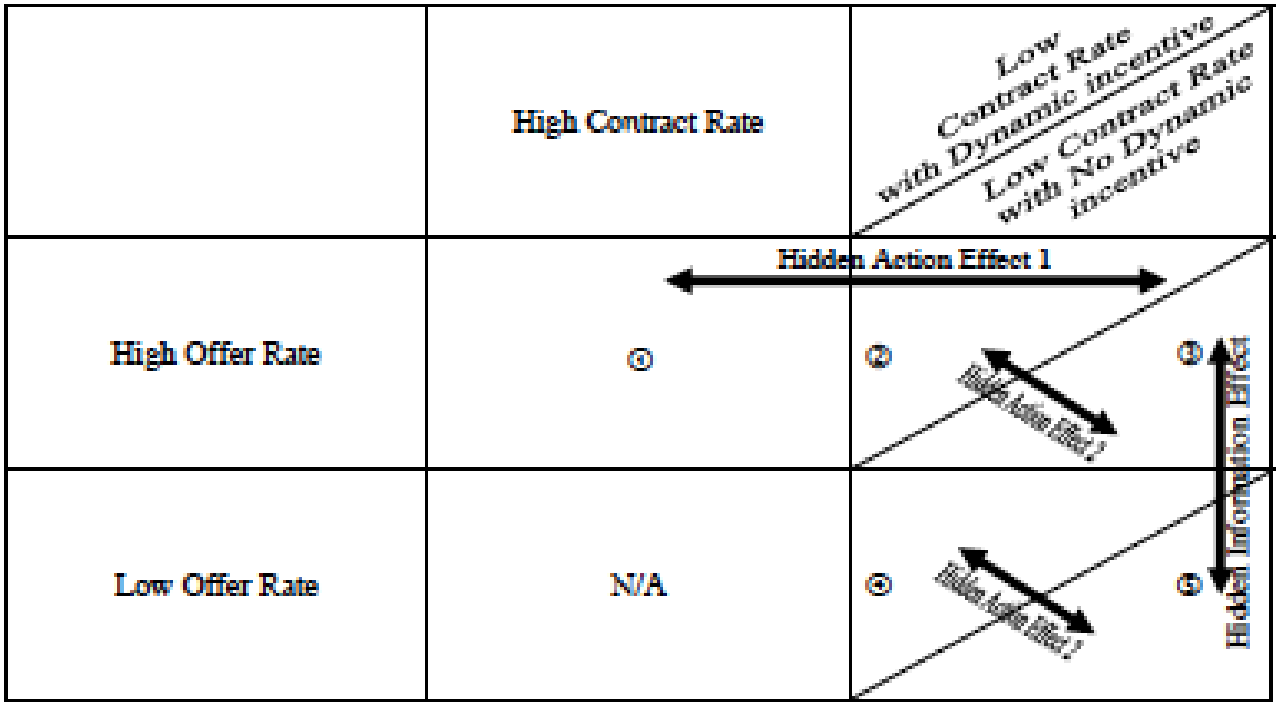
- Experimental approach to identifying distortions in the credit market:
- 58000 thousand "good" clients of a South African bank: invited by mail to get a new loan.

The question

- Three interest rate effects:
- Adverse selection
- Repayment burden
- Moral hazard
- A design to separate them (Fig 1)
- Different offer rates
- Different contract rates
- Different length of potential contract
- Size of experimental variation

Design

FIGURE I: Some basic intuition for our identification strategy.



