Israel Economic Review Vol. 3, No. 1 (2005), 23–51

MARKET POWER OF BANKS AGAINST LARGE FIRMS— WHAT HAS CHANGED WITH THE OPENING OF THE ISRAELI ECONOMY

HEDVA BER AND SIGAL RIBON*

The gradual opening of the Israeli economy to the rest of the world during the 1990s, occasioned by globalization and the liberalization of capital flows, gave Israel's large firms more ways of financing their activities. This study asks whether this process decreased the market power of domestic banks vis-à-vis these firms, as reflected in the price that the firms paid for non-indexed NIS (domestic-currency) credit from the banking system, and asks which firms gained the greatest benefit from this process. The database that we used contains unique information about the entire set of industrial firms that are traded on the Tel Aviv Stock Exchange, including the interest rates that they paid for bank credit in 1993–2000 and information about their relations with the banks that lent to them. The main finding is that the firms as a class paid less for credit during the decade but some benefited more than others: those that maintained close relations with domestic banks, i.e., those that did most of their borrowing from a small number of banks or had long-term relations with them, and those oriented to domestic activity, i.e., that did little exporting.

1. INTRODUCTION

Israel's banking system is heavily concentrated and dominant in financial intermediation between lenders and borrowers. This dominance is reflected in the high share of sources of finance that firms raise from banks as opposed to non-banking financial entities (the capital market, institutional investors, etc.) and in the very wide variety of financial services that the banks provide in addition to classical services of lending and deposits. Over the years, this structure of activity and the banks' dominance has induced banks and firms to form close relationships. During the 1990s, however, as a result of globalization and liberalization measures applied to the domestic economy, firms were given more alternatives in obtaining sources of finance and financial services from financial intermediaries and investors abroad. Thus, they were able to raise sources from foreign banks and on foreign stock exchanges—and some of them put this possibility into practice. When a large number of foreign banks entered the Israeli economy, firms became even more able to obtain financial services

* Bank of Israel, Research Department.

We thank David Gheva and Arad May of the Bank of Israel Banking Supervision Department for helping us and giving us access to data and information; Vladimir Lifshitz, Roni Percik, Konstantin Kosanco, and Ohad Reich for their great assistance in gathering and processing the data; Yishay Yafeh, Eugene Kandel, Yona Rubinstein; participants in the Sapir Forum seminar; and participants in the October 2003 conference of the Research Department, "The Effect of the Reform and Policy Changes on the Israeli Economy," for their useful comments. The study was written for the Sapir Forum. We thank the Forum for its support.

(underwriting of issues, financing of mergers, etc.) from these intermediaries instead of the domestic banking groups. Did these processes induce the banks to compete more vigorously for large firms' business, and if it did, did all firms benefit from this?

Our goal in this study is to examine the banks' market power vis-à-vis Israel's large businesses in view of the liberalization of capital flows and the possibility that such firms—or some of them—would raise sources of finance in alternative ways. We want to find out whether relationship banking affects the banks' ability to exploit their market power when setting the price of credit they extend to these firms and whether their ability in this respect changed when the Israeli economy was opened up to the rest of the world during the 1990s. The interest rate firms are asked to pay is crucial among the factors behind their investment decisions, which, in turn affect the aggregate rate of investment. For the purpose of our inquiry, our main research question is: Did the effect of relationship banking on the price (interest rate) of bank credit change during the 1990s? In other words, as the economy opened up over the years, did the rent that the banks charged to large businesses when they set the interest rate on credit decrease, and which firms benefited the most from this? We posit two hypotheses: (1) before the economy was opened up and the firms' access to foreign sources of finance improved, the banks exploited their close relations with some firms and the fact that some firms had no access whatsoever to overseas alternatives (because they were oriented to domestic activity and not to exports) to charge them a higher lending rate. (2) After the liberalization, in contrast, the banks' ability to do so either diminished or disappeared altogether.

