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

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Abstract

This paper investigates the relationship between market power and supply of credit. Market power increases the returns to acquiring private information about borrowers. Through this channel, market power and supply of credit are positively related. However, creditors with market power also restrict supply of credit for standard reasons. The net effect is an empirical question. This paper makes several contributions. I construct a model in which both effects are present, and their relative strength depends on how much public information about borrowers is available. Using data on small firms' credit use, I show that market power and supply of credit relate positively insofar as the lending is based on the use of private information. Then, I document a change in the relationship between market power and supply of credit to small firms over the period 1987-1998: while in 1987 market power was associated with a significantly larger supply of credit, in 1993 and 1998 it was associated with a lower supply of credit. Finally, I show how consolidation and technological progress in the banking industry explain the change in the relationship between bank market power and supply of credit.

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1 Introduction

Informational asymmetries are pervasive in credit markets: relevant information about the quality of firms and their projects is observable to firms, and not to creditors. This opens the possibility that market power on the creditor side has a non trivial effect on the equilibrium supply of credit. On the one hand, market power increases the rent extraction associated with acquiring private information about firms. Therefore it induces more aggressive competition to recruit (good) borrowers and more investment in acquiring private information. I call this the *informational effect* of market power, through which a higher degree of creditor market power leads to a *larger* supply of credit. On the other hand, market power reduces total credit for standard reasons. I call this the *traditional effect* of market power, through which a higher degree of creditor market power leads to a *smaller* supply of credit. These two effects go on opposite directions, and the net effect is an empirical question.

In this context, this paper studies the relationship between creditor market power and equilibrium supply credit for small firms. Small firms are particularly problematic borrowers. Relative to big corporations, public, verifiable information on small firms is scarce. In the banking literature, small firms are said to be informationally opaque. This informational opacity increases the value of acquiring private information in order to produce loans. Indeed, relationship lending, a technology for producing private information through repeated interaction between borrowers and lenders, is intensively used in small firm lending. Therefore, small firms are a good empirical application to test the validity of the theoretical ideas outlined above.

In an important paper, Petersen & Rajan (1995) document, using 1987 cross-section data on usage of credit by small firms, a positive relationship between bank market power and supply of credit to small firms. Their result motivates the investigation undertaken here. I contribute to the literature in several dimensions. First, I propose a model in which the two effects of market power on supply of credit arise. Additionally, the model produces testable predictions about the circumstances in which one effect should dominates the other. The model is then taken to the small firm credit market data. My specification allows for the two above mentioned effects. As in Petersen & Rajan (1995), the *total* effect of market power is *positive* in 1987. I find, however, that the *traditional* effect of market power is *negative*, con-

sistent with my model and standard intuition. The *informational* effect is positive, and this is what drives the total effect of market power to be positive. Then, I document a change in the total effect of market power for the years 1993 and 1998, using similar new data: for the later periods, the total effect of market power is *negative*. This means that the balance between the *traditional* (negative) and the *informational* (positive) effects has shifted in favor of the former. Finally, aggregate data indicates that consolidation in the banking industry increased the costs of using relationship lending. Consistent with the model, this induced a decrease in the relative importance of the informational effect and, therefore, rationalizes the documented change in the total effect of market power on supply of credit to small firms.

Evaluating whether market power can have positive effect on credit supply is important in two dimensions. First, it is interesting *per se*, as a test of theory in information economics. Second, it is relevant from a policy perspective. There has been considerable concern among policy makers about the effects of recent deregulation in the banking industry on the supply of credit to small firms.[1] During the last 20 years, banking markets, both local and nationwide, have become more concentrated, and policy makers worry about lack of competition on the small firms' credit market. This paper evaluates directly how market power relates to credit for small firms. Furthermore, it tests whether market power can have a *positive* effect under certain circumstances. As preview, the results in this paper indicate that the effect of market power has become more and more negative over time. It is still true, however, that for certain small firms market power may lead to *more* credit.

This paper draws on several different literatures. The banking literature builds on the original idea in Stiglitz & Weiss (1981) that informational imperfections can lead to credit rationing. The association between relationship lending and the availability of credit has been studied by Berger & Udell (1995) and Petersen & Rajan (1994). In general, these authors find a positive association between strength of the firm-bank relationship and credit availability. Especially important for my purposes is Berger & Udell (1995), in which strength of relationship is measured by the length of relationship. Other papers look at the ability of large banks to lend to small firms, which is important to explain the documented trend of the total effect of market

[1] See Berger et. al. (1995), Berger et. al. (1997), Peek & Rosengreen (1996) and Strahan & Weston (1996).

power on credit supply. Berger & Udell (2002) outline the main theoretical reasons why large banks have more difficulty lending to informationally problematic borrowers such as small firms. Berger et. al. (2003) document this fact using data on small firms. Finally, some work has been done on the effect of mergers on the portfolio of loans to small firms of the consolidated institution, finding mixed results. See Berger et. al. (1997), Peek & Rosengreen (1996) and Strahan & Weston (1996).

There is also a literature, both theoretical and empirical, on the relationship among bank market power, relationship lending and credit supply. Several works raise the possibility that, if there is asymmetry of information between borrowers and creditors, the theoretical relationship between market power and supply of credit is not trivially negative. Broecker (1990) suggest that a limited number of banks can be sustained in equilibrium when creditors face adverse selection of borrowers. Specifically related to my work, Hauswald & Marquez (2000) and Boot & Thakor (2000) analyze how bank competition lowers the value of establishing relationships with borrowers. Both papers use the concept of dual credit markets: a relationship one, and a formal, transaction-based one. I draw heavily on this dichotomy in my analysis. Finally, Petersen & Rajan (1995), as it was described above, document a positive relationship between market power and credit supply to small firms, giving empirical support for the theoretical ideas in the literature.

The paper is organized as follows. In section 2, I develop a theoretical model that guides the subsequent empirical discussion. Section 3 describes a general estimation procedure. Section 4 presents the main results: the decomposition of the effect of market power into the traditional and the informational effects; and the documentation of the change, over time, in the total effect of market power. The interpretation of results is in section 5. I use information on the evolution of the small firm - bank relationship and on the evolution of the banking market structure to interpret the results in part 4. Section 6 concludes.

2 Theoretical Motivation

I build a simple two period model that captures the interaction between the market structure and information. In the first period, interest rates, and therefore the equilibrium supply of credit, depends on the market structure

and on the prospects of future rents associated with acquiring information about good borrowers. More market power has two effects on the equilibrium supply of credit. On the one hand, it decreases credit, for standard reasons. I call this the **traditional effect**. On the other hand, it increases credit since banks, anticipating larger future rent extraction, compete more aggressively to recruit good borrowers. I call this the **informational effect**. The cost of recruitment is lending to bad borrowers. Therefore, the effect of market power on the first period equilibrium quantity of credit is ambiguous. The model also allows the total effect of market power to vary with the amount of public information about firms. The more public information there is, the lower the informational effect is, and the more negative (or less positive) the effect of market power is.

2.1 The Model

Primitives

There are two types of borrowers in the market: bad and good. Good borrowers live two periods. Each period, they have a project that costs 1 and yields a return $R \in \left[\underline{R}, \overline{R}\right]$, where $\underline{R} > 1$. Second period project is feasible only if the first period project was completed.[2] Good borrowers' project returns are uniformly distributed in the $\left[\underline{R}, \overline{R}\right]$ interval. Bad borrowers have no project: they intend to run away with the money and they live one period. The total mass of borrowers is 1, of which a proportion λ is good (and $1 - \lambda$ is bad).

Borrowers do not have internal finance; their only source of finance is banks. There are N banks in the market, which is taken to be exogenous. Banks have zero cost of funds, do not discount future profits, and the competition regime is Cournot.

[2] This assumption is innocuous and is made for simplicity.

Timing and Information

There are two periods. Borrowers know their type and the return of their projects. As of period $t = 1$, information on the type and return is private to borrowers. The only public information is the distribution of types (λ) and the distribution of returns (uniform in $\left[\underline{R}, \overline{R}\right]$).

At $t = 1$, all bad borrowers and some good borrowers get financed because banks cannot tell them apart. Since the project is indivisible, borrowers can borrow from only one bank. Lending in period $t = 1$ is interpreted here as establishing a relationship. After lending in $t = 1$, the bank learns the type of borrower, but not her return.

In period $t = 2$ an identical new generation of borrowers arrives. This generation, however, lives only one period. Another difference is that, now, banks receive a signal about bad borrowers. This signal identifies a proportion $\gamma \in [0, 1]$ of the bad borrowers. I interpret this signal as the amount of public information about firms in the market. I call this market for new borrowers the **open market**. The open market is an arms' length lending market: it is a non-relationship market in which banks have no private information about borrowers. It is composed of the good and bad borrowers that have just arrived in period $t = 2$. Therefore, in period $t = 2$, banks operate in two markets: one of their captive clients and another of new clients.[3]

Banks have a marginal cost c in using the private information about borrowers acquired in period $t = 1$. This is the cost of using relationship lending. It reflects the fact that transmitting private information from the first acquirer (generally a loan officer) to the ultimate decision makers is costly.[4]

Good old borrowers have two options in $t = 2$: borrow from their old bank, or in the open market. If they choose the latter, they are charged an interest rate that takes into account that there is a mass $(1 - \lambda)(1 - \gamma)$ of bad borrowers in the second generation. Nevertheless, the opportunity of going to the open market prevents banks from extracting all rent from all good old borrowers. It is assumed that, in period $t = 2$, good old borrowers cannot credibly transmit, to other banks, any private information their banks have about them. Therefore the banks they have established a relationship with are able to extract some, but not all, rent out of this private information

[3] I borrow this modelling idea from several papers in the literature. See Hauswald & Marquez (2000), Boot & Thakor (2000) and Dell'Ariccia (2001).

[4] See discussion below or Berger & Udell (2002).

acquired in the first period. The amount of rent extraction depends on the market structure because the more competitive the open market is, the more attractive the option of borrowing in open market is.

Solving the Model

Banks compete in quantities (Cournot) in the first period and in the second period open market. Therefore there is only one interest rate in both markets. I solve the model by backward induction. Since banks are *a priori* similar, I look for a symmetric equilibrium. Details of derivations and proofs are in appendix 2.

Period $t = 2$

The first step is to derive the equilibrium **open market** interest rate in period $t = 2$. In equilibrium, only the new good and bad borrowers participate in the open market. Whatever the (uniform across new borrowers) interest rate is, bad borrowers demand the loan since they plan to run away with the money. Good borrowers plan to repay. For any given rate I assume that bad and good borrowers split evenly among banks. Good borrowers demand the loan if and only if the interest rate on the loan is lower than or equal to the return on their projects.[5] Since there is a mass 1 of borrowers, λ out of which are good, the total market demand for good borrowers:

$$\frac{\left(\overline{R} - \widehat{R}\right)\lambda}{\left(\overline{R} - \underline{R}\right)} = D\left(\widehat{R}\right)$$

Let q_i be the quantity bank i targets to supply to good borrowers at the second period free market. In order to supply this quantity to good borrowers, bank i must also supply $q_i \frac{(1-\lambda)(1-\gamma)}{\lambda}$ to bad borrowers. Therefore, the marginal cost of producing loans is $1+\frac{(1-\lambda)(1-\gamma)}{\lambda}$. Let $\mathbf{Q}_{-i}=(q_1, ..., q_{i-1}, q_{i+1}, .., q_N)$ be the vector of quantities for all banks except i. The profit function for bank i is:

[5]It is conceivable that good borrowers might accept a higher interest rate than their return, anticipating they will be recognized as good and be compensated in the second period. I am implicitly assuming a break-even condition in every period.

$$\mathbf{\Pi}_{fm}\left(\mathbf{Q}_{-i}, q_i; \lambda, \overline{R}, \underline{R}, \gamma\right) = \left[\overline{R} - \frac{\left(\overline{R} - \underline{R}\right)}{\lambda}\left(\sum_{j \neq i} q_j + q_i\right) - \left(1 + \frac{(1-\lambda)(1-\gamma)}{\lambda}\right)\right] q_i$$

From now on I assume that $1 + \frac{(1-\lambda)(1-\gamma)}{\lambda} < \overline{R}$, that is, the marginal cost of loans is lower than the highest possible return. This assumption is innocuous since otherwise there would be no lending in the market to begin with. Let $R^*(N, \lambda, \gamma)$ be the equilibrium interest rate in the second period open market. In a symmetric equilibrium:

$$R^*(N, \lambda, \gamma) = \overline{R} - \frac{\left(\overline{R} - \left(1 + \frac{(1-\lambda)(1-\gamma)}{\lambda}\right)\right) N}{N+1} \tag{1}$$

Proposition 1 *The second period equilibrium open market interest rate is decreasing in the number of banks. In other words,* $\frac{\partial R^*(N,\lambda,\gamma)}{\partial N} < 0$. *Furthermore, in the competitive limit, the second period open market interest rate is the marginal cost, that is,* $\lim_{N \longrightarrow \infty} R^*(N, \lambda, \gamma) = 1 + \frac{(1-\lambda)(1-\gamma)}{\lambda}$. *The open market equilibrium interest rate is decreasing in in the informational content of the signal* γ, *that is,* $\frac{\partial R^*(N,\lambda,\gamma)}{\partial y} < 0$. *Furthermore, in the limit case of a perfect signal* ($\gamma = 1$), *the second period open market interest rate is the traditional Cournot one, that is,* $\lim_{\gamma \longrightarrow 1} R^*(N, \lambda, \gamma) = \frac{\overline{R}}{1+N}$.