Results

TABLE I

EMPIRICAL TESTS OF HIDDEN INFORMATION AND HIDDEN ACTION: FULL SAMPLE

	OLS							
Dependent Variable:	*Monthly Average Proportion Past Due*		*Proportion of Months in Arrears*		*Account in Collection Status*		*Standardized Index of Three Default Measures*	
Mean of Dependent Variable:	0.09	0.09	0.22	0.22	0.12	0.12	0	0
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Contract rate (Hidden Action Effect 1)	0.005	0.002	0.006*	0.002	0.001	−0.001	0.014	0.004
	(0.003)	(0.004)	(0.003)	(0.004)	(0.005)	(0.005)	(0.011)	(0.013)
Dynamic repayment incentive dummy (Hidden Action Effect 2)	−0.019*	−0.000	−0.028**	0.004	−0.025**	−0.004	−0.080**	−0.000
	(0.010)	(0.017)	(0.011)	(0.021)	(0.012)	(0.020)	(0.032)	(0.057)
Dynamic repayment incentive size		−0.005		−0.009**		−0.006		−0.023*
		(0.004)		(0.004)		(0.005)		(0.013)
Offer rate (Hidden Information Effect)	0.005	0.004	0.002	0.002	0.007	0.007	0.015	0.015
	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)	(0.011)	(0.012)
Observations	4348	4348	4348	4348	4348	4348	4348	4348
Adjusted *R*-squared	0.08	0.08	0.14	0.15	0.06	0.06	0.10	0.11
Probability(both dynamic incentive variables = 0)		0.06		0.00		0.06		0.01
Probability(all 3 or 4 interest rate variables = 0)	0.0004	0.0005	0.0003	0.0012	0.0006	0.0016	0.0000	0.0001

Interpretations

- No significant adverse selection (but there for women)
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- Conservative choice of the original lending amount?
  - Why is the future interest rate effect stronger?
- Not very strong support for adverse selection at all. Some support for moral hazard.

QUESTIONS

What else could it be: The Banking Channel for Credit Constraints

- While small lenders lend their own money, larger lenders (call them banks) take money from depositors and relend them.
- This creates incentive problems, especially since the depositors want full safety (this is also why banks have very low cost of capital)
- Banks are therefore heavily regulated and penalized for defaults on their lending by the regulator
- However banks do not directly control their lending and collecting which is done by "loan officers" whose incentives are not always aligned with the banks
- And some of them are corrupt and would love to lend to their friends and family and allow them to default
- Loan officers often have to decide on amounts that are many times their salaries

Implications of this view

- Loan officers will tend to be very risk averse–they are exposed to the down side
- "Lazy banking"
  - Follow the rules very carefully (not use soft information)
  - Avoid lending to new people/new projects
  - Avoid taking decisions (by relying on the decisions made previous loan officers)
- However when a loan goes bad they may want to pretend that it did not happen by giving the firm a bigger loan to pay back the previous one
  - At least postpones the problem of reporting a default and with some luck, it may go away or become someone else's problem
  - Corruption makes it even more tempting
  - "Evergreening"
  - Misallocation of capital (defaulters tend to be worse than average investors).

Evidence of lazy banking

- Data from a single bank about lending decisions
- Very rigid
- Seemingly uncorrelated with anything

Table 2: Characteristics of Loans

	1997	1998	1999	2000	2001
	(1)	(2)	(3)	(4)	(5)
proportions of cases in which					
Granted limit remained the same	0.66	0.64	0.65	0.76	0.73
Limit was attained by the borrower	0.81	0.67	0.77	0.76	0.68
Granted limit from banking system remained the same	0.66	0.63	0.63	0.76	0.73
Maximum authorized limit has increased	0.63	0.74	0.73	0.58	0.77
Predicted sales have increased	0.72	0.67	0.73	0.71	0.70
Granted limit <maximum authorized limit	0.60	0.63	0.60	0.50	0.47
Granted limit <0.20*predicted sales	0.85	0.85	0.79	0.82	0.82
Means:					
Ratio granted limit/maximum authorized	0.88	0.81	0.90	0.83	0.99
	(.061)	(.05)	(.054)	(.056)	(.126)
Ratio granted limit/(0.20*predicted sales)	0.62	0.63	0.68	0.63	0.68
	(.041)	(.037)	(.034)	(.055)	(.064)
number of loans	175	217	213	175	163

Note:

1.Each column present the data on the limit approved in a given year (to be used in the following year).

2.Limits from other banks were not collected in year 2002.