The unique database used in this study includes microeconomic information about manufacturing firms traded on the Tel Aviv Stock Exchange in 1993–2000. These firms constitute a sample of Israel's population of large businesses; their sales account for 40 percent of total manufacturing sales (which come to one-fourth of business-sector gross product). Therefore, it is important and interesting to see how the banks compete for their custom, even though, of course, they are not representative of the entire population of Israeli firms because they have the characteristics of size, goodwill, and proven access to non-banking sources of finance. The database includes the prices (interest rates) that each manufacturing firm paid for credit each year, itemized by types of credit taken (indexed, non-indexed, etc.), and was amassed manually from notes to the annual financial statements. We augmented these data by culling information from the databases of the Banking Supervision Department, including information about the number of banks from which each firm borrowed, the amount of bank credit taken, and information about how the financing bank classified each firm's riskiness. On the basis of the last-mentioned type of information, we were able to define variables that reflect the intensity of the bank–firm relationship. Additionally, we added for each firm data about characteristics such as profitability, size, age, and so on, as shown in the firms' financial statements.

The data on the interest rate paid for credit, on the one hand, and the firms' relations with the banks, on the other hand, allow us to examine directly the questions of competition and changes in competition in a way that, to the best of our knowledge, has not been performed in studies in Israel thus far.[1] In particular, we use the microeconomic information to conduct

[1] Gheva (1979) examined a sample of 600 customers in search of factors that affect the cost of credit in revolving capital facilities and found that firm size, industry, and the bank–firm relationship affect the interest rate.

a differential examination and ask which firms engage in relationship banking and whether the opening of the economy to the rest of the world has affected different firms differently. Notwithstanding its uniquenesses, however, our database has several drawbacks. The first, of course, is that it includes information only about publicly traded firms, which are not representative of the entire population of Israeli firms. Its second drawback is derived from the link that we created with data from the Banking Supervision Department, because the Department has data only on firms that are defined as large borrowers and not on all traded companies. In practice, however, a large number of traded companies are large borrowers from the banking system.[2] Third, we focus on the banks' lending interest rate and have no information about fees that these firms paid the banks.

Our work ties in with a vast literature that has developed vigorously in recent years about the advantages and disadvantages of relationship banking and that relates to the fields of financial intermediation and industrial organization. According to this literature, the effect of relationship banking, which may be reflected, for example, in a firm's borrowing from only one bank or working with the same bank for several years, is not unequivocal. The protracted nature of the relationship and its concomitant—the refinement and expansion of the bank's information about the firm—may allow the bank to charge the firm a lower price for credit over time because its uncertainty about the firm's quality declines. However, long-term relations may enable the bank to exploit its monopolistic power and charge the firm a higher interest rate for the credit that it provides (the captive-customer problem). According to the latter approach, relationship banking allows a bank to lower the price of credit (and make more credit available to the firm) at the outset of the relationship, when the firm has little goodwill, because the bank knows that it will be able to charge a higher price later on, when the firm establishes itself and becomes more dependent on its relationship with the bank. Thus, the bank subsidizes lending at the beginning of its relationship with the firm, expecting the firm to profit later on. In this case, the firm's relationship with the bank allows the bank to benefit from these future earnings. This approach is also linked to the discussion of switching costs in the Industrial Organization literature. This is because we may assume that asymmetric information generates switching costs for the lender when moving from one bank to the other. Klemperer (1987, 1995) shows, using a simple model, that the existence of switching costs is expected to generate market power and monopolistic profits. In a two-period model the price is expected to be higher in the second period after the customer was captured. Beyond that, the price in both periods may be higher relative to the situation with no switching costs.[3]

In recent years, much empirical evidence has been amassed in favor of the latter approach, showing on the basis of the firms' data that relationship banking increases the value of the firm, makes more credit available to the firm, but raises the price that the bank charges the firm for credit. Much of this evidence was obtained in regard to small and medium enterprises, which are typified by information asymmetry and poor access to sources of finance. Several studies, however, looked into the effect of relationship banking on traded companies (which,

[2] We correct the estimation for the bias that selection may cause.

[3] Kim, Kliger and Vale (2003) show for the Norwegian banking system that switching costs between banks are on average about 4.2 percent (about a third of the average price of credit at that time), and in the large banks about 2 percent. According to their model, switching costs produce about a third of the market power of banks against their customers.

for the most part, are also larger).[4] Large businesses are important due to their large share in economic activity, as stated.