Proof: See appendix 2. ■

Propositions 1 says a few important things. The second period open market interest rate ($R^*(N, \lambda, \gamma)$), which determines the informational rent banks extract from good old borrowers, increases with market power (proposition 1). There are two types of rent: informational rent and pure market power rent. When the market gets more competitive, banks are less able to extract pure market power rent from good old borrowers: in the limit when N goes to infinity, interest rate is equal to marginal price, and only informational rent survives. On the other hand, informational rents decrease with the informational content of the signal γ. In the limit, when the signal γ goes to 1, the informational rent disappears and only pure market power rent survives.

I now derive the second period profits from good old borrowers. Since banks know, at period $t = 2$, both the type and return of their old good

borrowers, they behave as a perfectly discriminating monopolist and extract all rent from a fraction of their good old borrowers. Let $\widetilde{R}$ be the interest rate on good old borrowers. The pricing policy is:

$$R\left(\overline{R}, R^*\right) = \begin{cases} R^*, \text{ if } \frac{\overline{R}+1}{2} \geq R^* \\ \frac{\overline{R}+1}{2}, \text{ otherwise} \end{cases}$$

I solve the (more interesting) case in which the highest possible return is high enough so that the condition $\frac{\overline{R}+1}{2} \geq R^*$ is satisfied. Let q_i^1 be the first period supply by bank i, that is, the mass of good borrowers recruited in period $t = 1$. Profits from good old consumers at period $t = 2$ are:

$$\mathbf{\Pi}_{go}\left(q_i^1; \overline{R}, R^*\left(N, \lambda\right)\right) = q_i^1\left[\left(R^* - 1\right)\left(\overline{R} - R^*\right) - c\right] \tag{2}$$

Proposition 2 *For any given mass of period $t = 1$ good borrowers (q_i^1), period $t = 2$ profits from them are decreasing in the number of banks in the market. That is, $\frac{\partial \mathbf{\Pi}_{go}\left(q_i^1; \underline{R}, \overline{R}, R^*(N,\lambda,\gamma)\right)}{\partial N} < 0$.*

Proof: See appendix 2. ■

Proposition 2 simply confirms what was suggested by propositions 1 to 4: the amount of second period rent extraction decreases with market power. The more competitive the second period open market is, the lower the open market interest rate is, and the more attractive this rate is to good old borrowers.

Period $t = 1$

Using (2), and noticing that the first period profit from good and bad borrowers is the same as the second period open market profit, the profit function as of period $t = 1$ is

$$\mathbf{\Pi}\left(\mathbf{Q}_{-i}, q_i; \lambda, \gamma, \overline{R}, \underline{R}, N\right) = \mathbf{\Pi}_{fm}\left(\mathbf{Q}_{-i}, q_i^1; \lambda, \gamma, \overline{R}, \underline{R}, N\right) + \mathbf{\Pi}_{go}\left(q_i^1; \underline{R}, \overline{R}, R^*\left(N\right)\right) \tag{3}$$

Let $Q^*\left(N, \lambda, \gamma\right)$ be the total equilibrium supply of credit in the market. Solving this program and imposing symmetry, one gets:

$$Q^*(N,\lambda,\gamma) = \underbrace{\frac{N}{N+1}\left[\frac{\left(\overline{R}-1\right)\lambda}{\left(\overline{R}-\underline{R}\right)}\right]}_{Q_C^*} +$$

$$\underbrace{\frac{N}{N+1}\left[\left(\frac{R^{*^2}}{2}-R^*\right)-\left(\frac{\underline{R}^2}{2}-\underline{R}\right)+\left(R^*-1\right)\left(\overline{R}-R^*\right)-c\right]}_{Q_I^*} \qquad (4)$$

Equation (4) has content. The term Q_C^* is the common Cournot term. The novelty is term Q_I^*. It is $\frac{N}{N+1}$ multiplied by the per unit profit on old good borrowers in $t=2$.

Proposition 3 *The term Q_C^* is increasing in N. The relationship between Q_I^* in N is ambiguous. Therefore the effect of market on the equilibrium amount of credit is ambiguous. That is, $\frac{\partial Q_C^*}{\partial N} > 0$ and $\frac{\partial Q_I^*}{\partial N} \lesseqgtr 0$*

Proof: See appendix 2. ■

Proposition 3 is important. It says that an increase in N (decrease in market power) has two effects. The first comes through the term Q_C^*. This is the traditional effect of increases in the number of banks in a Cournot model. The second term is the informational effect, which comes through Q_I^*. It may be negative because $\frac{\partial R^*(N,\lambda,\gamma)}{\partial N} < 0$: the more banks (the less market power there is), the less rent banks can extract from borrowers with whom they have established a relationship. Therefore they become less aggressive in the first period. $\frac{\partial Q_I^*}{\partial N}$ is unambiguously negative if there are enough banks in the market. The analysis will assume this is so.[6] In this case, an ambiguity in the effect of market power on credit supply arises.

The interesting question is: under which circumstances is the effect of market power on equilibrium credit supply positive or negative?

Proposition 4 *If the informational content of the signal γ is high and/or if the cost of using private information c is high, then the informational effect disappears and only the traditional effect is operative.*

[6] See the Appendix on the details of the model.

Proof: See appendix 2. ■

Propositions 3 and 4 are the main bulk of the theoretical analysis and they guide the empirical analysis. Proposition 6 establishes that the effect of market power can be decomposed into the traditional and the informational effects. Proposition 7 says the latter effect will be stronger, relative to the former, the less public information there is about firms and/or the more costly it is to use private information.

2.2 Note on Assumptions

There are four crucial assumptions: quantity competition (Cournot); the arrival and life span of borrowers; the timing of arrival of the signal γ; and the inability of good borrowers to avoid second period rent extraction. I discuss the importance of these assumptions and how sensitive results are to them.

The assumption of quantity competition is often problematic since it is more natural to imagine suppliers competing in prices. It buys me the equilibrium price not degenerating to marginal cost. For it to be reasonable in this setting, it had to be true that new borrowers, who have no established relationships with any bank, perceive banks as homogeneous. Another way to justify it is as a second stage of a game, in which in the first stage banks choose quantities to be brought to the credit market and then compete in prices. See Kreps & Scheinkman (1983). Indeed, the assumption does not seem outrageous. Banks do seem to decide on portfolio allocation beforehand, which makes the total amount of small firm credit supply somewhat fixed on later periods.

The assumption on the life span of borrowers is made for convenience. In a more general model, second period borrowers would also live two periods, making the model an Overlapping Generations one. First period quantity would still enter positively in the second period profits, and therefore the informational effect would still arise.

The arrival of public information is also important. I assume banks receive a signal γ about second period bad borrowers. It facilitates the analysis by making the sign. If banks received a signal for borrowers in period 1 and 2, then public information signal γ would play exactly the same role as λ, and the cross derivative in proposition 6 would be ambiguous. It can be thought of as a credit-scoring report that contains only negative information. The mechanics of the assumption are not important, since I could equivalently

assume first period bad borrowers attempt to return to the market, but some will be labeled with a bad credit report. All that matters is that γ changes the proportion of good and bad borrowers in the second period. For this assumption to make sense it must be true that all creditors, not only the one that establishes a relationship with the borrowers, learn something about their types, especially if the type is bad. This seems reasonable in reality since credit reports are available to all creditors, and are especially informative for high risk borrowers.

Finally I make two important assumptions on the ability of borrowers to avoid future period rent extraction. First, I do not permit them to borrow from several banks in the first period. Second, they cannot transmit credibly information to other banks. Mechanically, the first assumption is just a corollary of the fact that the project is indivisible. If this was not so, borrowers would have a relationship market composed of more than one lender and the qualitative results would all go through. In the limit case, however, in which borrowers spread their borrowing among all N banks the informational effect disappears. All one needs to make this assumption innocuous is some fixed cost in obtaining loans. This produces *de facto* indivisibilities and the results would all go through qualitatively.

The second assumption is a simplification. Clearly, in real settings, the fact that borrowers have relationships with banks contains information for other banks. In the model, the extreme case is analyzed: there is no information whatsoever for other banks in the fact that borrowers have a relationship with one lender. The model is then an approximation to (more realistic) situations in which some information about borrowers is contained in the fact that they have banking relationships, or have ever received a loan. Indeed this is the whole point of private information: it is soft and not easily transmittable to outsiders.

3 The Empirical Model

3.1 Private Information, Market Power and Supply of Credit

In this section I outline an empirical model to test the predictions from the theoretical part. Proposition 6 says bank market power has two effects on quantity of credit: a traditional effect, through which bank market power re-

stricts credit; and an informational effect, through which bank market power increases credit. The former is the well known fact that suppliers with market power restrict quantity. The latter is a novelty of this paper. Lenders extract rent from private information they acquired about good borrowers. The amount of rent extraction is increasing in bank market power (proposition 1). Therefore, the more market power banks have, the more aggressive they are in recruiting borrowers and, consequently, the larger the amount of credit in early periods is.

The model also imposes restrictions on the circumstances under which one effect is likely to dominate the other. The larger the stock of public information about borrowers, the lower the amount of rent banks can extract from good old borrowers. The intuition is simple. For a lender, the value of acquiring private information about a good borrower depends on what other lenders know about this borrower. In the limit, when all in known about borrowers, there is no rent to extract out of acquired private information, regardless of the market structure. In this case the informational effect disappears and the total effect of market power on credit supply is unambiguously negative.

The empirical model allows for these features. I estimate two objects: the total effect of bank market power on credit supply, that is, $\frac{\partial Q^*}{\partial N}$ in terms of the model; and the total effect decomposed into the traditional and informational effects. Furthermore, the relative importance of these two effects is allowed to vary with the relative availability of public information about borrowers.

The relative amount of public information is measured using a concept from the banking literature: relationship lending. If there is little public information about borrowers, creditors base their lending decisions on private information. In this circumstance, one would expect them to use technologies that are specific to produce private information. Therefore the degree to which these technologies are used is a function of the availability of public information. The main technology for producing private information is relationship lending. Since it is an important concept for the purposes of this paper, I define it explicitly.

Definition 1 *Relationship Lending: Lending based on intense use of private information about the borrower, acquired through repeated interaction between creditor and borrower.*

From now on, I use the terms relative amount of public information and use of relationship lending interchangeably. If transactions between borrow-

ers and lenders are mediated through relationship lending as opposed to impersonal methods, it means the relative amount of public information is low. Systematic differences in the effect of market power between firm-bank transactions based on these two different technologies are interpreted as evidence of the relative strength of the informational effect.

3.2 Econometric Specification

Let CS_{it} be total bank credit supply for firm i at year t. Let MP_{it} be market power at the relevant baking market in which firm i is located at year t, and RL_{it} is a dummy variable that turns on if relationship lending is being used as an information producing technology to lend to firm i. The credit supply schedule for firm i is:

$$CS_{it} = f\left(MP_{it}, MP_{it} * RL_{it},\ RL_{it}, \text{controls}\right) + \varepsilon_{1it} \tag{5}$$

The theoretical exposition predicts that if the cost of using relationship lending (c) and/or if the amount of public information (γ) are high enough, then the relative importance of the informational effect is lower. That is:

$$f_1 < 0,\ f_2 > 0 \text{ and } f_3 > 0 \tag{6}$$

The predicted signs of f_1 and f_2 come straight from the discussion above: f_1 is the traditional effect of market power, while f_2 is the informational one. The total derivative of credit supply with respect to market is:

$$\frac{df}{dMP_{it}} = f_1 + RL_{it} * f_2 \tag{7}$$

The effect of market power on the supply of credit is ambiguous. Since the predicted signs are $f_1 < 0$ and $f_2 > 0$, market power will tend to have a positive effect the larger is RL_{it}, as the theory predicts. In other words, the effect of market power tends to be less negative (more positive), the more the firm-bank relationship is mediated through relationship lending. The main purpose of our empirical strategy is to estimate the parameters in (5), especially the effect (7).

Following Petersen & Rajan (1995), the effect (7) is estimated through an indirect procedure. The procedure relies on information on firms' usage of a non-formal source of credit: trade credit. Trade credit is finance provided by the firms' suppliers of inputs (other than capital) by allowing firms to pay

for goods after the delivery date. Inversely, suppliers also offer Early Payment Discounts (henceforth, EPD), which are discounts for payment before a certain date. Forgoing EDPs carry an implicit interest rate. How can a firm take advantage of them, if she wants to? Either by using cash in hand or by borrowing from other sources, such as banks. I estimate a demand for Early Payment Discounts.