Table 3: Changes in working capital limits, by firm characteristics

	Proportion	Propoportion of cases where limit was increased	Propoportion of cases where limit was not changed	Mean of: log(current limit) -log(past limit)	Proportion of cases where limit was changed: Client<=5 years	Proportion of cases where limit was changed: Client>5 years
	(1)	(2)	(3)	(4)	(5)	(6)
A- HAS PAST UTILIZATION REACHED MAXIMUM ?						
Yes	0.72	0.34	0.60	0.16	0.55	0.67
No	0.28	0.30	0.66	0.12	0.61	0.71
Difference		0.05	-0.05	0.03	-0.05	-0.04
		(.054)	(.056)	(.04)	(.081)	(.072)
B-HAVE PROJECTED SALES INCREASED?						
Yes	0.71	0.43	0.52	0.19	0.54	0.54
No	0.29	0.25	0.61	0.06	0.50	0.67
Difference		0.18	-0.09	0.13	0.04	-0.13
		(.076)	(.079)	(.053)	(.114)	(.101)
C-HAVE ACTUAL SALES INCREASED?						
Yes	0.71	0.33	0.62	0.13	0.61	0.68
No	0.29	0.25	0.69	0.12	0.70	0.72
Difference		0.08	-0.06	0.02	-0.09	-0.04
		(.041)	(.043)	(.029)	(.059)	(.05)
D-HAS PROFIT OVER SALE INCREASED?						
Yes	0.56	0.29	0.67	0.11	0.64	0.69
No	0.44	0.35	0.61	0.16	0.61	0.69
Difference		-0.05	0.06	-0.05	0.03	0.00
		(.042)	(.044)	(.028)	(.059)	(.053)
E- HAS CURRENT RATIO INCREASED?						
Yes	0.53	0.32	0.62	0.12	0.61	0.70
No	0.47	0.29	0.67	0.14	0.67	0.68
Difference		0.03	-0.05	-0.02	-0.06	0.02
		(.038)	(.04)	(.027)	(.052)	(.049)

Direct evidence for agency problems in banks (from Hertzberg, Liberti and Paravasini, 2007)

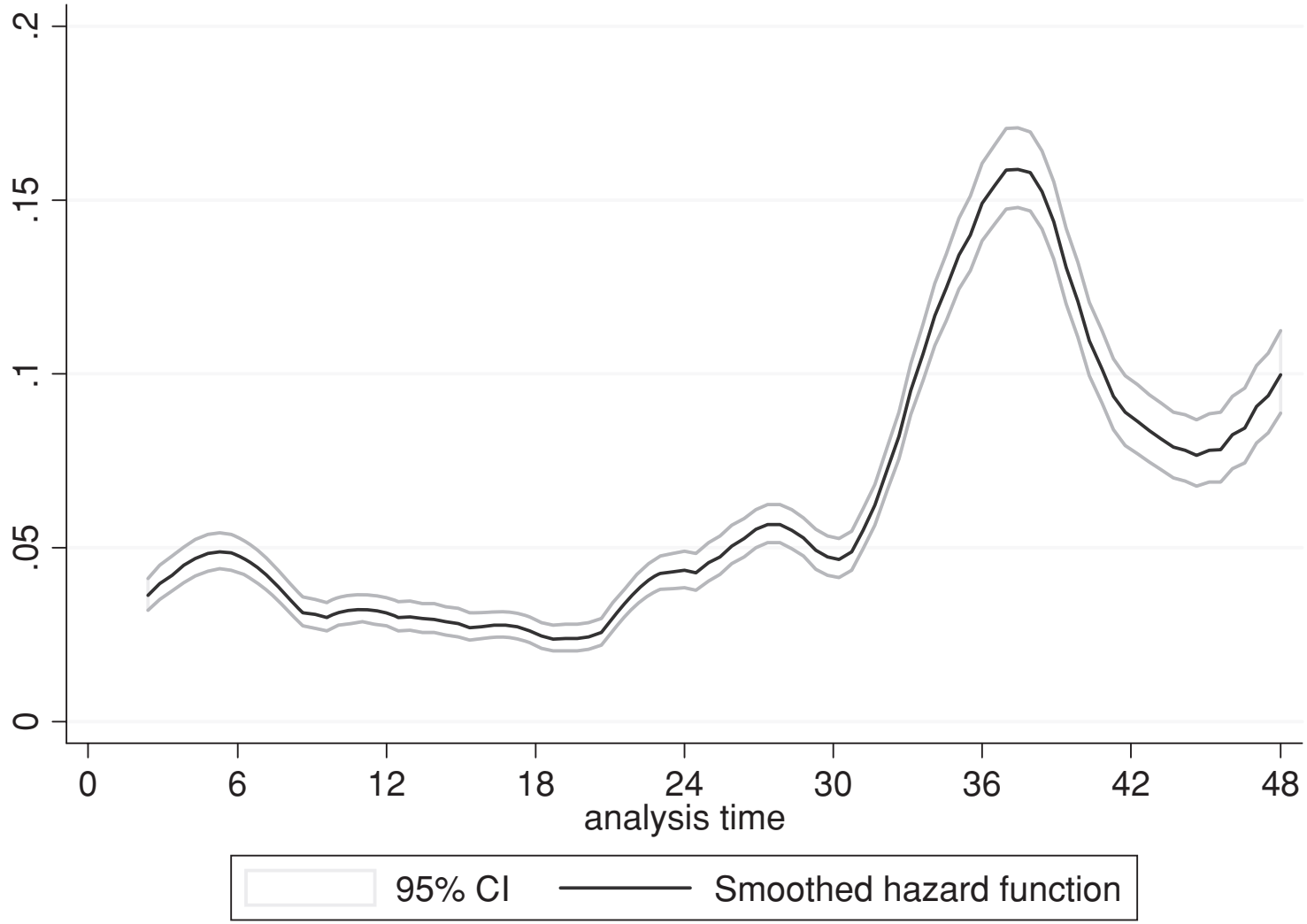
- Think of a loan that was bailed out (or given a bigger loan that was not warranted)
- Which is then scheduled to be but transferred to another loan officer
- Also assume that in order to justify to get that big loan the firm must be rated highly.
- So the undeserving firms need to be rated highly when they get that loan

