Market Power and Availability of Credit: An Empirical Investigation of the Small Firms' Credit Market

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- **<u>FACT</u>: Using 1987 data on small firms, a positive correlation between bank market power and small firm credit availability has been documented**

In this talk I show that:

- Bank market power restricts credit to small firms

- However, for borrower-creditor transactions based on relationship lending, might increase small firm credit availability

Related Literature

- Bank Market Power and Small Firm Credit Supply: Petersen & Rajan (1995). Document the positive correlation

- Relationship Lending and Small Firm Credit Supply: Berger & Udell (1995) and Petersen & Rajan (1994) document positive association between strength of firm-bank relationships and supply of credit

- Bank Organizational Structure and Relationship Lending: Berger & Udell (2002), Berger et. al. (2003)

RELATIONSHIP LENDING *vs.* ARM's LENGTH LENDING

- **Relationship Lending**

  Lending based on intense use of private proprietary information about the borrower and repeated interaction between creditor and borrower.

- **Arm's Length Lending**

  Lending based on public information, and impersonal relation between creditor and borrower

1. THE MODEL

Assumptions

- Two types of borrowers: good ($\mathbf{l}$), and bad (1-$\mathbf{l}$)

- Good types live 2 periods. In each have a project that costs 1 and has return $R \in \left[\underline{R}, \bar{R}\right]$. Bad types run away with the money

- 2 periods. 2nd: period a new generation (same proportions) comes but everybody lives 1 period

- Returns and type are private to borrowers

- Banks learn type by lending in the 1st period

- In the second period banks receive a signal γ, which is proportion of identified bad borrowers

- Constant marginal cost of c of using the information acquired in the 1st period

- 2 markets (2nd period): arm's length (open market) and relationship

- Cournot Competition in the arm's length market

Second Period Open Market Rate

$$R^*\left(N, \mathbf{l}, g\right) = \bar{R} - \left(\frac{N}{N+1}\right)\left[\bar{R} - \left(1 + \frac{1 - \mathbf{l}\left(1 - g\right)}{\mathbf{l}}\right)\right]$$

Second Period Profit from Good Old Borrowers

$$\mathbf{P}_{GO}\left(q_i^1; R^*, \bar{R}\right) = q_i^1 \left(R^* - 1\right)\left(\bar{R} - R^*\right) - c$$

First Period Quantity of Credit

$$Q^*\left(N,\boldsymbol{l},\boldsymbol{g},c\right) = \underbrace{\left[\frac{N}{N+1}\right]\left(\bar{R} - \left[1 + \frac{1-\boldsymbol{l}\left(1-\boldsymbol{g}\right)}{\boldsymbol{l}}\right]\right)}_{Q^*_C = \text{Traditional}}$$

$$\underbrace{\left[\frac{N}{N+1}\right]\left(R^* - 1\right)\left(\bar{R} - R^*\right) - c}_{Q^*_I = \text{Informational}}$$

Comparative Statics

$$\frac{\partial Q_C^*}{\partial N} > 0 \text{ and } \frac{\partial Q_I^*}{\partial N} < 0$$

If c and/or $\boldsymbol{g}$ are high enough

$$\mathbf{P}_{GO}\left(q_i^1; R^*, \bar{R}\right) = q_i^1\left(R^* - 1\right)\left(\bar{R} - R^*\right) - c$$

disappears and only the traditional effect survives

Two Hypothesis

1 – The effect of bank market power depends on how the transaction between the bank and borrower is mediated

2 – Exogenous shocks that increase the cost of using private information or increase the amount of public information decreases the effect of market power

2. Empirical Modeling

Empirical Model should allow for

- **Two Components of Market Power**
  - ➢Traditional $\rightarrow$ direct effect
  - ➢Informational $\rightarrow$ interaction

- **Informational Effect should vary according to the amount of public information and availability of private information**

AVAILABILITY OF PUBLIC INFORMATION (g)

- Lack of Public Information (low g) $\rightarrow$ Creditors need to acquire private information. Same for cost of using acquired private information (c)