Let EPD_{it} be the demand for EPDs; TC_{it} be the implicit interest rates involved in forgoing early payment discounts; $\mathbf{P}_{it}$ be the average interest rate on bank credit; INV_{it} be the amount of investment opportunity for firm i; finally, CS_{it} be bank credit supply, as defined above.

$$EPD_{it} = h\left(CS_{it}, \mathbf{P}_{it} - TC_{it}, INV_{it}, CASH_{it,}\text{controls}\right) + \varepsilon_{2it} \tag{8}$$

TC_{it} is the implicit price of forgoing EPDs. All that matters to the demand for EPDs is the difference between bank credit interest rate and the implicit interest rate in forgoing EPDs, $\mathbf{P}_{it} - TC_{it}$. The amount of bank credit supply (CS_{it}) enters the behavioral equation because small firms may be credit rationed, and hence it has an effect on demand for EPDs above and beyond the interest rate differential $\mathbf{P}_{it} - TC_{it}$. INV_{it} enters because the more investment opportunities a firm has, the more it demands of inputs and this affects how much trade credit - and its flip side EPDs - it will demand. $CASH_{it}$ is the ratio of cash in hand to assets: it controls for liquidity. I expect:

$$h_1 > 0,\ h_2 > 0,\ h_3 > 0 \text{ and } h_4 > 0 \tag{9}$$

Since CS_{it} is not observable, substitute (5) into (8) to obtain:

$$EPD_{it} = h\left(\begin{array}{c} f\left(MP_{it}, RL_{it}, MP_{it} * RL_{it}, \text{controls}\right) + \varepsilon_{it}, \\ INV_{it}, \mathbf{P}_{it} - TC_{it}, CASH_{it}, \text{ controls} \end{array}\right) + \varepsilon_{2it} \tag{10}$$

Combining (9) with (7):

$$\frac{dEPD_{it}}{dMP_{it}} = h_1 * \left(f_1 + RL_{it} * f_2\right) \lesseqgtr 0 \tag{11}$$

The ambiguity on the sign of (11) comes directly from the ambiguity of (7). Its sign depends on how large is the negative independent effect of market power (f_1), how large the interaction effect of market power and relationship

is $(R_{it} * f_2)$ and how much relationship lending is used as an information producing technology (level of RL_{it}) .

Unfortunately, bank credit interest rates are not observable. Is the conditional mean of EPDs with and without the price difference much different? Although $\mathbf{P}_{it} - TC_{it}$ correlate with market power, it is arguable that it is not. For this data set, implicit prices in forgoing EPDs are so high that $\mathbf{P}_{it} - TC_{it}$ is likely to be very high. In this case, variations in $\mathbf{P}_{it} - TC_{it}$ would not affect the demand for EPDs.[7]

3.2.1 Measurement *Caveats*

Estimating (10) involves measuring the regressors. In this subsection it is described how they are measured, and how measurement error can affect estimates.

An important *caveat* is the fact that market concentration will be used to *proxy* for market power. It is well known that market concentration is an imperfect measure of market power: high concentration is compatible with very competitive market structure, and low concentration is also compatible with little competitiveness.[8] As long as the difference between the "true" market power and concentration does not vary systematically with excluded factors, all this causes is an attenuation bias. As it will be clear below, the estimated effects would be even stronger if not for attenuation bias. Furthermore, concentration has been used in the banking literature with some success, in the sense that in other studies it did capture interesting effects. The best example is Petersen & Rajan (1995) itself.

Another concern about the measure of market power is the geographical dimension. The concentration measure available is classes of Herfindhal indexes on the *local* banking markets. Local means the MSA or the county where the firm's headquarters are located. This may increase even further the measurement error problem: the relevant banking market may be broader. In a cross-section sense, the data used in this paper suggests that some firms do business with far away banks. The question then is how relevant, as a

[7] For 1993, for example, the median annual implicit interest rate in forgoing EPDs was 106%. The mean rate is not even meaningful for it is too high. The argument is that, at the levels of $\mathbf{P}_{it} - TC_{it}$ in question, $\mathbf{P}_{it} - TC_{it}$ does not really belong to the equation.

[8] Price competition in homogenous goods markets (Bertrand) is an example of the former. Cartel is an example of the later. See Bresnahan (1989) for a comprehensive survey on estimating market power.

proportion of total firms, these are. In a time-series sense, changes in importance of these firms may be driving some of the results. As it will be clear below, neither of these concerns seems relevant empirically.

Whether banks use relationship lending, and how intensively they use, is also not observable. Length of relationship between the firm and its most important supplier of financial services is used as a *proxy*. However imperfect, length seems to be a reasonable measure, since relationship lending is defined as repeated interaction between borrower and creditor. However, the value of length as measure of how intensively relationship lending is being used may be changing over time. Hence measurement error on length is possibly increasing and this may drive some of the results, as it will be explained below.

4 The Market Power - Credit Supply Regression

In this section I estimate the empirical model proposed in section 3. There are two goals: decompose the total effect of bank market power into the informational and traditional effects; and document how the total effect is changing over time.

4.1 The Data

I use data from the Survey of Small Business Finances, conducted by the Federal Reserve Board in 1987, 1993 and 1998. Each survey is a cross-section of small firms (less than 500 employees) containing detailed information on: firms' use of bank credit and trade credit; financial standings firms; relationship between firms and their financial service providers. Together they form a synthetic panel. The SSBF surveys have two major drawbacks: lack of information on the banking market and on the characteristics of creditors. About the former, the only available information is classes of Herfindahl Index, and whether it is an MSA or not. About the latter no information at all is available. Hence I can account neither for market level factors, nor for characteristics of suppliers of credit.

The survey design was a stratified sample. Larger firms and firms owned by minorities were oversampled. All estimation procedures use weights pro-

vided in the survey to account for how representative of the general population each observation is. See Data Appendix for a detailed explanation.

4.2 The Specification

A linear specification of (10) is estimated for three years: 1987, 1993 and 1998. Let Y_i^* be the percentage of times firm i takes advantage of EPDs.

$$\begin{aligned} Y_i^* &= \beta_0 + \beta_1 \log(\text{assets}) + \beta_2 \text{Length1} + \beta_3 \text{Concentration3} \\ &\quad + \beta_4 \text{Length1} * \text{Concentration3} + \beta_5 \log(\text{age}) + \beta_6 \text{MSA} + \beta_7 \text{Legal} \\ &\quad + \beta_8 \text{numinsti} + \phi_1 \log(\text{Cash}) + \phi_2 \text{Region} + \phi_3 \text{Sector} + \varepsilon_i \end{aligned} \tag{12}$$

The mapping between the specification (12) and the empirical model (10) is the following. The first set of regressors, with associated β coefficients, corresponds to bank credit supply, that is, the function $f(\bullet)$ in (10). The second set of regressors, associated with ϕ coefficients, corresponds to the remaining terms of the EDP equation (10).

Y_i^* is a latent variable, observable only when it assumes values in the $(0, 100)$ interval.

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

Assuming that the difference between implicit interest rates on forgoing EPDs and the interest rate on bank loans is large enough, the firm would like to take advantage of more than 100% of EPDs, if she has enough bank credit and/or liquidity. Conversely, if the firm has very little or no bank credit and very little liquidity, it would like to take advantage of less than 0% of EPDs. This is equivalent to the firm offering her costumers EDPs, in order to produce liquidity. Therefore, I estimate the parameters in (12) using a Tobit with censoring at 100 and at 0. The coefficient of interest is the one on concentration3 (β_3). In table 1, variables are described, and table 2 presents summary statistics on these variables.

I estimate two versions of equation (12). First, I impose the restriction that $\beta_4 = 0$. In this specification, the coefficient β_3 represents the total effect of bank market concentration on credit supply. Then I estimate (12) without any restriction. The coefficient on concentration3 (β_3) is now the traditional

effect, and the coefficient on the interaction term (β_4) is the informational effect. The variable Length1 is 1, if the length of relationship between the firm and her main bank is longer than 6 years, and zero otherwise. For firms that have bank relationships longer than 6 years, the firm-bank transaction is mediated through relationship lending, and the effect of bank market power is $\beta_3 + \beta_4$, that is, the traditional plus the informational effect. In other words, lending for this firms is based on acquisition of private information, and the informational effect is operative. For the other firms, the transaction is mediated through impersonal methods. Lending is not based on acquisition of private information and only the traditional effect - β_3 - is operative.

The rationale for specifying length as a categorical variable comes out of the model, which indicates that there may be a relevant threshold for acquisition of private information. If this is true, short differences in length contain only noise, that is, variation that instead of helping to identify the parameters, hinders it. There is no economic reason for 6 years as the threshold for Length1. This threshold is chosen because it is roughly the median length over the three survey years. Results are fairly robust to different thresholds, as I show below.

I impose structure on the conditional variance of the error term ε_i. The dependent variable is the proportion of times the firm took advantage of EPDs that were *offered* to her. If a firm receives few offers of EPDs, the error term is noisy. This is because, conditional on all controls, the observed proportion of times the firm took advantage of EPDs is an estimate of the true desired proportion of times. Just as the sample proportion is a more precise estimator of the population proportion for larger sample sizes, the observed proportion of EPDs is a more precise estimator of the true one the larger the number of offers is. Therefore, the estimation procedure downweighs observations with few offers of EPDs, relative to observations with a large amount of offers of EPDs. Since the variance in estimating a population proportion is proportional to the inverse of the number of observations, every observation is weighted by multiplying it by the square root of the number of times the firm was offered EPDs. Let NO_i be the number of EDP offers that firm i received, and σ^2 be the (constant) variance of ε_i. Then

$$Var\left(\varepsilon_i \left| NO \right.\right) = \frac{\sigma^2}{NO_i}$$

In order to make the model homoskedastic, I multiply all variables by $\sqrt{NO_i}$. I use this as model for the variance of the error term to estimate the

model by Weighted Least Squares (WLS).

Estimates for the restricted model are presented in table 3, while the full model is presented in table 4.

In table 3, estimated coefficients have the expected signs. Column 1 has the results for 1987. The first estimated coefficient says the partial elasticity of EPD with respect to assets is -5.2% points. It means a 1% increase in size (as measured by assets) is associated with 5.2% points less EPDs being taken advantage of by the firm. This result is estimated quite precisely: p-value is 0%. The coefficient on legal indicates the effect of limited liability is -13.0% points. Older firms take more advantage of EPDs: the partial elasticity is 15.9% points, which indicates older, more established firms have more availability of bank credit. Having relationship with more than 6 years with the main bank is associated with taking 6.8% points more advantage of EPDs. Firms which spread their banking services appear to take less advantage of EPDs: each additional institution is associated with less 2.6% points less EPDs. Urban firms take less advantage of EPDs: -15.2% points less than non-urban firms. Finally, firms with more liquidity take, as expected, more advantage of EPDs: a 1% increase in cash-in-hand is associated with taking advantage of EDPs 9.2% points more times.

Finally, in 1987, firms located in highly concentrated local banking markets (Herfidahl Index > 1800) are taking advantage of EPDs 10.4% points *more* times than firms located in other banking markets. The coefficient is precisely estimated: p-value is 9%. The estimated total effect of EPDs, and hence of credit supply, with respect to market concentration is positive. In 1987, the informational effect outweighs the traditional one. This is qualitatively similar to the main result in Petersen & Rajan (1995)

This estimated coefficients on bank market concentration changes significantly for the years 1993 and 1998. In 1993, the coefficient drops to 3.6% points and it is not estimated precisely anymore. For 1998, the point estimate is *negative* 3.5% points. This is the first contribution of this paper: I document a change in the total effect of market concentration on small firms credit supply between the late 1980s and the late 1990s. Over time, the informational effect is becoming less important relative to the traditional effect.

Table 4 shows the full version of (12). For brevity I present and describe only the estimated coefficients on concentration3 and the interaction term. First, notice that introducing the interaction term reduces the estimated coefficient on concetration3 for 1987: from 10.4% points (table 3, column 1)

to 3.5% points (table 4, column 1), and is not estimated precisely anymore. Introducing the interaction term decomposes the total effect of bank market power into the traditional and informational effects. The coefficient on concentration3 is now the traditional effect. Therefore it is expected that it would go down significantly. For 1993 and 1998, the estimated coefficients on concentration3 (the traditional effect) are also significantly lower in table 4 than in table 3. Furthermore, they have the expected negative sign, as the model predicts. Precision of estimation is not very high (p-values of 30% and 22%, respectively). The sensitivity analysis below shows, however, that the negative estimated coefficient is fairly robust to changes in the specification.