However

- The loan officer who takes over observes the history of what happened and can infer the borrower's likely type.
- He has no reason to give a big loan to those undeserving firms. He will want to cut the loan that they are getting
- He will surely down-grade them in terms of their rating.
- Anticipating this discrepancy, the first loan officer will start down-grading them from before he has to hand it over
- And the ratings given at that time will be much better at predicting borrower performance than they were when the loan was given
- This is the prediction they test using Argentine bank data
- In this bank loans are supposed to get transferred every 3 years.
- They find that ratings crash at the end of that period and their predictive power rises.

Figures

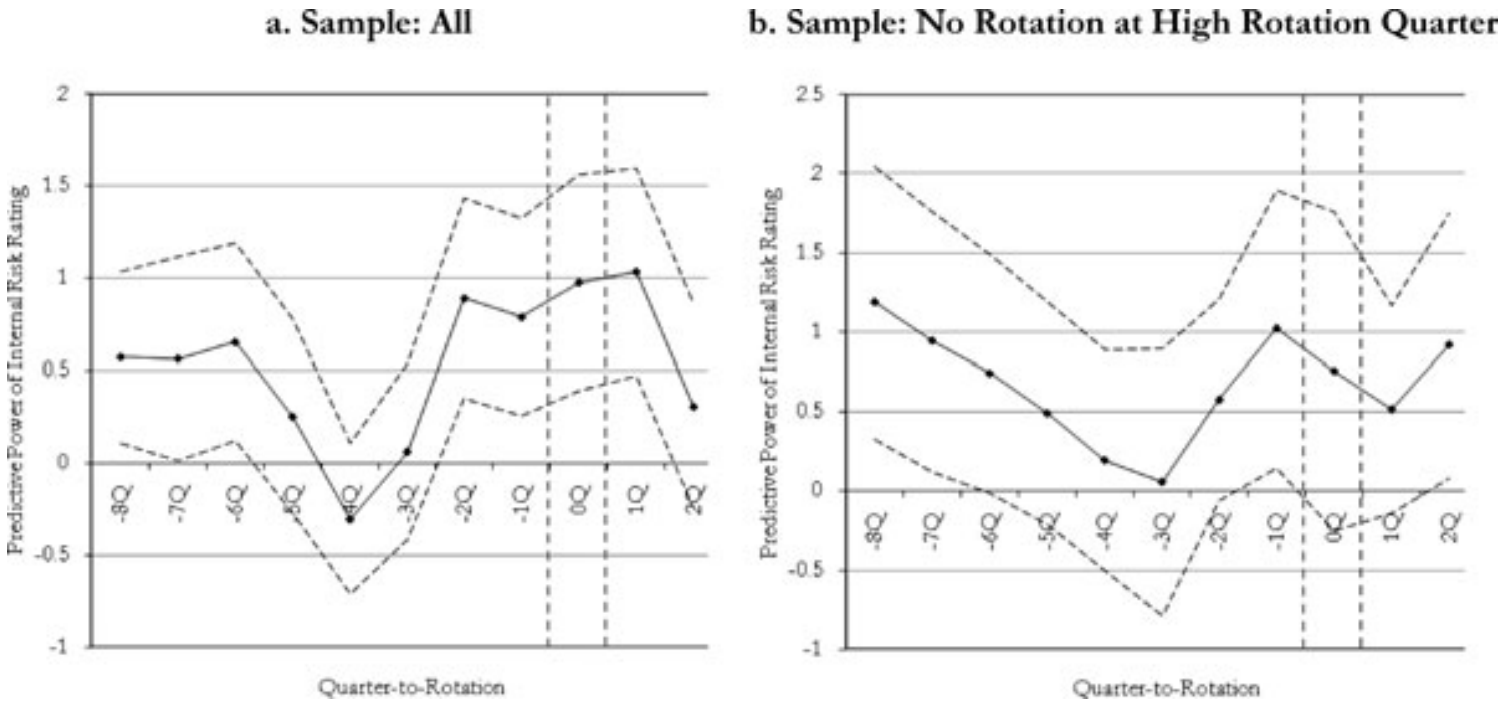
Loan officer rotation



Figures

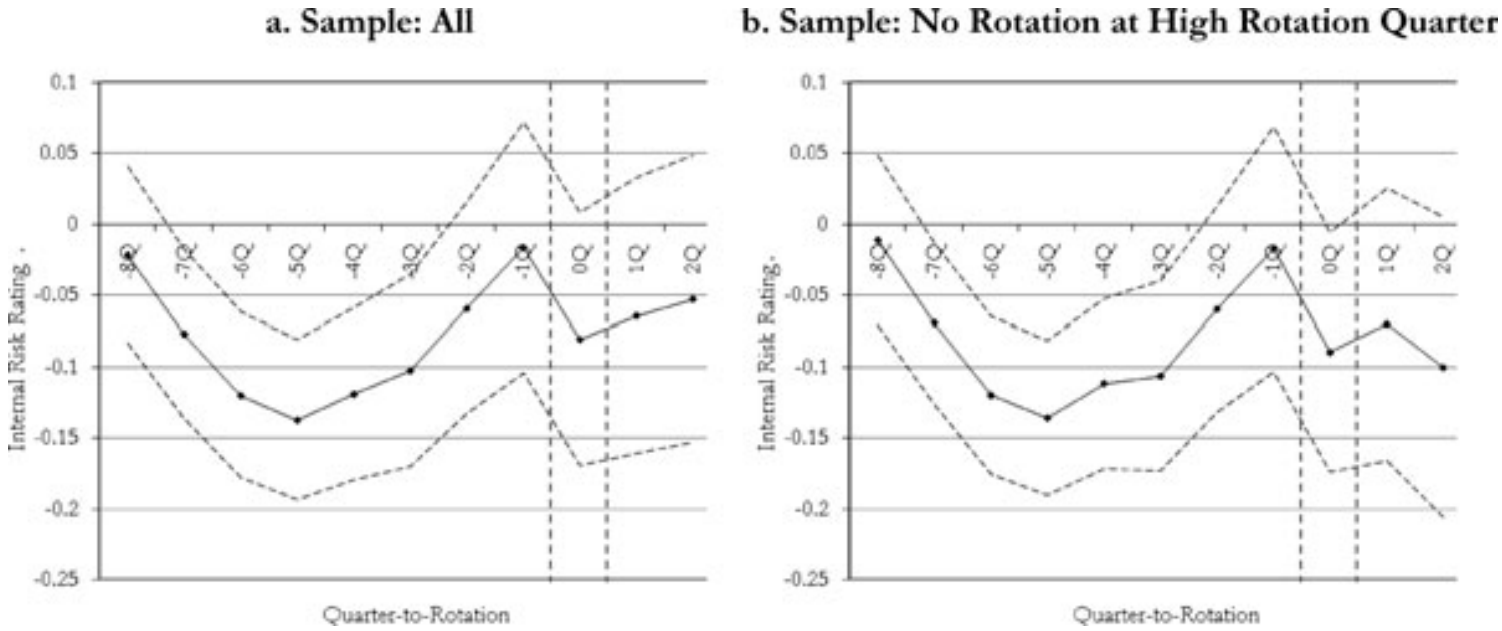
Predictive Power of Internal Ratings

- Constructed by regressing probability of default on risk rating, controlling for external risk rating