- Relationship Lending: technology to acquire private information

- If low g, then banks should be using more relationship lending $\rightarrow$ more value in acquiring private information (establishing relationships)

Credit Supply

Let i index a firm. Let CS be Credit Supply

MP_i = Bank market power relevant for firm

RL_i = Use of relationship lending by creditors of the firm

$$CS_i = f \left(\underbrace{MP_i}_{\text{TRADITIONAL EFFECT}} , \overbrace{MP_i * RL_i}^{\text{INFORMATIONAL EFFECT}} , RL_i , \text{controls} \right) + e_i$$

THE EFFECTS

$$\frac{dCS_i}{dMP_i} = \underbrace{f_1}_{\text{TRADITIONAL EFFECT}<0} + \overbrace{RL_i \cdot f_2}^{\text{INFORMATIONAL EFFECT}>0}$$

ESTIMATING SUPPLY OF CREDIT

- Similar to Petersen & Rajan (1995)
  - ➢ Use information on Early Payment Discounts (EPDs)
- **EARLY PAYMENT DISCOUNTS**

  Cash discounts offered by firm's suppliers (other than capital) for early payments
- **FACT**: Very High Implicit Interest Rates in forgoing EPDs. Implicit interest rate= 106% (median)

EPD EQUATION

- Use of EPDs depends on: bank credit availability, cash in hand, investment opportunities, difference between implicit rates and bank credit rates

$$EPD_i = h\left(CS_i, P_i - TC_i, CASH_i, INV_i, \textbf{controls}\right) + e_i$$

I expect $h_1 > 0$

THE EFFECTS AGAIN

- The Derivative of EPDs with respect to market power is:

$$\frac{dEPD_i}{dMP_i} = h_1 \acute{}\ \left(f_1 + RL_i \acute{}\ f_2 \right)$$

$$\mathbf{sign}\left(h_1 \acute{}\ \left(f_1 + RL_i \acute{}\ f_2 \right)\right) = \mathbf{sign}\left(f_1 + RL_i \acute{}\ f_2 \right)$$

3. THE DATA

Survey of Small Business Finances (SSBF) for the years 1987, 1993 and 1998

- The three surveys together form a Synthetic Panel.

- Stratified cross section of small firms (≤ 500 employees)

The data includes firm level information on:

- **Inventory of financial products:**

  ➢ Use of Bank Credit: line of credit, mortgages, credit card usage, vehicle loans, etc.

  ➢ Use of Trade credit, including pricing

  ➢ Firm characteristics: age, legal status, credit score (1998)

  ➢ Characteristics on bank-firm relationship: distance, length of relationship, number of products purchased

DRAWBACKS OF THE DATA

- Very Few Bank Market Information: MSA/Rural, classes of Bank Market Concentration

- No information on bank characteristics

4. Estimates

Let Y_i be the percentage of EPDs firm i took advantage of

$$Y_i = b_0 + b_1 \log(\text{assets}_i) + b_2 \text{length1}_i + b_3 \text{Concentration3}_i$$
$$+ b_4 \text{length1}_i * \text{Concentration3}_i + b_5 \log(\text{agefirm}_i) + b_6 \text{MSA}_i$$
$$+ b_7 \text{LEGAL}_i + b_8 \text{NumInsti}_i + f_1 \log(\text{CASH})_i + f_2 \text{SECTOR}_i$$
$$+ f_3 \text{REGION}_i + e_i$$

bs: correspond to the supply equation

f: correspond to the rest of EPD equation

LENGTH1

LENGTH1= $\begin{cases} 1, & \text{if firm-bank relationship} \geq 6 \text{ years} \\ 0, & \text{Otherwise} \end{cases}$

6 YEARS IS ROUGHLY THE MEDIAN AMONG THE THREE YEARS

SHORT TERM VARIATION JUST NOISE

CENSORING

- At high interest rate differentials

  ➢ Firms with lots of bank credit and/or cash-in-hand would like to take more than 100%

  ➢ Very cash or bank credit constrained firms would like to *give* EPDs to make cash

$$Y_i = \begin{cases} 100, & \text{if } Y_i^* \geq 100 \\ Y_i^*, & \text{if } Y_i^* \in (0,100) \\ 0, & \text{if } Y_i^* \leq 0 \end{cases}$$