The informational effect is the estimated coefficient on the interaction term. It is positive for the three survey years, as the theory predicts. For 1987, it is 14.6% points. This says that, for firms for which relationship lending is operative (length >6 years), the effect of being in a more concentrated bank market on bank credit supply is positive 28.1% points. For the other firms, it is only positive 3.5% points. For 1993 and 1998 the same general pattern holds. However, the effects are even stronger and are precisely estimated. The informational effect is, for 1993, 28.0% points, and 22.9% points for 1998, with p-values of 5% and 12%, respectively. Both the traditional and informational effect are very significant economically for 1993 and 1998. These results corroborates the theory outlined in section 2.

4.2.1 Sensitivity Analysis

Although all estimated point estimates are as predicted by the theoretical analysis, some of them are not precisely estimated. This calls for robustness checks on the specification.

Table 5 has the same model estimated above but with different thresholds for the length variable: 5 and 7 years. Although the precision of estimation falls across the board, the patterns of the five year (columns 1 to 3) and the seven year (columns 4 to 6) thresholds are similar to the six year threshold. For all three survey years the informational effect (coefficient on interaction) is positive. For 1993 and 1998 the estimated traditional effects (concentration3) are negative. Relative to table 3, all estimated coefficients on concentration3 still fall significantly.

The second robustness check is estimating the model with log(Length) instead of a categorical variable. Tables 6 and 7 present the results for the restricted and the unrestricted models. The pattern is remarkably similar to

tables 3 and 4. For the unrestricted model, the trend of the total effect of market power on bank credit supply is the same: estimated coefficients on concentration3 is positive for 1987, then negative for 1998, with 1993 in the middle. See table 6. When I decompose the total effect into the traditional and informational effects the results are the same. The estimated coefficient on concentration3 - which now is the traditional effect - drops significantly for all years. Actually the results here are stronger than in table 4: all point estimates for concentraiton3 are negative and very significant economically. Precision of estimation is about the same as in table 4. Only 1993 shows a reasonably precise estimate for concentration3, with p-value of 14%. Again, the estimated informational effect is positive, significant economically and, for 1993, significant statistically.

Finally I present a log model that is not estimated by WLS. Results are in table 8. Columns 1 to 9 show results for different specifications. In columns 1 to 3, both log(Length) and the Concentration3*log(Length) are omitted. When only log(Length) is included (columns 4 to 6), the estimated coefficients on Concentration3 does not change significantly: for 1987 it is still positive and of the same magnitude. When only Concentration3*log(Length) is included (columns 7 to 9), the estimated coefficients on Concentration3 change dramatically. For 1987 it goes from 11.6% points (column1) to *minus* 26.5% points (column 7). It becomes *negative,* as the model suggests. For 1993 and 1998, including Concentration3*log(Length) makes the estimated coefficients on Concentration3 significantly more negative: from -7.8% to -68.9% points, and from -11.6 to -65.5% points, respectively. The estimated coefficients on the interaction effect are between 10 and 14% for these years, and are estimated with precision. When the full model - with both Concentration3*log(Length) and log(Length) included - is estimated (columns 10 to 12) the coefficient on Concentration3*log(Length) falls to around 5.5% points. However, the estimates are not precise anymore, indicating that additional structure is necessary to produce precise estimates.

The robustness checks indicate that the estimated coefficient in tables 3 and 4 are product of arbitrary imposition by the specification. Imposing reasonable, guided by theory, structure on the model does not in itself impose the point estimates, but increase the precision of estimation.

5 Interpretation of Results

This section has two purposes. First, I interpret the cross section results in section 4 in the light of the exposed theory and I contemplate whether alternative explanations may also rationalize the results. Second, I evaluate several explanations for the documented trend of total effect of market power on credit supply. Unfortunately, my evidence is rather anecdotal since I do not have banking market and bank characteristics information within the survey, which would allow me assess, within my empirical model, the possible explanations.[9] Nevertheless, aggregate evidence on the evolution of the banking industry is available.

5.1 Interpretation: The Cross-Section Results

The results described in the previous section indicate that the theory has support on the data. The estimated traditional effect of market power on credit supply is negative, as one would expect. The informational effect is positive. This is true both in the specification with $\log(\text{length})$ and with length grouped above and below 6 years. Hence, the data corroborates the ideas in the model: bank market power has a negative effect on supply of credit to firms for which the bank-firm transaction is not mediated by relationship lending. In other words, if acquisition of private information is not important for producing loans, then the information effect is small and the total effect of bank market power is negative, dominated by the traditional effect.

What other explanations could rationalize these results? A simple one is the following.[10] Length does measure availability of public information about firms. There is, however, no informational effect. Firms with longer bank relationship lengths also have more established reputations. It is conceivable that it is easier for them to take their businesses somewhere else if there is lack of local bank competition. Hence the interaction effect would be just capturing the fact that banking markets for established firms are more

[9] Some authors have had access to this data (see for example Berger et. al. (2002)). It is not, however, publicly available. I am currently working towards getting access to them. Below it will be clear how one could use this information to better evaluate the explanations.

[10] I thank Tim Bresnahan for pointing this out. I also borrow part of the terminology from him.

competitive for any given level of local bank market concentration.

The explanation is compatible with local bank power having a negative or zero effect. It is not, however, compatible with local bank market having a positive effect for long bank relationship length firms, which is the case for all three survey years (see table 4). For 1998, I can evaluate the story more precisely, since the SSBF/1998 has information on the credit score of firms. If the story is true, then credit scoring should pick up the same effect as length, possibly even stronger: higher quality firms should have a more competitive credit market at their disposal. Table 9 presents the estimates of a model in which length is replaced by credit score. The variable **score** assumes values 1 to 5, where 1 represents the lowest risk category and 5 represents the highest risk category. Score picks up something: its direct effect is roughly *minus* 18% points and is significant statistically (table 9, columns 2 and 4). So higher risk firms take less advantage of EPDs, as expected. The interaction effect, however, is zero: 0.2% points (table 9 column 4). Therefore, the story that banking markets are more competitive for better firms is not supported by the data.

5.2 Interpretation: The Time-Series Results

In this subsection, I argue that the theory presented is compatible with the documented trend of the effect of bank market power on supply of credit to small firms. The aggregate trends in the US banking industry over the last 20 years made the use of relationship lending more expensive. Furthermore, public information based methods, such as credit scoring, have become cheaper and more readily available to banks. Therefore, it is not surprising that the relative importance of the traditional and informational effects is shifting towards the former.

Increasing Cost of Using Relationship Lending? Increased Availability of Public Information?

How large the informational effect is, relative to the traditional effect, depends on how costly it is to acquire or use private information and how much public information is available about firms. Relationship lending is a technology for producing private information about firms. If the cost of acquiring

or using private information (c) is high enough, the informational term disappears and market power has an unambiguously negative effect on credit. In other words, banks would not rely on acquisition of private information to produce loans, and there would be no informational effect. Addtionally, if availability of public information (γ) is high enough, then, even if the cost of using and acquiring private information is low, the informational effect disappears. In this case, the rents associated with having the private information are not enough to recoup the costs in acquiring and using it.

Relationship Lending was defined as the acquisition of private, soft information on firms through repeated interaction between the firms and their banks. Within the black box labeled "bank", private information, mostly non-verifiable, has to be transmitted inside the organization, from the originator - usually a loan officer - to the decision makers. There are both theoretical reasons and documented empirical evidence to suggest that larger, farther away, and more organizationally complex banks face a higher cost in producing and using private information. One reason is the separation of authority in deciding capital allocation and investment in soft information gathering (see Stein (2002)). In this case, the loan officer underinvests in soft information acquisition because 1) it is difficult to transmit it credibly to the decision maker on capital allocation, and 2) the agent (the CEO, for example) with authority on capital allocation decision may divert resources away from the loan officer, making his investment useless. In this sense, the more distant, organizationally, the loan officer and the ultimate decision maker on capital allocation are, the more serious this underinvestment is.

Another reason is agency costs. Incentives of agents in different layers of the banking hierarchy might not be aligned. In this case large banks are in disadvantage in using private information, since monitoring distant (either organizationally or physically) agents, is relatively difficult (see Hauswald & Marquez (2002) and Berger & Udell (2002)). One would expect then that large, organizationally complex, and geographically disperse banks would use more impersonal methods of lending, that is, they would rely more on hard, verifiable public information.

Compatible with these ideas, Berger et. al. (2003) document that larger banks shy away from borrowers without formal financial records and use more impersonal methods of interaction. Cole et. al. (1998) find that the probability that a large bank will approve small businesses' loans is insensitive to relationship type information, whereas small banks do not respond to hard information variables, such as leverage and cash-in-hand. Frame et.

al. (2001) and Akhavein et. al. (2001) document that large banks tend to adopt credit scoring methods earlier, and use them as substitutes for relationship lending. See also Berger, Frame & Miller (2002). Berger & De Young (2002) report an improvement in control, by parent banking firms, of their subsidiaries over the last 15 years. This improved control is likely to come, at least in part, from adoption of standardized methods of lending such as credit scoring, or financial statement or asset based lending. See also Berger & Udell (2002). Therefore, if the structure of the banking industry is changing towards banks becoming farther away from firms, larger and more complex, then relationship lending should become more expensive to use, and hence one should expect the informational effect to be less relevant in later periods. Furthermore, the availability of public information methods, such as credit scoring, would further undermine the relative importance of the informational effect.

Finally, it is important to notice that neither the model nor the argument above imply that large banks would lend less to small firms. All it says is that large banks would shy away from relationship lending type of technologies to produce loans. Indeed, the empirical evidence is mixed concerning the ability of large banks to lend to small firms. See Berger, Rosen & Udell (2001), Berger, Saunders, Scalise & Udell (1997) and Berger, Demsetz & Strahan (1999).

I start with an indirect measure of cost using relationship lending. By revealed preference, one can infer the degree with which banks are using relationship lending by the length of their relationship with firms. In this sense the evolution of length is informative. From table 1, the average length of relationship is indeed decreasing over time. While in 1987, the average length of a small firm and her main provider of financial services was roughly 11 years, in 1993 and 1998 it was 9.8 and 9.5 years, respectively. Therefore, it does seem that relationship lending is less relevant in the later periods. It is important to recognize, however, that the change in the mean length is driven by reallocation of probability mass among the bottom half of the distribution of length, not by an uniform decrease in length, as evidenced by table 10 and figures 1 and 2. The true decrease in length mean is, however, likely to be underestimated in the SSBF, given the widespread consolidation in the banking industry, as it will be argued below.

The evolution of distance between firms and their banks is a direct measure of cost of using relationship lending. The average distance between firms and banks has increased over the period: from 11.3 miles in 1987, to 14.9

and 33.3 miles in 1993 and 1998, respectively (table 11, row 1, columns 1 to 3). The change in mean distance is driven by non-trivial reallocations of probability mass among short term distance, and increases in distance between firms and banks that were already very far away. See table 11 and figures 3 and 4. This undermines the information contained in the increase in mean distance. Again, however, the increase in distance is likely to be underestimated.

Distance is only one part of the story. Organizational structure of banks is another. The structure of the banking market has changed dramatically in the last 20 years: deregulation of geographical restrictions has led to widespread consolidation (see Berger et. al. (1995) and Rhoades (2000)). For the purposes of this paper, I am interested in this evolution insofar as it changes the size of banks and local banking market concentration. Table 12 presents some trends for the size and number of banks, table 13 contains information of mergers by size of acquiring and acquired banks and, finally, table 14 categorizes mergers according to the organizational complexity of acquiring banks.

Size of banks, whether measured in assets or deposits, has steadily increased over the years. While an average bank had a little more than $263 million (1998 dollars for the whole discussion) of assets in 1987, it had more than $620 of assets in 1998 (table 12, row 4). The trend is monotonically increasing. Deposits follow the same pattern (table 12, rows 9 to 11). This increase was across the board. Table 11 shows that bank size increased for all three different size classes of banks (small, medium and large), although the increase is more pronounced among large banks.[11] This is mostly due to consolidation in the banking industry during the1980s and 1990s, which caused a significant decrease in the number of commercial banks (from 11,462 in 1987 to 8,774 in 1998, see table 12). This consolidation involved mainly larger banks buying smaller banks: the number of large banks actually increased, and the major fall in the number of banks occurred in the small bank category (see table 12). Table 13 confirms this pattern yet again: the size of acquiring banks is, on average, 29 times of the acquired bank.

Closely related to the trend in size, banks became more complex organizationally. Commercial banks can be divided in three broad categories: multibank holding companies, one-bank holding companies and indepen-

[11] Small banks: assets less than U$ 100 million. Medium banks: assets between U$ 100 million and U$ 1 billion. Large banks: more than U$ 1 billion.

dent banks. The two last categories are more complex organizationally. As expected, since organizational complexity correlates with size, most of the mergers in the 1980-1998 period had a multi-bank holding company as the acquiring party: 64% on average (see table 14). One-bank holding companies come second, with 27% on average for the period. There is no significant trend in these percentages, except perhaps for the diminishing importance of independent banks, the simplest organizational form, as acquiring banks. Therefore the average organizational complexity of banks has increased over time.