Additional literature that relates to our study discusses the effect of opening up the economy on financial intermediation. The literature about countries around the world presents evidence that competition in intermediation increases after an economy is opened up to the rest of the world and foreign banks enter. This literature probes the effects of the opening up of economies mainly by means of data from banks and not from borrowers. Other studies ask how opening up and liberalizing an economy affects banks' ability to exploit their relations with firms to charge them a higher price for credit (Weinstein and Yafeh, 1998). There is also some research evidence about the effect of the liberalization of the Israeli economy on competition in financial intermediation. According to this evidence, the liberalization led to an increase in competitive behavior. This happened in commercial banking even though the number of banks did not change, due to the very possibility of firms' borrowing abroad (Ribon and Yosha, 1999). In regard to another financial field, underwriting services, it was found that although the liberalization did prompt foreign investment banks to become active in Israel, they served only a certain group of customers and not customers at large. Therefore, not all domestic firms enjoyed the benefits of their entry and gained from the increase in competition (Ber, Lucamat, and Nachmani, 2002). The contribution of our study lies in its microeconomic examination of the influence of the economic liberalization on the banks' exploitation of market power, focusing on borrowing firms. Our interest in this study is to establish a link between the literature on relationship banking and the literature on the effect of capital-flow liberalization, and to examine whether the influence of relationship banking in Israel on the price of credit that the firms paid changed after the economy was opened up and firms were given more alternatives in raising sources of finance.

The main findings of the study are that the spread between the cost and the price of credit narrowed during the 1990s—i.e., the rent charged by banks to large firms as an aggregate decreased—but that the change was more beneficial to some firms than to others. Several findings reflect this. First, the spread between the price of credit charged by banks and the domestic risk-free interest rate narrowed during that decade. Although we examined the pricing of credit for large firms, we found that at the beginning of the decade the banks charged these firms a higher interest rate than that warranted by the firms' riskiness and quality. As stated, however, the domestic banks' ability to charge a high price declined significantly, and the main reason seems to have been the opening up of the economy to the rest of the world. The most meaningful finding of the study is that two kinds of firms gained the most from the capital-flow liberalization and the ability to raise sources outside the banking system—those that practiced relationship banking and those oriented to domestic activity (i.e., that did little exporting). At the beginning of the decade, the banks exploited their power to charge these firms a higher interest rate, but in the second half of the 1990s this ability diminished severely and, according to various indicators, actually disappeared. Thus, we show that the indicators of relationship banking (such as length of the relationship in years and the concentration of the firm's bank credit) had an upward effect on the price of credit paid by the firms at the beginning of the decade but had no significant effect on credit price at the end of the

[4] Houston and James (1996) examined the effect of relationship banking on traded companies (i.e., large firms) in the U.S. Agarwal and Elston (2001) explored the same issue in regard to large firms in Germany.

decade. Furthermore, at the beginning of the decade, firms that exported—i.e., were active in foreign markets, and therefore, had good reputation in these markets—were evidently able to raise sources from alternatives to domestic banks and, therefore, paid less for credit from domestic banks. (In other words, they had greater demand elasticity in borrowing from domestic banks.) Moreover, firms that were not active abroad (that did not export) evidently found it difficult to raise sources abroad at the beginning of the decade. Over the years, however, even non-exporting firms apparently acquired the ability to raise sources abroad in view of the increases in capital inflows and in foreign investors' interest in domestic firms. In addition to these findings, we obtained results about how the banks set the price of credit. The main results pointed in the expected direction: the riskier the firm, the more it has to pay the banks for credit, and vice versa.

The rest of the study is organized in the following way: Part 2 presents the theoretical and empirical background and the conceptual framework of the analysis. Part 3 presents the data, Part 4 shows the estimation and its results, and Part 5 summarizes the study.

2. THEORETICAL BACKGROUND AND METHODOLOGY

a. The effect of relationship banking

One of the main functions of financial intermediaries (hereinafter, for brevity's sake, banks) is to deal with the problem of information asymmetry between borrowers—owners of ventures that need to be financed—and lenders, who own sources of finance. A vast literature that has developed over recent decades claims and shows that banks have an advantage in gathering information about and keeping track of firms, resulting in the creation of mechanisms of supervision over firms' activities (Boyd and Prescott, 1986; Leland and Pyle, 1997). Additionally, various empirical studies, focusing on traded firms, have shown that the market takes a favorable view of information indicating that a firm has received credit from the banking system (e.g., Lummer and McConnell, 1989). For the process of gathering of information by the lender to take place, the borrower–lender relationship obviously must be long-term and not transitory. Against this background, a literature on relationship banking has developed over the past decade. The concept of relationship banking lacks a precise and unequivocal definition but is invoked to denote long-term relations between a bank and a customer that signify a greater commitment on the bank's part to the borrower's solvency. Several variables point to the existence of such a relationship. The most direct indicator is the duration of the relationship, a variable that may represent the possibility that the bank has amassed its own information about the customer. To measure the intensity of the relationship, the share of the main lender in the firm's total debt, or some other indication of concentration of the firm's borrowing, is used (e.g., Hans and Van Cayseele, 2000; Blackwell and Winters, 1997). The more concentrated the firm's relationship with the bank is, the stronger one should expect the relationship to be. Another criterion that the literature uses to examine the quality of a bank–firm relationship is additional services that the bank provides the firm, as Cole (1998) shows in detail.