MODEL FOR THE VARIANCE

$$VAR\left(e_i \mid NO_i\right) = \frac{s^2}{NO_i}$$

NO_i = NUMBER OF OFFERS OF EPDs

Descriptive Statistics: Means and Standard Deviations of Regression

| | YEAR | | | | | | | | |
| | 1987 | | | 1993 | | | 1998 | | |
	Mean	St. Dev	Nº obs	Mean	St. Dev	Nº obs	Mean	St. Dev	Nº obs
Early Payment Discounts (%)	63.7	1.25	1929	59.4	.90	2213	59.5	1.45	1473
Assets (US$thd)	476.25	32.52	3224	488.57	26.94	4632	414.88	20.96	3553
Cash (US$ thd)	46.24	3.31	3224	137.55	12.2	4541	45.76	4.22	3472
Legal (%)	48.4	-	3224	51.2	-	4632	55.0	-	3560
Agefirm (months)	13.3	.25	3224	14.3	.22	4632	13.3	.22	3560
Length (months)	132.7	3.0	3128	102.7	1.86	4465	94.1	2.1	3452
Nº of Institutions	1.98	.02	3224	2.0	.02	4632	2.0	.02	3560
Concentration 1 (%)	12.9	-	3224	-	-	4632	4.9	-	3560
Concentration3 (%)	47.7	-	3224	51.4	-	4632	52.7	-	3560
MSA (%)	75.9	-	3224	78.9	-	4632	79.9	-	3560
Same MSA/County (%)	93.0	-	3224	91.7	-	4632	89.9	-	3560

Table 2 Source: Federal Reserve Board – Survey of Small Firms' Finances. All variables as defined in section 4. Same MSA/County is the percentage of firms that are located at the same MSA/County as their main provider of financial services.

Dependent Variable: % of Early Discount Payments Taken

Independent Variables	YEAR		
	1987	**1993**	**1998**
	Financial Characteristics		
Log(Assets)	-5.2	5.2	-7.3
	(.06)	(.01)	(.00)
Log(Cash)	9.2	-0.4	10.7
	(.00)	(.76)	(.00)
	Firm Characteristics		
Legal	13.4	5.2	-8.2
	(.04)	(.48)	(.30)
Log(Agefirm)	15.9	13.4	89.0
	(.00)	(.02)	(.00)
	Relationship Characteristics		
Length1	6.8	.16	19.2
	(.30)	(.84)	(.01)
Number of Institutions	-2.6	-4.8	-6.4
	(.30)	(.05)	(.03)
	Banking Market Characteristcs		
Concentration3	**<u>10.4</u>**	**<u>3.6</u>**	**<u>-3.5</u>**
	<u>(.09)</u>	**<u>(.60)</u>**	**<u>(.69)</u>**
MSA	-15.2	-5.8	-2.7
	(.00)	(.41)	(.79)
Upper-Censored	854	1048	561
Uncensored	726	715	509
Lower- Censored	245	406	298

Table 3 Source: Federal Reserve Board – Survey of Small Firms' Finances. Tobit estimates: upper censoring at 100, lower censoring at 0. Dependent Variable: percentage of times firm takes advantage of Early Payment Discounts. N° of observations: 1896 (1987), 2169 (1993) and 1456 (1998). ***p*-values in parentheses.**