What can be made out of this? The evidence in tables 10 to 14 shows that most of the increase in bank size is due to larger banks growing larger by acquiring small and medium sized banks. Furthermore, it appears that larger banks acquired a significant amount of smaller banks in markets they previously did not operate (see table 15 on horizontal *versus* market extension mergers). This indicates that cost of using relationship lending has increased over time, implying a decrease in the relative importance of the informational effect.

The evidence on the increase in bank size and complexity is more convincing than the evidence on the decrease in relationship length and on the increase in distance between banks and firms. Length and distance refer to the bank the firm does business with, not the corporate entity that owns it. Since there was a considerable change in ownership in the sample period, towards larger and more complex banks taking over smaller, simpler banks, the relevant change in length and distance are underestimated. The same observed length, for example, of relationship in 1998 corresponds, on average, to a lower relationship with the ultimate owner of that bank than in 1987. The fact that the average acquiring bank is significantly larger that the acquired only reinforces the argument: large banks find relationship lending less valuable than the previous, and on average smaller, bank. The same argument can be made about distance: the relevant distance between the firm and bank, from an organizational view point, may be the distance between the firm and the bank's headquarters. Again the merger activity in the industry indicates firms and banks' headquarter are farther apart than what is reported in the survey.

Why is the Traditional Effect Increasing?

The change in estimated average total effect of market concentration on credit is due, partially, to the traditional effect becoming more pronounced. This could be rationalized in two ways: mechanically, if the difference in average concentration between the classes of Herfidahl indexes is increasing; and economically, if the high concentration markets are becoming more concentrated. The former is obvious. The later is subtler. Evidence on the relationship between number of competitors and competition regime in geographically localized market for other industries shows that competition increases mainly with the first few entrants in the industry.[12] In other words, if high concentration markets are becoming even more concentrated, even in absolute terms, the effect of the dummy concetration3 should be larger. Again both these explanations seem to be falsified by the aggregate data available. Table 16, taken from Rhoades (2000), presents some averages on the trend on local banking market concentration.

The pattern one can take away from table 16 is that concentration increased in originally less concentrated markets. Among MSAs, roughly half of them experienced increases in concentration. Among those that experienced increases in concentration the original level of concentration was relatively low: an average Herfidahl Index of 1690 between 1984 and 1991, and 1696 between 1991 and 1998. The average increase was 353 units between 1984 and 1991, and 486 units between 1991 and 1998. Among those that experienced decreases in concentration the original level of concentration was relatively high: an average Herfidahl Index of 2227 between 1984 and 1991, and 2237 between 1991 and 1998. The pattern for non-MSAs is similar, though their original level of concentration was much higher. This fact falsifies the idea that differences in averages between concentration classes in the SSBF are increasing. It actually indicates they are decreasing, since concentration increased (decreased) mostly in previously not so concentrated (concentrated) local banking markets.

[12] See Bresnahan & Reiss (1990, 1991).

6 Conclusion and Future Research

This paper establishes two important empirical facts. First, bank market power has two effects on supply of credit to small firms. On the one hand, it decreases supply of credit through the traditional effect. On the other hand, it increases supply of credit through the informational effect. Second, the relative importance of the two effects has changed in the 1987-1998 period: while in 1987 the total effect of market power was positive, in 1993 and 1998 it became negative. Estimates suggest that this change is significant. Both these findings are consistent with the theory presented.

I cannot establish precisely what factors were driving this change since I do not observe local bank market and bank characteristics. I can, however, present explanations based on aggregate data on the evolution of the banking industry over the last 20 years. Changes in the structure of the banking industry, especially the increase in organizational complexity and size of banks, seem to have caused an increase in the cost of using relationship lending (see Berger et. al. (2002)). Although the informational effect is still operative, its relative importance has decreased over time.

The questions left partially unanswered in this paper open an interesting research agenda on how bank market power affects credit markets. First, the tentative evidence presented here suggests that the changing organizational structure of banks will change how bank market power affect credit supply to small firms, through the informational effect. Second, not only are banking markets are becoming more concentrated, but also concentration has an increasingly negative effect. Regarding the former, making the tentative explanation sharper demands richer information about the characteristics of banks within the SSBF data set. This would allow assessing how the informational effect varies with bank size and complexity. Explaining the latter involves more information on local bank market characteristics. This would allow for a more refined analysis of the traditional effect of bank market power.

Lastly, the results in this paper have important policy implications. Over time, the informational effect became less operative, because of the increased cost of using relationship lending as a private information production technology. This is due to the changing structure of the banking industry towards the prevalence of large, nationwide banks. If this trend continues unabated, the results of this paper indicate bank market power will have an increasingly negative effect on credit supply to small firms. In this case, concerns

about the effect of increasing bank market power on the supply of credit to informationally opaque borrowers, such as small firms, are legitimate.

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APPENDIX 1: DATA

The main data source is the National Survey of Small Business Finances 1987 (NSSBF 1987) and the Survey of Small Business Finances 1993 and 1998 (SSBF 1993 and 1998, respectively), performed by the Federal Reserve Board. The three surveys together form a synthetic panel for which an observation is a firm.

Each survey is composed of a cross section of small firms (≤ 500 employees). The design was a stratified random sample. Stratification was in 2 dimensions for 1987, size of firm (in number of employees) and broad census region, and 3 dimensions for 1993 and 1998, size, region and minority ownership. In all three surveys larger firms were oversampled, and for 1993 and 1998 ethnic minority owned firms were also oversampled. Hence, different firms did not have, *ex ante*, the same probability of being included in the sample. Weights are provided and all estimation procedures in this paper take into account the different probabilities of being included in the sample. Weights also correct for sample selection due to non-responsiviness. Since it has been shown that non-responsiviness correlates with credit worthiness, this is an important feature of the SSBF. Sample sizes vary from survey to survey, and unfortunately, so does coverage and some definitions of the variables.

Although some questions differ among survey, in general the data is comparable between surveys. The main advantages of this data set is its richness of information on the firm level usage of financial products, including substitutes to formal bank credit, such as trade credit. The main flaw is its lack of bank characteristics and local bank market information. While about the latter only classes of Herfindhal indexes are available, no information at all is available about the former. For further details on the survey procedures, the weighting corrections and general information on the SSBFs, see the technical publications available on the Federal Reserve Board's website. I list them in the references.

Note on the Early Payment Discounts

The variable Early Payment Discount (EPD) is reported differently for the different survey. In the 1998 and 1987 surveys, it is the percentage of cash discounts offered by suppliers the firm took advantage of. In the 1993 survey, five classes are reported. None, fewer than half, about half, more than half, almost or all. I map this into numerical classes: % of EPD $\in (0, 20)$, % of

EPD $\in (20, 40)$, % of EPD $\in (40, 60)$, % of EPD $\in (60, 80)$ and % of EPD $\in (80, 100)$. The mapping is rather arbitrary, but the estimates are robust to different mappings.

APPENDIX 2: DETAILS OF THE MODEL

The Free Market Interest Rate

Let q_i be the quantity supplied by bank i to good borrowers at the second period free market. In order to supply this quantity to good borrowers, bank i must supply bad borrowers with a quantity $q_i \frac{(1-\lambda)(1-\gamma)}{\lambda}$. Let $\mathbf{Q}_{-i} = (q_1, ..., q_{i-1}, q_{i+1}, .., q_N)$ be the vector of quantities for all banks except i. The profit function for bank i is:

$$\mathbf{\Pi}_{fm}\left(\mathbf{Q}_{-i}, q_i; \lambda, \overline{R}, \underline{R}\right) = \left[\overline{R} - \frac{\left(\overline{R} - \underline{R}\right)}{\lambda}\left(\sum_{j \neq i} q_j + q_i\right) - \left(\frac{\lambda + (1-\lambda)(1-\gamma)}{\lambda}\right)\right] q_i$$

At the optimal:

$$q_i^* = \frac{1}{2}\left(\frac{\left(\overline{R} - \frac{\lambda + (1-\lambda)(1-\gamma)}{\lambda}\right)\lambda}{\left(\overline{R} - \underline{R}\right)} - \sum_{j \neq i} q_j\right)$$

In a symmetry equilibrium, $q_i^* = q_j^* = q^* \forall i, j$:

$$q^* = \frac{\left(\overline{R} - \frac{\lambda + (1-\lambda)(1-\gamma)}{\lambda}\right)\lambda}{\left(\overline{R} - \underline{R}\right)(N+1)}$$

Let R^* be the equilibrium interest rate. Then

$$R^*(N, \lambda, \gamma) = \overline{R} - \frac{\left(\overline{R} - \frac{\lambda + (1-\lambda)(1-\gamma)}{\lambda}\right)N}{N+1}$$

Proof of Proposition 1

Straightforward differentiation: $\frac{\partial R^*\left(\overline{R},N\right)}{\partial N}=-\frac{\left(\overline{R}-\frac{\lambda+(1-\lambda)(1-\gamma)}{\lambda}\right)}{(N+1)^2}<0$

Straightforward differentiation: $\frac{\partial R^*\left(\overline{R},N\right)}{\partial \lambda}=-\frac{(1-\gamma)N}{(N+1)}<0.\blacksquare$

Proof of Proposition 2

Result follows directly from Proposition 1 and differentiation of (2). ■

Derivation of the Equilibrium Quantity of Credit Q^* in $t=1$

Using (2), I can write the profit function as of period 1 as:

$$\mathbf{\Pi}\left(\mathbf{Q}_{-i},q_i;\lambda,\gamma,\overline{R},\underline{R},N\right)=\mathbf{\Pi}_{fm}\left(\mathbf{Q}_{-i},q_i^1;\lambda,\gamma,\overline{R},\underline{R},N\right)+\mathbf{\Pi}_{go}\left(q_i^1;\underline{R},\overline{R},R^*\left(N\right)\right)$$

Solving this program:

$$2q_i^1+\sum_{j\neq i}q_j=\frac{\left(\overline{R}-1\right)\lambda}{\left(\overline{R}-\underline{R}\right)}+\left(\frac{R^{*^2}}{2}-R^*\right)-\left(\frac{\underline{R}^2}{2}-\underline{R}\right)+\left(R^*-1\right)\left(\overline{R}-R^*\right)-c$$

Define Q^* to be the total equilibrium supply of credit in the market. Imposing symmetry and solving for q^*, and multiplying by N, one gets:

$$Q^*=\underbrace{\frac{N}{N+1}\left[\frac{\left(\overline{R}-1\right)\lambda}{\left(\overline{R}-\underline{R}\right)}\right]}_{Q_C^*}+$$

$$\underbrace{\frac{N}{N+1}\left[\left(\frac{R^{*^2}}{2}-R^*\right)-\left(\frac{\underline{R}^2}{2}-\underline{R}\right)+\left(R^*-1\right)\left(\overline{R}-R^*\right)-c\right]}_{Q_I^*}$$

Proof of Proposition 3

For the first part, trivially:

$$\frac{\partial Q_C^*}{\partial N} = \frac{1}{(N+1)^2}\left[\frac{\left(\overline{R}-1\right)\lambda}{\left(\overline{R}-\underline{R}\right)}\right] > 0$$

For the second part.

$$\begin{aligned}\frac{\partial Q_I^*}{\partial N} &= \frac{1}{(N+1)^2}\left[\left(\frac{R^{*^2}}{2}-R^*\right)-\left(\frac{\underline{R}^2}{2}-\underline{R}\right)+\left(R^*-1\right)\left(\overline{R}-R^*\right)-c\right] \\ &\quad +\frac{N}{N+1}\left[\overline{R}-R^*\right]\frac{\partial R^*\left(N,\lambda,\gamma\right)}{\partial N}\end{aligned}$$

By Proposition 1 $\frac{\partial R^*(N,\lambda,\gamma)}{\partial N} < 0$. Therefore the second term is negative. Since $\overline{R} \geq R^* \geq \underline{R}$, the first term is positive. ■

Proof of Proposition 4

By inspection, when γ and/or c are high, the amount of rent extraction will be zero or negative. In this case the second term on (3) disappears and only the tradtional Cournot term survives.■

VARIABLE
$\text{Concentration1} = \begin{cases} 1, \text{ if Herfidahl Index on Banking Market} < 1000 \\ 0, \text{ otherwise} \end{cases}$
$\text{Concentration3} = \begin{cases} 1, \text{ if Herfidahl Index on Banking Market} > 1800 \\ 0, \text{ otherwise} \end{cases}$
$\log(\text{Assets})$ = Log of book value of assets
$\log(\text{Agefirm})$ = Log of age of firm
$\log(\text{Cash})$ = Log of cash in hand (end of fiscal period)
$\text{Legal} = \begin{cases} 1, \text{ if legal Status in not Limited Liability} \\ 0, \text{ otherwise} \end{cases}$
$\log(\text{Length})$ = Log of length of relationship between firm and main provider of financial services
Numinst = Number of financial institutions firm does business with
Region = Set of census region dummies
Sector = Set of Economic Sector Dummies
$\text{MSA} = \begin{cases} 1, \text{ if firm is located in a Metropolitan Statistical Area} \\ 0, \text{ otherwise} \end{cases}$
Score = Credit Score for the firm. 1=lowest risk, 5=highest risk

Descriptive Statistics: Means and Standard Deviations of Regression Variables

	YEAR								
	1987			1993			1998		
	Mean	**St. Dev**	**Nº obs**	**Mean**	**St. Dev**	**Nº obs**	**Mean**	**St. Dev**	**Nº obs**
Early Payment Discounts (%)	63.72	1.25	1929	59.47	0.90	2213	59.53	1.45	1473
Assets (US$ thd)	476.25	32.52	3224	488.58	26.94	4632	415.04	21.02	3553
Cash (US$ thd)	46.24	3.31	3224	137.52	12.24	4541	45.82	4.22	3472
Legal (%)	48.41	-	3224	51.26	-	4632	55.05	-	3560
Agefirm (months)	13.34	0.25	3224	14.32	0.22	4632	13.36	0.22	3560
Length (months)	132.78	3.02	3128	102.72	1.86	4465	94.17	2.12	3452
Nº of Institutions	1.98	0.02	3224	2.03	0.02	4632	2.01	0.02	3560
Concentration3 (%)	47.73	-	3224	51.41	-	4632	52.72	-	3560
MSA (%)	75.91	-	3224	78.94	-	4632	79.92	-	3560
Same MSA/County (%)	93.07	-	3224	91.72	-	4632	89.91	-	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	**10.4**	**3.6**	**-3.5**
	(.09)	**(.60)**	**(.69)**
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. Nº of observations: 1896 (1987), 2169 (1993) and 1456 (1998). WLS with square root of number of EPD offers as weight. *p*-values in parentheses.