Figures

Levels of ratings



Career Concerns

Effect of Downgrade on Loan Officer's Assets Under Management

	No. of Firms				Debt			
Dependent Variable (logs)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No. of events pre–high rotation quarter loan officer downgrades firm 1–6 months prior (*#DGPRE*)	−0.104*** (0.036)	−0.145*** (0.023)		−0.135*** (0.028)	−0.170 (0.108)	−0.184** (0.073)		−0.173** (0.060)
No. of events pre–high rotation quarter loan officer downgrades firm 7–12 months prior (*#DGPRE_12*)			−0.079** (0.037)				−0.078 (0.069)	
No. of events post–high rotation quarter loan officer downgrades firm 1 –6 months after (*#DGPOST*)	0.083 (0.127)	−0.038 (0.083)	−0.056 (0.105)	−0.040 (0.099)	0.171 (0.289)	0.294 (0.277)	0.293 (0.281)	0.141 (0.499)
No. of events pre–high rotation quarter loan officer's firm downgraded post–high rotation quarter (*#DGSUCC*)	−0.466*** (0.074)	−0.330*** (0.071)	−0.355*** (0.090)	−0.310*** (0.075)	−0.701*** (0.176)	−0.681*** (0.142)	−0.728*** (0.114)	−0.592*** (0.154)
#DGPRE × (dummy = l if loan officer in highest age quartile)				0.085 (0.138)				0.104 (0.261)
#DGPOST × (dummy = l if loan officer in highest age quartile)				−0.058 (0.122)				0.254 (0.488)
#DGSUCC × (dummy = l if loan officer in highest age quartile)				0.241*** (0.141)				0.653*** (0.243)

QUESTIONS

Are bank clients credit-constrained? (Based on Banerjee-Duflo (2014))

- Access to banks is often used as a measure of financial development
- Only relatively privileged firms have access to bank credit.
- However as we have already seen, there are good reasons why bank clients may not get as much credit as they want from the bank
- This does not mean that they are credit constrained: they might get the extra credit they want elsewhere.

An empirical approach to credit constraints

- How do we know whether a firm is credit constrained?
- We need to know its marginal product of capital, but how can we estimate the production function?
- A natural experiment approach
- Indian banks, both private and public, are required to lend 40% of their portfolio to the priority sector.
- In January 1998 firms India with fixed capital between Rs. 6.5 million and Rs. 30 million became eligible for (possibly subsidized) priority sector credit from banks. Firms below Rs.6.5 million were already eligible.
- In early 2000, the limit was lowered back to Rs. 10 million.
- We study the impact of newly becoming eligible/ineligible for subsidized credit on the growth rate of borrowing, sales and profits using firm level data that we collected from a single bank.

Some useful concepts

- It is useful to distinguish between credit rationing and credit constraints
- Consider a firm that faces a series of interest rates $r(1) < r(2), ... < r(N)$. Let the corresponding amounts of borrowing be $kt1), k(2), ...k(N)$.
- Suppose $k(r) : f'(k) = r$ where $f(k) is the firm's production function$.
- If $\sum_i = 1^n < k(r(n))$ then the firm is credit rationed
- If $\sum_i = 1^N < k(r(N))$ then the firm is credit constrained.

Theoretical challenge

- The fact that firm absorbs more subsidized credit does not mean that it is credit constrained. It could just be credit rationed.
- To be credit constrained you should be willing to borrow more at the interest rate you pay on the marginal dollar you borrow (not necessarily the subsidized rate, which may be infra-marginal).
- Unconstrained firms will use subsidized credit to pay down their existing debt:
- they only expand production once they only have subsidized debt.
- their production(sales) will grow slower than their credit.
- Constrained firms will use subsidized credit to expand sales.

Possible pitfalls of this strategy?

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Estimation

- We will mainly estimate

$$\begin{aligned} y_{it} - y_{it-1} &= \alpha_y BIG_i + \beta_y POST_t \\ &\quad + \gamma_y BIG_i * POST_t + \epsilon_{yit}, \end{aligned}$$

  for $y =$ logcredit, logrevenue, logprofits, etc; BIG represents newly eligible firms; the dummy $POST$ represents the post January 1998 period or the post January 2000 period.
- We will also estimate the effect of credit on sales or profits by instrumenting credit by $BIG * POST$
- $BIG * POST$ is uncorrelated with the probability of an enhancement in the loan size.
- Strongly correlated with loan size conditional on there being an enhancement.
- Because it is uncorrelated with the probability of enhancement, we can focus on the firms that got an enhancement