Dependent Variable: % of Early Discount Payments Taken

Independent Variables	YEAR			YEAR			YEAR	
	1987	**1993**	**1998**	**1987**	**1993**	**1998**	**1987**	**1998**
	Financial Characteristics							
Log(Assets)	-8.3	2.6	-9.6	-8.3	3.4	-8.0	-8.3	-9.5
	(.00)	(.03)	(.00)	(.00)	(.04)	(.00)	(.00)	(.00)
Log(Cash)	16.3	0.9	12.0	16.2	0.9	11.9	16.2	12.0
	(.00)	(.48)	(.00)	(.00)	(.49)	(.00)	(.00)	(.00)
	Firm Characteristics							
Legal	17.0	4.8	3.9	18.6	2.0	1.8	16.6	3.8
	(.01)	(.43)	(.45)	(.00)	(.76)	(.84)	(.00)	(.66)
Log(Agefirm)	11.3	15.2	17.6	12.9	14.8	15.1	11.5	17.5
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
	Relationship Characteristics							
Log(Length)	4.0	5.2	6.3	3.5	6.6	7.8	4.1	6.4
	(.09)	(.09)	(.08)	(.17)	(.06)	(.06)	(.09)	(.08)
Number of Institutions	-4.6	-4.6	-7.6	-4.9	-4.6	-8.4	-4.5	-7.7
	(.06)	(.02)	(.00)	(.06)	(.03)	(.00)	(.06)	(.00)
	Banking Market Characteristics							
Concentration 1	-	-	-	-	-	-	10.0	9.6
							(.34)	(.57)
Concentration3	**11.7**	**-5.8**	**-16.0**	**12.3**	**-7.2**	**-17.3**	**13.8**	**-14.9**
	(.06)	**(.31)**	**(.06)**	**(.07)**	**(.23)**	**(.04)**	**(.03)**	**(.09)**
MSA	-17.5	-5.8	-16.1	-19.9	-4.0	17.8	-17.9	-16.4
	(.00)	(.41)	(.12)	(.00)	(.59)	(.11)	(.00)	(.11)
Only Same MSA/County?	No	No	No	Yes	Yes	Yes	No	No
Upper-Censored	893	1048	590	818	927	529	893	590
Uncensored	746	715	546	657	636	464	746	546
Lower- Censored	257	406	320	227	362	264	257	320

Table 3 Source: Federal Reserve Board – Survey of Small Firms' Finances. Tobit estimates: upper censoring at 100, lower censoring at 0. Dependent Variable: percentage of times firm takes advantage of Early Payment Discounts. Nº of observations: 1896 (1987), 2169 (1993) and 1456 (1998). *p*-values in parentheses.

Dependent Variable: % of Early Payment Discounts

	1987	1993	1998
Concentration3	3.0	-13.4	-14.3
	(.74)	(.25)	(.24)
Concentration3*Length1	12.6	29.4	21.7
	(.27)	(.04)	(.14)

Table 4 Tobit Estimates. WLS with the square root of the number of early payment discounts as weights. All other controls in tables 3 and 4 included. *p*-**values in parentheses**.

Dependent Variable: % of Early Discount Payments Taken

Independent Variable	Year 1987	1993	1998	Year 1987	1993	1998	Year 1987	1993	1998	Year 1987	1993	1998
Concentration3	11.6 (.07)	-7.8 (.22)	-11.6 (.05)	**11.7 (.06)**	**-5.8 (.24)**	**-16.0 (.06)**	**-26.5 (.04)**	**-68.6 (.04)**	**-65.5 (.00)**	-8.6 (.60)	-28.7 (.25)	-39.5 (.29)
Concetration3*Log(Length)	- -	- -	- -	- -	- -	- -	**10.8 (.00)**	**14.5 (.00)**	**13.2 (.00)**	**5.2 (.19)**	**5.5 (.31)**	**5.6 (.42)**
Log(Length)	- -	- -	- -	4.0 (.06)	5.2 (.06)	7.7 (.05)	- -	- -	- -	1.2 (.71)	2.8 (.50)	3.2 (.56)

Table 5 Source: Federal Reserve Board – Survey of Small Firms' Finances. Tobit estimates: upper censoring at 100, lower censoring at 0. Dependent Variable: percentage of times firm takes advantage of Early Payment Discounts. Nº of observations: 1896 (1987), 2169 (1993) and 1456 (1998). All controls included in table 3 also included in this table. ***p*-values in parentheses**.