Dependent Variable: % of Early Payment Discounts Taken

	1987	1993	1998
Concentration3	3.5	-11.0	-13.5
	(0.73)	(.30)	(.22)
Concentration3*Length1	14.6	28.0	22.9
	(.26)	(.05)	(.12)

Table 4 Tobit Estimates. Upper censoring at 100 and lower censoring at 0. Nº of observations: 1896 (1987), 2169 (1993) and 1456 (1998).WLS with the square root of the number of early payment discounts as weights. Length1 = 1, if length ≥ 6 years, 0 otherwise. All other controls in tables 3 and 4 included. *p*-values in parentheses.

Dependent Variable: % of Early Payment Discounts Taken

	Threshold = 5 years			Threshold = 7 years		
	1987	**1993**	**1998**	**1987**	**1993**	**1998**
Concentration3	3.2	-6.6	-14.0	7.0	-2.4	-10.9
	(.74)	(.55)	(.24)	(0.42)	(.80)	(.31)
Concentration3*Length1	11.2	20.0	21.7	8.0	12.8	18.0
	(.34)	(.16)	(.14)	(.58)	(.37)	(.22)

Table 5 Tobit Estimates. Upper censoring at 100 and lower censoring at 0. Nº of observations: 1896 (1987), 2169 (1993) and 1456 (1998).WLS with the square root of the number of early payment discounts as weights. Columns 1 to 3, Length1 = 1, if length ≥ 5 years, 0 otherwise. Columns 4 to 6, Length1 = 1, if length ≥ 7 years, 0 otherwise. All other controls in tables 3 and 4 included. *p*-values in parentheses.

Dependent Variable: % of Early Discount Payments Taken

Independent Variables	YEAR 1987	1993	1998
	Financial Characteristics		
Log(Assets)	-5.7	5.7	-7.1
	(.04)	(.00)	(.00)
Log(Cash)	9.7	-0.4	10.8
	(.00)	(.73)	(.00)
	Firm Characteristics		
Legal	13.2	6.2	8.4
	(.00)	(.41)	(.29)
Log(Agefirm)	13.0	8.0	87.3
	(.00)	(.20)	(.00)
	Relationship Characteristics		
Log(Length)	7.5	5.9	9.8
	(.03)	(.20)	(.00)
Number of Institutions	-2.8	-4.0	-6.1
	(.27)	(.12)	(.03)
	Banking Market Characteristcs		
Concentration3	**11.7**	**2.9**	**-4.0**
	(.06)	**(.70)**	**(.64)**
MSA	-14.1	-0.4	-2.1
	(.09)	(.97)	(.83)
Upper-Censored	893	1048	590
Uncensored	746	715	546
Lower- Censored	257	406	320

Table 6 Source: Federal Reserve Board – Survey of Small Firms' Finances. Tobit estimates: upper censoring at 100, lower censoring at 0. WLS with square root of number of offers of EPDs as weights. Nº of observations: 1896 (1987), 2169 (1993) and 1456 (1998). *p*-values in parentheses.

Dependent Variable: % of Early Payment

	1987	1993	1998
Concentration3	-22.4	-48.0	-31.9
	(.42)	(.14)	(.29)
Concentration3*log(Length)	7.8	12.0	6.6
	(.19)	(.11)	(.32)

Table 7 Source: Federal Reserve Board – Survey of Small Firms' Finances. Tobit estimates: upper censoring at 100, lower censoring at 0. WLS estimates with square root of number of times firm was offered EPDs as weight. 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.

Dependent Variable: % of Early Discount Payments Taken

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

Table 8 Source: Federal Reserve Board – Survey of Small Firms' Finances. Tobit estimates: upper censoring at 100, lower censoring at 0. 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.

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 9 Source SSBF 1998. Same as 4a with log(length) substituted for credit score. *p-values* in parentheses

	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 10: Source: Federal Reserve Board – SSBF. Probabilities implied by estimated density functions. Method of Estimation: Adaptive Kernel. Length is measured in years, all number are in percentage points.

	Year				
				Difference	Difference
	1998	1993	1987	1998-1993	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 11: Probabilities implied by estimated density functions. Method of Estimation: Adaptive Kernel. Distance is measured in miles, all number are in percentage points

		Year						
		1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Nº of Banks	**Small**	8,292	7,789	7,259	6,658	6,203	5,853	5,408
	Medium	2,790	2,787	2,800	2,861	2,926	2,922	2,974
	Large	380	382	392	421	398	368	392
	All	11,462	10,958	10,451	9,940	9,527	9,143	8,774
Average Assets	**Small**	35	38	39	41	43	45	46
	Medium	210	215	222	228	235	245	244
	Large	5,616	6,252	6,985	7,369	8,670	10,764	11,386
	All	263	300	349	406	463	540	620
Average Deposits	**Small**	32	33	34	36	38	40	40
	Medium	181	183	186	191	195	209	202
	Large	4,088	4,371	4,699	4,847	5,710	7,146	7,308
	All	202	223	250	285	323	380	420

Table 12: Source: FDI. Evolution of average assets and deposits of commercial banks, by size category. Small = assets less $100 million, Medium = assets between $100 million and $1 Billion and Large = assets more than $1 Billion. Dollar amounts in 1998 $ million.

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

	Organizational Type of Acquirer (%)		
Year	**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 14 Source: Rhoades (2000). Mergers by acquirer organizational type, in percentage points.

	Type of Merger	
Year	**Horizontal**	**Extension**
1980	45	55
1981	49	51
1982	50	50
1983	65	35
1984	54	46
1985	44	56
1986	50	50
1987	33	67
1988	41	59
1989	56	44
1990	53	47
1991	55	45
1992	41	59
1993	51	49
1994	53	47
1995	33	67
1996	35	65
1997	37	63
1998	40	60
Average	47	53

Table 15 Source: Rhoades (2000). Type of merger, in percentage points. Horizontal: same market. Market Extension: acquirer previously did not operate in market.

MSAs with increase in Herfindahl Index	1984-1991	1991-1998
% of all MSAs	50	45
Average Herfidahl Index in 1984	1690	1696
Average Increase in herfidahl Index	353	486
Average 1998 dollars Deposits (millions)	6,173,853	11,353,253
MSAs with decrease in Herfindahl Index		
% of all MSAs	50	55
Average Herfidahl Index in 1984	2227	2237
Average decrease in Herfidahl Index	312	446
Average 1998 dollars Deposits	5,648,101	5,206,553

Non-MSAs with increase in Herfindahl Index	1984-1991	1991-1998
% of all MSAs	45	38
Average Herfidahl Index in 1984	3348	3417
Average Increase in herfidahl Index	488	596
Average 1998 dollars Deposits (millions)	213,327	250,406
Non-MSAs with decrease in Herfindahl Index		
% of all MSAs	55	62
Average Herfidahl Index in 1984	1193	1308
Average decrease in Herfidahl Index	55	62
Average 1998 dollars Deposits	195,415	246,586

Table 16 Source: Rhoades (2000). Trend of averages of Herfindahl index, by MSA, Non-MSA.

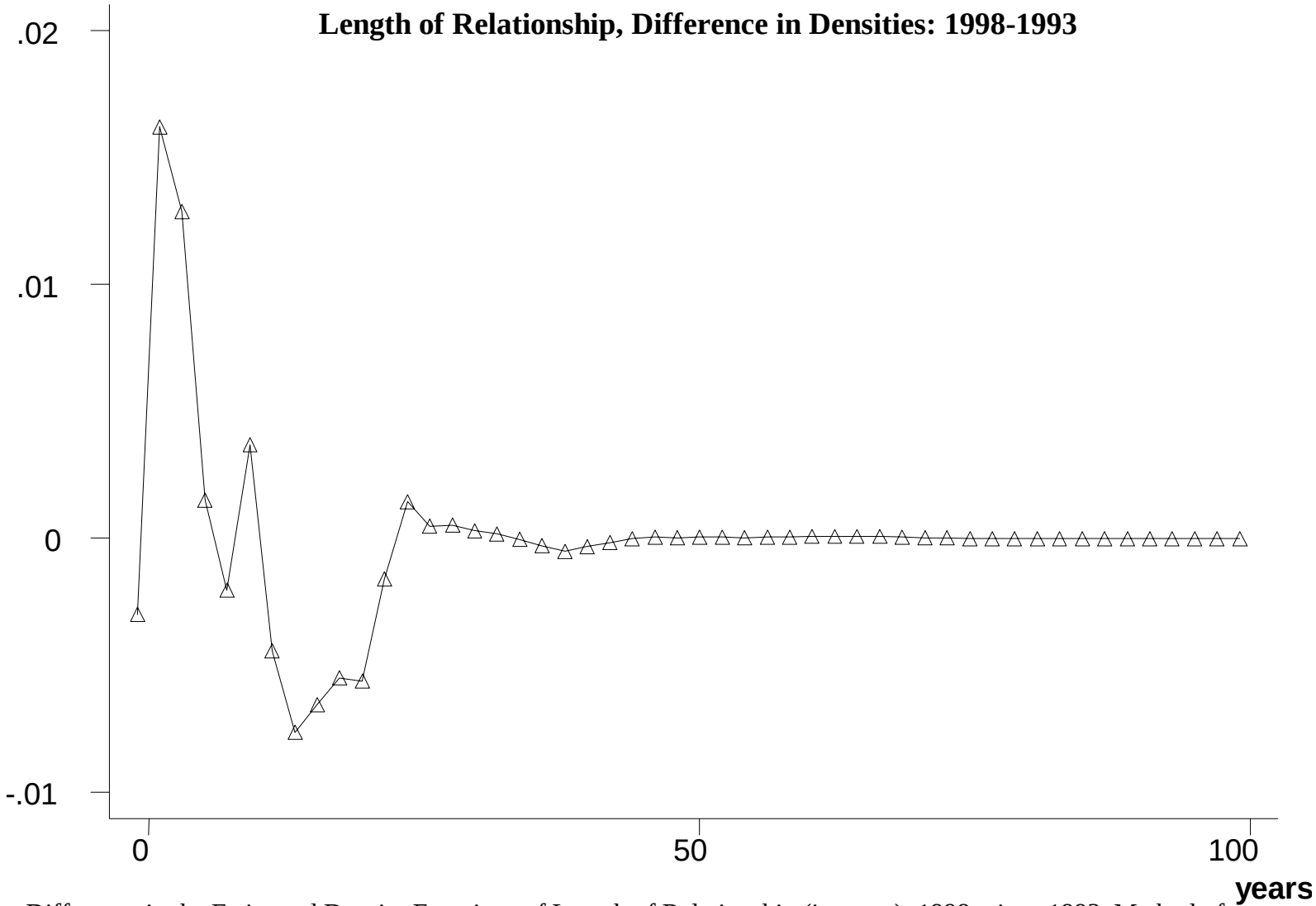

Figure 1a: Difference in the Estimated Density Functions of Length of Relationship (in years): 1998 minus 1993. Method of Estimation:: Adaptive kernel, with Epanechnikov Kernel.