Results

- The OLS effect of growth in credit on growth in revenues is essentially zero. Why might this be?
- What do we learn from using the policy shock? Who would be the compliers in our theory?
- Credit to BIG firms grows faster in the POST period
- No change in the interest rate
- Firms appear to be credit constrained–sales grows almost as fast as credit suggesting that they are not using subsidized credit to pay off market borrowings (substitution).
- Sales grows at about the same rate at firms that have no market borrowing and at firms with some market borrowing, confirming that there is no substitution.
- Profit has an elasticity of 1.8, implying that an extra rupee of credit increased profits net of interest by almost 1.4 rupees.

Results

	Dummy equal to 1 if			Log(working capital limit availble at t)-log(w		
	limit was changed between t and t-1	limit increased between t and t-1	limit decreased between t and t-1	Whole sample	Sample with change in limit	Whole
	(1)	(2)	(3)	(4)	(5)	
PANEL A: t=1997-2000						
post	0.000	-0.026	0.026	-0.034	-0.115	
	(.050)	(.052)	(.024)	(.026)	(.074)	
big	-0.043	0.016	0.027	-0.059	-0.218	
	(.052)	(.051)	(.041)	(.028)	(.088)	
post*big	-0.022	0.050	-0.028	0.095	0.271	
	(.087)	(.079)	(.044)	(.033)	(.102)	
	487	487	487	487	155	
PANEL B: t= 1999-2003						
post2	0.069	-0.073	0.004	-0.027	-0.038	
	(.032)	(.037)	(.024)	(.024)	(.075)	
biggest	0.017	0.041	-0.058	0.067	0.232	
	(.129)	(.131)	(.017)	(.059)	(.063)	
post2*biggest	0.008	-0.127	0.119	-0.121	-0.442	
	(.179)	(.172)	(.033)	(.082)	(.191)	
	769	769	769	769	217	
PANEL C: t= 1997-2003						
post*biggest (γ_{3kb})	0.067	-0.041	-0.026	0.089	0.346	
	(.150)	(.150)	(.024)	(.059)	(.146)	
post*medium (γ_{4kb})	-0.059	0.076	-0.016	0.088	0.233	
	(.098)	(.090)	(.051)	(.041)	(.122)	
post2*biggest (γ_{5kb})	0.054	-0.176	0.122	-0.142	-0.482	
	(.175)	(.170)	(.033)	(.077)	(.181)	
post2*medium (γ_{6kb})	0.168	-0.177	0.010	-0.077	-0.185	
	(.034)	(.052)	(.040)	(.044)	(.167)	
	924	924	924	924	265	

Results

	Complete sample				Sample wh
	interest rate$_t$ - interest rate$_{t-1}$	log(interest rate)$_t$ -log(interest rate)$_{t-1}$	dummy for interest rate decline	log(turnover/limit)$_t$ -log(turnover/limit)$_{t-1}$	interest rate$_t$ - interest rate$_{t-1}$
	(1)	(2)	(3)	(4)	(5)
A. t=1997-2000					
post	-0.165	-0.010	0.280	0.154	-0.127
	(.128)	(.008)	(.074)	(.174)	(.249)
big	-0.002	0.000	0.098	0.412	-0.036
	(.132)	(.008)	(.106)	(.188)	(.241)
post*big	0.073	0.002	-0.135	-0.112	0.163
	(.169)	(.011)	(.125)	(.260)	(.337)
	430	430	430	93	141
B. t=1999-2002					
post2	0.035	-0.009	-0.029	0.018	-0.146
	(.072)	(.013)	(.038)	(.116)	(.167)
biggest	-0.062	-0.007	-0.010	0.971	-0.077
	(.110)	(.008)	(.063)	(.578)	(.188)
post2*biggest	0.099	0.020	0.001	-0.840	0.206
	(.147)	(.017)	(.098)	(.868)	(.385)
	719	721	721	139	203

Conclusion

- Firms are clearly severely credit constrained.
- There is clearly a large wedge between the rates paid to savers and the marginal product of capital
- Marginal product is very high (possibly over 100%) for the set of compliers.
- This does not directly tell us about whether the marginal product is equalized in all uses.
- However it does suggest that people who have wealth would rather invest it than put in the bank, even if the investment is not the most productive.

QUESTIONS