5. INTERPRETATION

5.1 Cross-Section Interpretation

- Cross-Section Interpretation
  - ➤ Theory outlined seems to be corroborated by data
  - ➤ Traditional Effect negative and significant economically and statistically, especially after decomposition
  - ➤ Informational Effect positive

Cross section interpretation continued …

- Alternative story
  - ➢ Length captures the fact that older firms have a more competitive bank market on their disposal
  - ➢ Does not seem supported by data: interaction with age of firm or credit score (1998) is not significant economically and statistically

Dependent Variable: % Early Payment Discounts

	Year = 1998			
Concentration3	-11.6	-16.6	5.1	-16.7
	(.05)	(.05)	(.58)	(.30)
score	-	-18.3	-	**-18.4**
	-	(.00)	-	(.08)
Concetration3*score	-	-	-6.7	**.02**
	-	-	(.00)	(.99)

Table 6 Source SSBF 1998. Same as 4a with Length1 substituted for credit score. *p-values* **in parentheses**

5.2 TIME-SERIES INTERPRETATION

- Informational Effect Explanations
  - ➤ Decreasing importance of relationship lending as an information production technology
  - ➤ Length measures Relationship Lending with more error

- Traditional Effect Explanations
  - ➤ Changing Competition Regime/Bank market definition

Relationship lending less important?

- Use of more public rather than private information
- Factors that influence cost of using relationship lending (Berger et. Al (2002))
  - ➢ Distance between banks and firms
  - ➢ Size of Banks
  - ➢ Complexity of Banks
- Indirect Measure: trend of length.

RL less important continued …

- **Length** (in years)
  - ➢average going down: 11 in 1987, 9.8 in 1993 and 9.5 in 1998.
  - ➢Reallocation of probability mass within lengths <10
- **Distance** (in miles)
  - ➢increasing:11.3 in 1987, 14.9 in 1993 and 33.3 in 1998.
  - ➢Far away banks becoming even farther away
- **Both trends underestimate the true increases**

TREND OF LENGTH

	Year				
	1998	1993	1987	Difference 1998-1993	Difference 1993-1987
Average Length	9.5	9.8	11.0	-0.3	-1.2
Average Length|Length ≤10	4.1	4.0	4.2	0.1	-0.2
P(Length<=2)	16.9	17.8	23.0	-0.9	-5.2
P(2<Length<=6)	45.2	35.6	23.6	9.6	12.0
P(6<Length<=10)	16.2	16.2	16.8	0.0	-0.6
P(10<Length<=20)	14.7	22.0	21.5	-7.3	0.5
P(Length>20)	6.9	7.4	15.1	-0.5	-7.7

Table 7: Source: Federal Reserve Board – SSBF.
Probabilities implied by estimated density functions.
Length is measured in years, all number are in percentage
points.

TREND IN DISTANCE

| | **Year** | | | | |
	1998	**1993**	**1987**	**Difference 1998-1993**	**Difference 1993-1987**
Average Distance	33.3	14.9	11.3	18.4	3.6
P(Distance<1)	18.0	15.6	28.1	2.4	-12.5
P(1<Distance<3)	36.2	41.5	34.9	-5.3	1.3
P(Distance<10)	85.1	86.7	91.1	-1.6	-4.4
P(10<Distance<20)	7.6	7.0	5.3	0.5	1.7
P(20<Distance<50)	3.5	3.1	2.1	0.4	1.0
P(Distance>50)	3.8	3.2	1.5	0.6	1.7

Table 8: Probabilities implied by estimated
density functions. Distance is measured in
miles, all number are in percentage points

RL less important continued …

- **Size of Banks** (in mil of 1998 dollars)
  - ➢ Average Size (assets): 152 in 1987, 300 in 1993 and 620 in 1998. Consolidation
  - ➢ # of large (>1,000 in assets) banks increasing relative to small banks (<100 in assets): 380 and 8,292 in 1987; 5,408 and 392 in 1998

- **Organizational Complexity**
  - ➢ Complexity Increasing
  - ➢ Consolidation again: multi-bank holding buying single bank holding or independent banks

	Bank size	Year						
		1992	1993	1994	1995	1996	1997	1998
Assets	Small	36	38	40	42	43	45	47
	Medium	210	215	222	228	235	245	245
	Large	5,616	6,252	6,985	7,369	8,670	10,764	11,386
Deposits	Small	32	33	34	36	38	40	40
	Medium	181,159	183,312	186,021	191,532	195,252	209,225	202
	Large	4,088	4,371	4,699	4,847	5,710	7,146	7,308