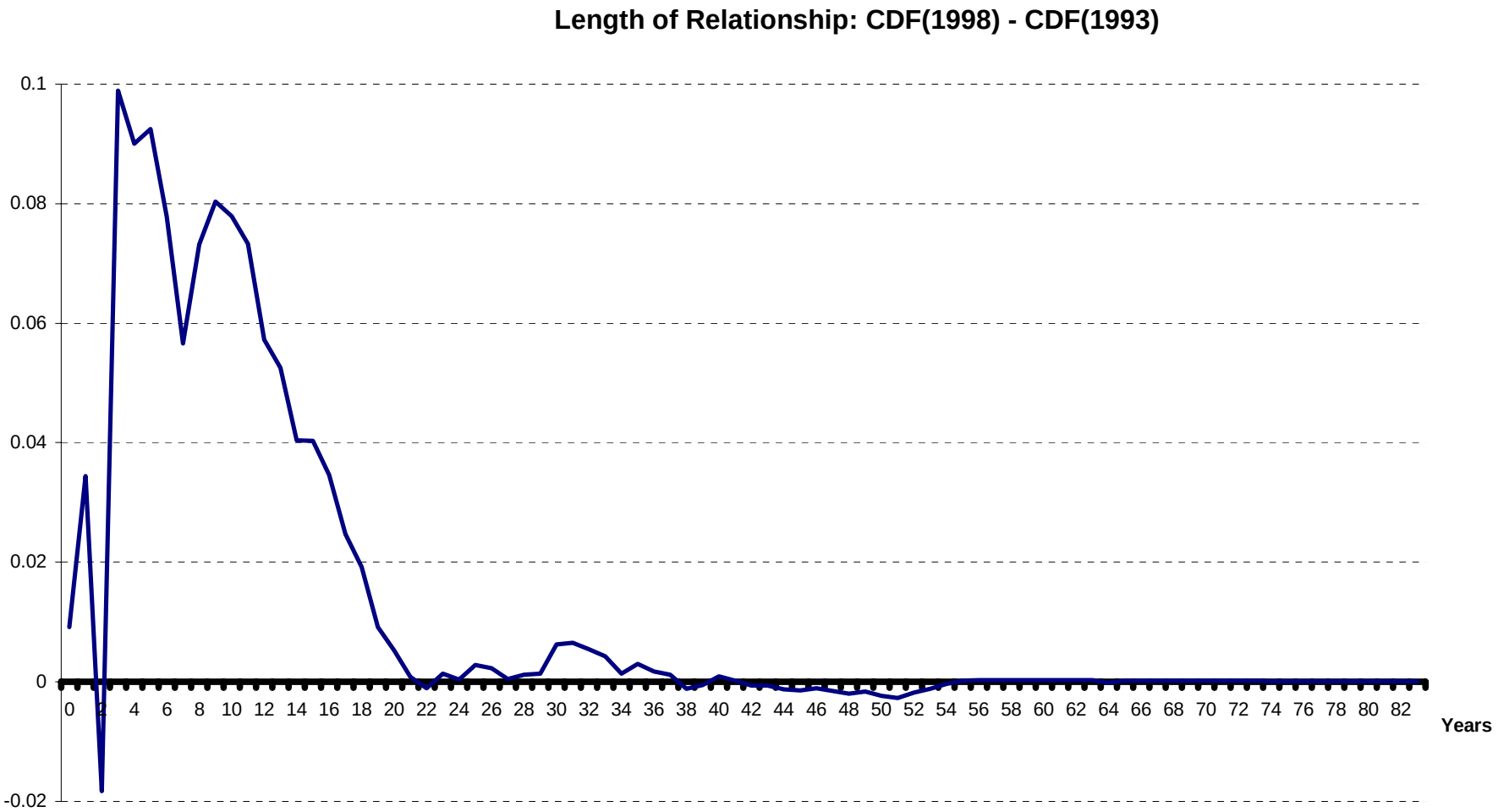

Figure 1b: Difference in the Estimated Cumulative Distributions of Length of Relationship (in years) : 1998 minus 1993. Method of Estimation:: Adaptive kernel, with Epanechnikov Kernel.

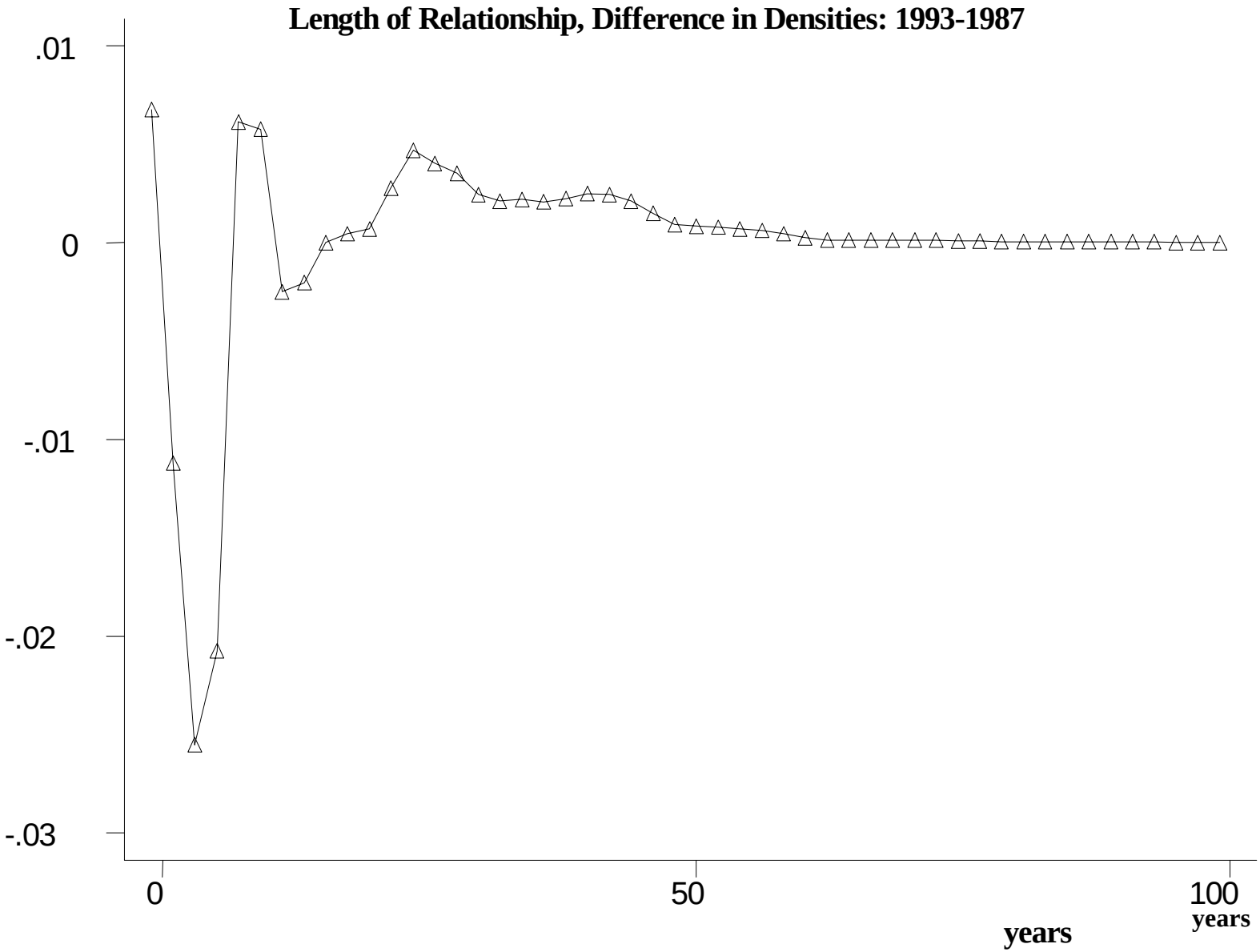

Figure 2a: Difference in the Estimated Density Functions of Length of Relationship (in years) : 1993 minus 1987. Method of Estimation:: Adaptive kernel, with Epanechnikov Kernel.

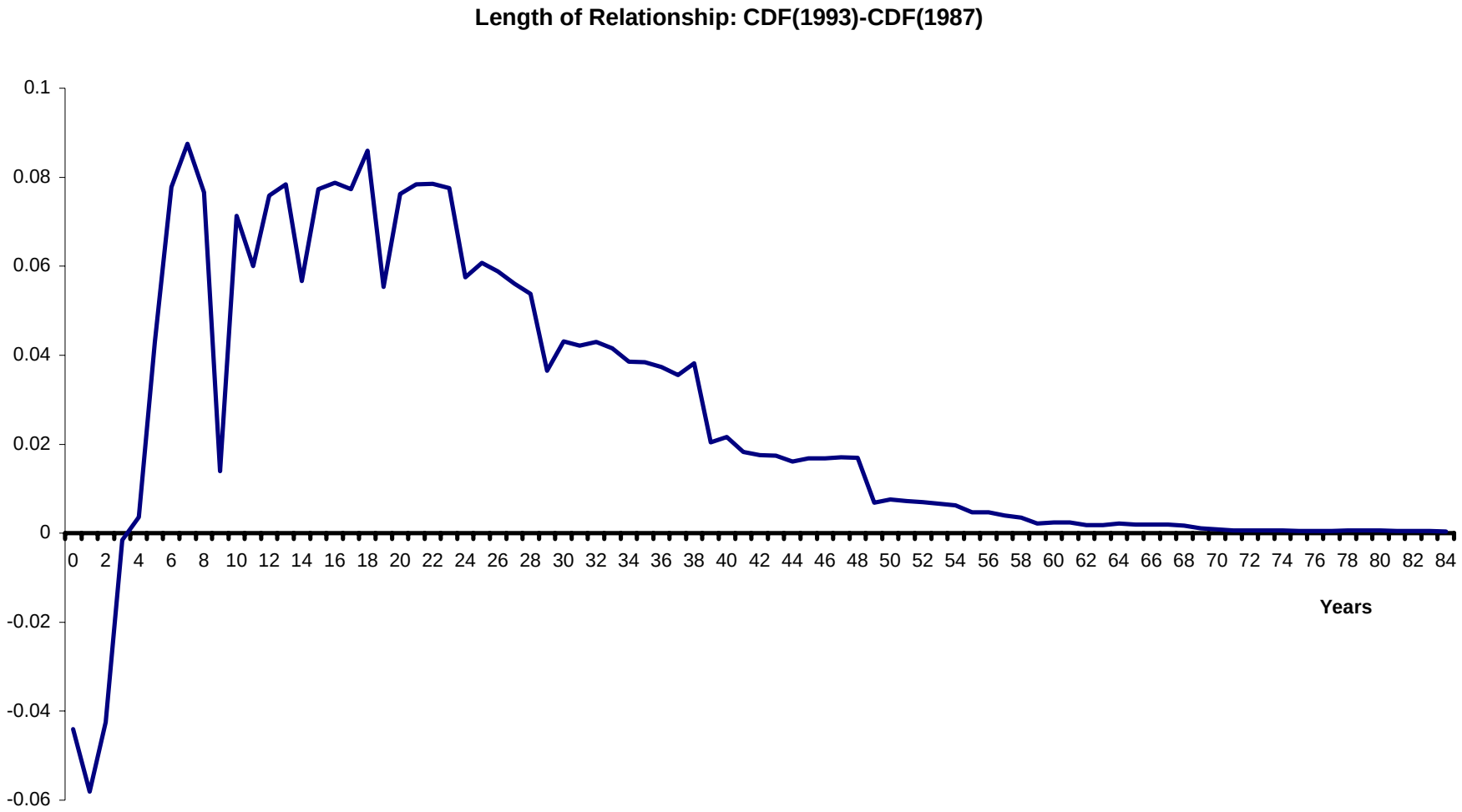

Figure 2b: Difference in Estimated Cumulative Distributions of Length of Relationship (in years): 1993 and 1987. Method of Estimation: Adaptive Epanechnikov Kernel.