Table 9: Source: FDI. Evolution of average assets and deposits of commercial banks, by size category. In millions of dollars. Small = assets less $100 million, Medium = assets between $100 million and $1 Billion and Large = assets more than $1 Billion. All numbers inside the table are in constant 1998 $1.000.

| Year | Organizational Type of Acquirer (%) | | |
	Multi-Bank Holding Company	One-Bank Holding Company	Independent Bank
1980	59	14	27
1981	66	14	20
1982	61	23	16
1983	55	32	13
1984	56	28	16
1985	57	35	8
1986	66	27	7
1987	76	20	4
1988	72	22	6
1989	60	29	11
1990	60	32	8
1991	63	25	12
1992	66	30	4
1993	69	24	7
1994	69	27	4
1995	66	29	5
1996	67	26	7
1997	65	30	5
1998	65	33	2
Average Percentage	64	27	9

Table 10 Source: Rhoades (2000). Mergers by acquirer organizational type, in percentage points.

Year	Acquired Bank current $	Acquired Bank 1998 $	Acquiring Bank current $	Acquiring Bank 1998 $	Acquiring/Acquired
1980	54	77	1,743	2,488	32
1981	95	124	2,266	2,955	24
1982	98	121	2,569	3,150	26
1983	117	138	1,972	2,321	17
1984	158	179	3,101	3,517	20
1985	141	155	2,326	2,550	16
1986	165	176	3,873	4,136	23
1987	190	197	14,036	14,546	74
1988	187	187	6,249	6,247	33
1989	124	119	3,444	3,304	28
1990	119	109	3,829	3,521	32
1991	436	386	9,789	8,660	22
1992	413	355	10,459	9,002	25
1993	236	198	9,305	7,806	39
1994	251	206	8,233	6,742	33
1995	525	420	11,021	8,824	21
1996	696	547	35,929	28,235	52
1997	432	333	9,560	7,376	22
1998	1,216	930	16,728	12,791	14
Total Average		261		7272	29

Table 11: Source: Rhoades (2002). Average size (in terms of assets) of acquired and acquiring banks, 1980-1998. In millions of Dollars

RL less important continued …

- Larger banks rely more on hard information (Berger et. al. 2003)

- Size correlates positively with adoption of credit scoring based lending (Frame et. al. 2001, Akhavein et al 2001)

- Hard information based lending substitutes for private soft information

Is Bank Market Definition Changing?

- Bank market definition is local for the survey: MSA/County

- From table 2: decrease in the percentage of firms in the same MSA/County as their Main Providers. Not significant: 93% in 1987, 91.7% in 1993 and 89.9% in 1998

- Traditional Effect estimated *more* not less precisely

Is the Competition Regime Changing?

- Changing competition regime due to increase concentration in already concentrated market? Bresnahan & Reiss (1990,1991)

- Evidence is that more concentrated markets became *less* concentrated, and less concentrated markets *more* concentrated.

- Also rules mechanical explanations: between classes difference increasing

6 Conclusion and Future Research

Theory explains cross-section results

- Bank market power **does** restrict credit supply.

- But the informational effect matters:
  - ➢ For firm-bank transactions intermediated by relationship lending, the negative effect is less pronounced, and **may** even be positive.
  - ➢ An alternative interpretation: if the amount of public information is small, the negative is less pronounced

- Alternative explanations falsified

Conclusion continued …

Theory is consistent with the trend of bank market power effect

- The negative effect is more pronounced in the mid/late 90s than in the late 80s
- Consolidation and technological advances in the period
  - ➢ Cost in using relationship lending increasing overtime. Larger, more complex, farther away banks
  - ➢ Technological advances increased the amount and cost of using public information: credit scoring

Future Research

- More data necessary to nail down the time-series fact (working on it …)

  ➢ Data on Bank Characteristics within the Survey: informational effect by bank size, organizational structure and distance (correctly measured)

  ➢ Bank Market level: explain the trend of the traditional effect?