Distance Between Firm and Main Bank, Difference in Densities: 1998-1993

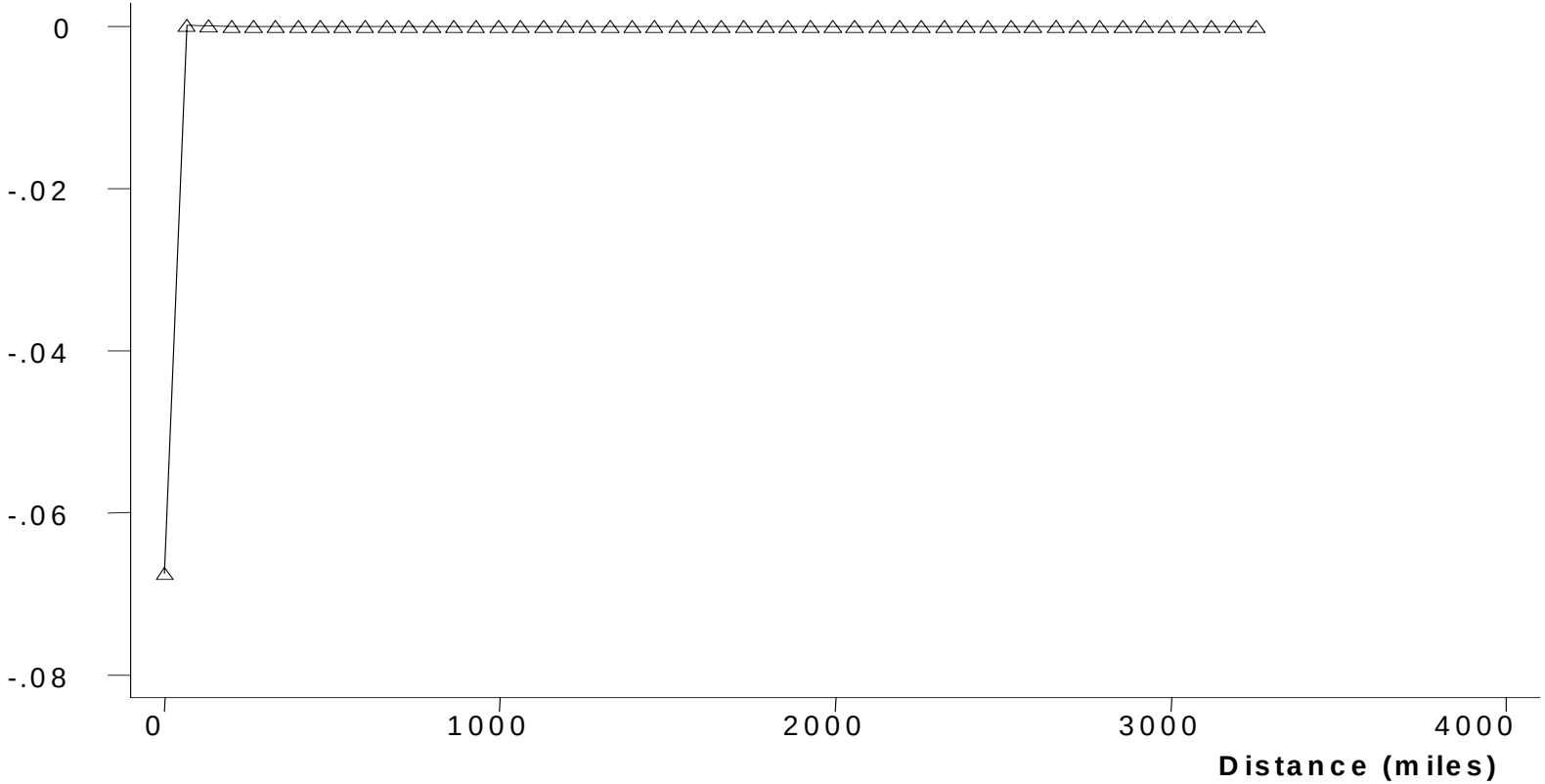

Figure 3a: Difference in the Estimated Density Functions of Distance (in miles): 1993 minus 1987. Method of Estimation: Adaptive kernel, with Epanechnikov Kernel.

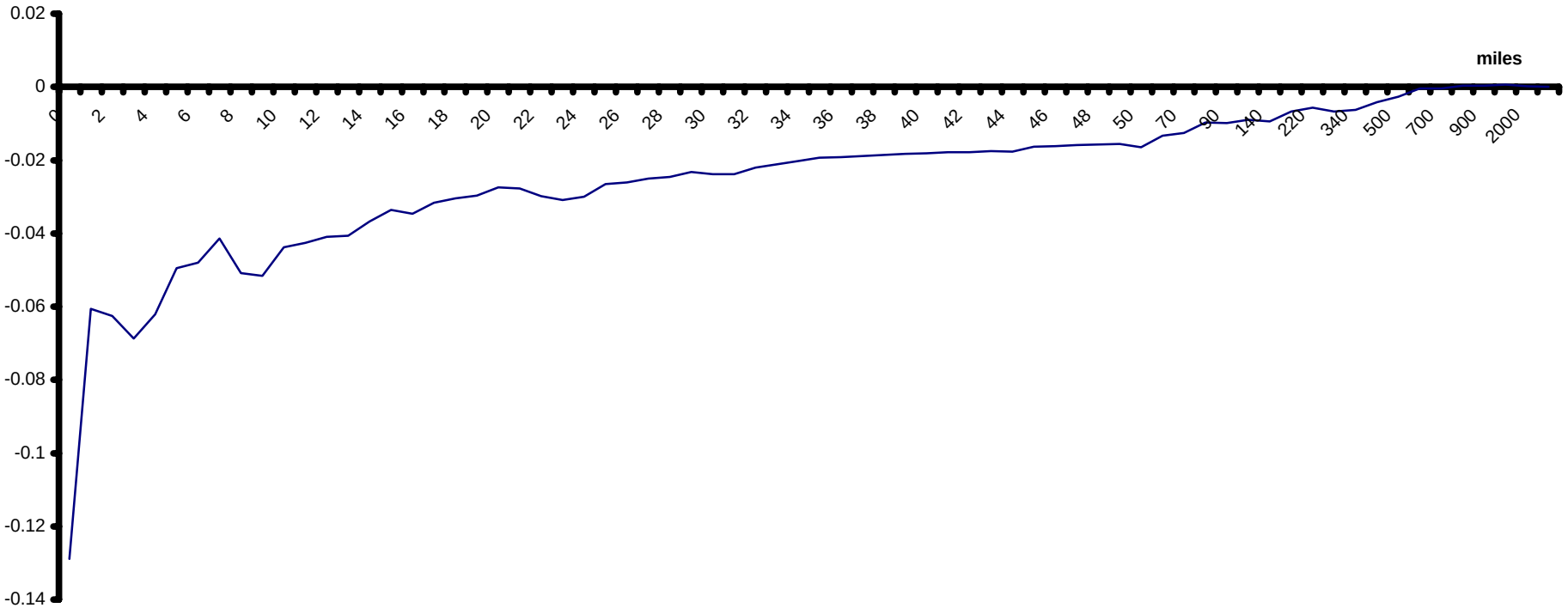

Figure 3b: Difference in the Estimated Cumulative Distributions of Distance (in miles): 1993 minus 1987. Method of Estimation:: Adaptive kernel, with Epanechnikov Kernel.

Distance Between Firm and Main Bank, Difference in Densities: 1993-1987

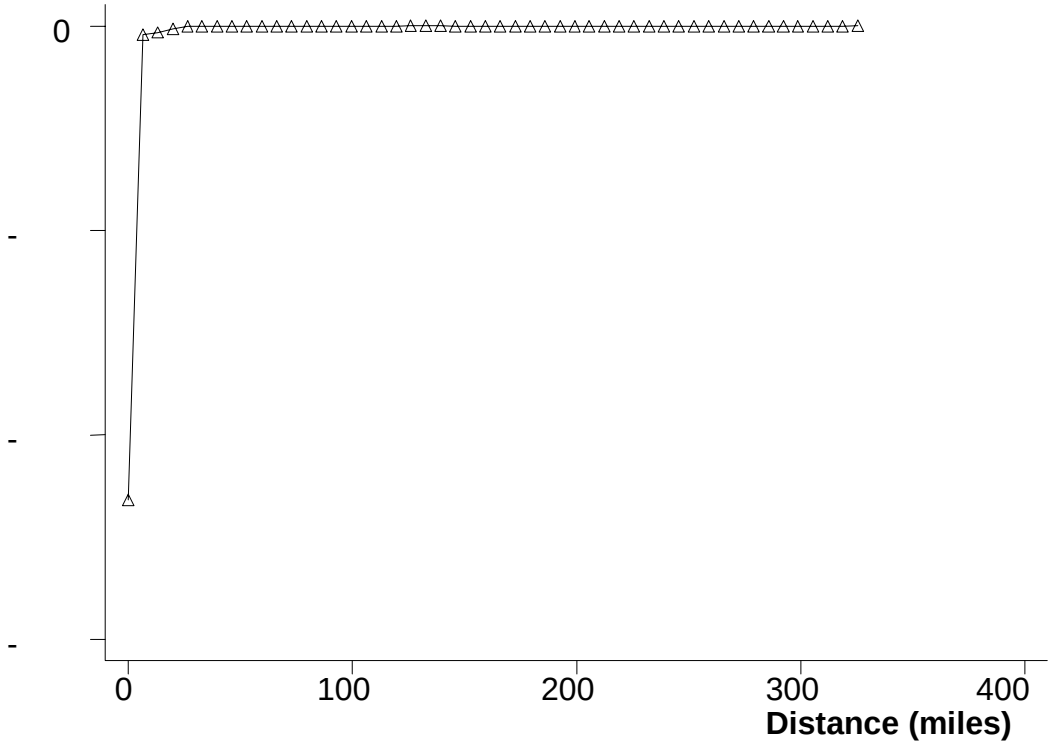

Figure 4a: Difference in the Estimated Density Functions of Distance (in miles): 1998 minus 1993. Method of Estimation: Adaptive kernel, with Epanechnikov Kernel.

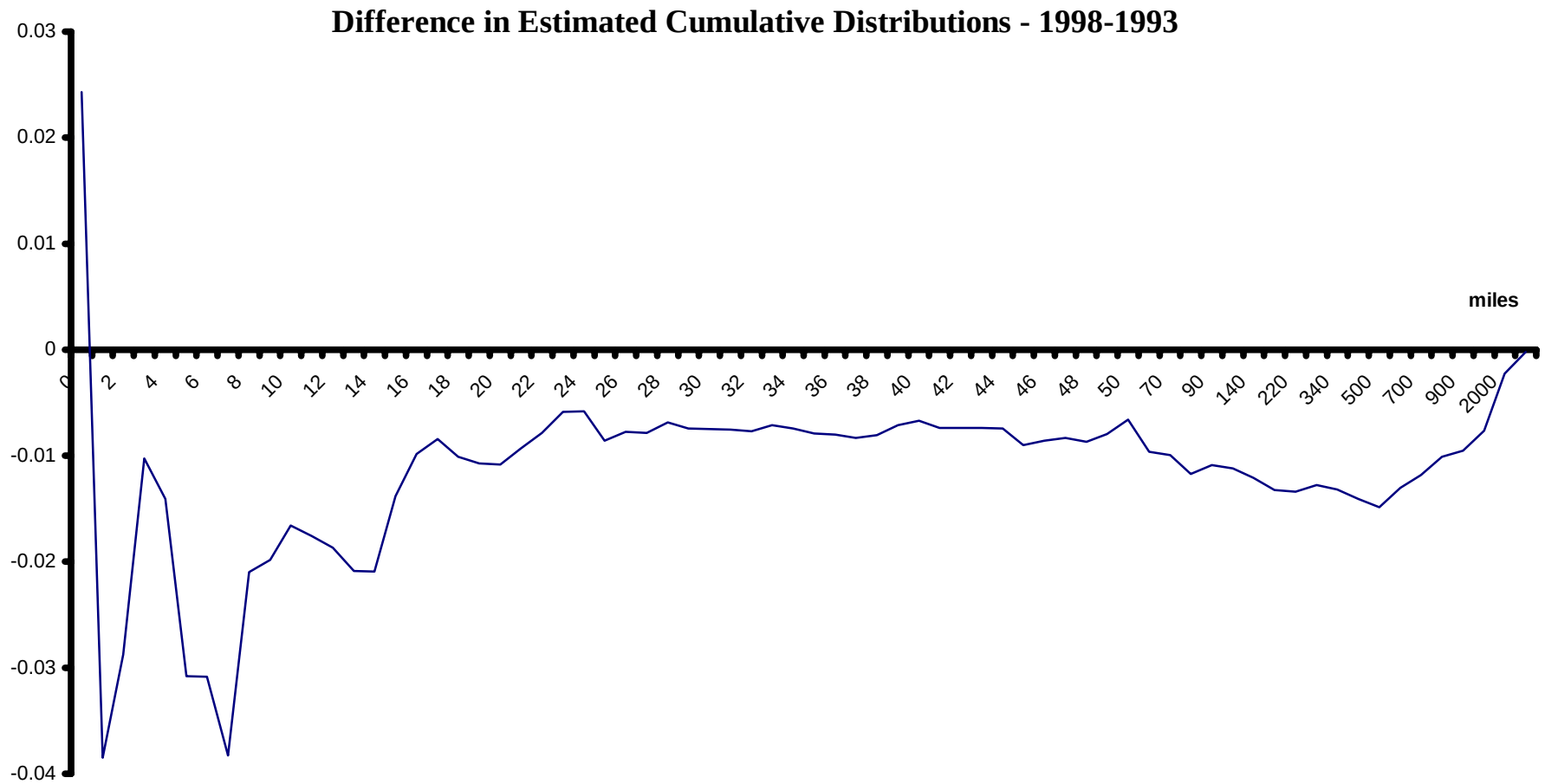

Figure 4b: Difference in the Estimated Cumulative Distributions of Distance (in miles): 1998 minus 1993. Method of Estimation:: Adaptive kernel, with Epanechnikov Kernel.