Most of this literature focuses on empirical examination of the implications of relationship

banking (or relationship lending) on the availability and price of credit. (Some studies also look into the effect of the relationship on the firm's profitability and growth rate.) A small number of studies establish the theoretical basis for analysis of the phenomenon. This literature gives rise to two main approaches that predict opposite effects of relationship banking on credit availability and price.

According to the first approach, relationship banking is advantageous in several ways:

a. It facilitates better monitoring of moral-hazard problems of the firms' executives.
b. It facilitates greater flexibility and discretion in bank–lender relations. Both sides find it easier to renegotiate loans in relationship banking than when a firm borrows from the capital market, for example.
c. It facilitates financing of transactions from which the bank may profit in the long term but not in the short term.
d. It gives the firm access to a wide variety of banking services (in the case of a universal bank) in addition to credit and allows the firm to benefit from the economies of scope and scale in financial intermediation.

In view of these characteristics, this approach argues that long-term relationship banking enhances the availability of credit to the firm and allows the bank to improve its lending terms after it gauges the borrower's quality. Therefore, we would expect to find a long-term decline in lending interest. Boot and Thakor (1994) present a theoretical model that elicits this result. They show that long-term relationship banking improves wellbeing by allowing banks to issue (secured) credit at a submarket price after they determine the borrower's quality. Petersen and Rajan (1995) also show, by means of a simple model, that banks charge good borrowers lower interest after they learn to distinguish between good and bad borrowers.[5]

The second approach, in contrast, claims that relationship banking has disadvantages that originate in two factors.

a. A strong relationship between a firm and a bank may create a "captive-customer" situation. In other words, the information that the bank gathers about the firm will allow the bank to exploit monopolistic power against the firm, especially after the venture being financed is under way (Rajan, 1992). Banks amass market power vis-à-vis borrowers even though they may be in a state of ex ante competition. It is also possible that when a firm works with one bank, it obtains financial services other than credit, such as management of provident funds for its employees, investment-banking services, etc. The complexity and diversity of the relationship make it difficult for the firm to change banks, and for this reason the firm becomes the bank's "captive."
b. The bank's "flexible budget" allows it to be insufficiently tough with the firm, resulting in a situation of throwing good money after bad.

Overall, the prolongation of relationship banking is actually reflected in a long-term increase in lending interest. The models shown in Greenbaum, Kanataz, and Venezia (1989) and Sharpe (1990) are consistent with this approach.

Many studies have tested empirically the existence of effects of firm–bank relations on the price of loans and loan availability. The best known of them are Petersen and Rajan (1994),

[5] The more market power the bank has, the smaller the decrease in interest will be. See discussion below of the relationship between the extent of competitiveness in the market and the implications of long-term relationship banking.

Berger and Udell (1995), and Weinstein and Yafeh (1990). They elicit various results that correspond to one of the alternative theories mentioned above. Petersen and Rajan (1994) looked into the effect of relationship banking on both the price and the availability of loans. Although they hypothesize that more information reduces risk and, therefore, should be reflected (in a competitive market) in lower interest, they find no significant effect of the duration of the bank-customer relationship on loan price. Petersen and Rajan suggest the possibility that in a non-competitive market, the advantages of relationship banking will be manifested not in a lower price for credit but in greater availability. They also find that the more banks a firm works with, the higher the interest rate it will pay. The availability of bank credit for the firm, measured in terms of the extent of use that the firm makes of suppliers' credit, which is more expensive, is affected by the firm's relationship with its bank. Relations with more banks make credit not only more expensive but also less available. Weinstein and Yafeh (1998), examining the effect of relationship banking in Japan (where relationship banking has unique features that include issue of credit, holding of shares, and appointment of bank officials to posts in the firm), found that such relations raise the cost of credit to the firm but make sources of finance more available.[6] In contrast, Berger and Udell (1995), who analyzed relationship banking by examining information on lines of credit, found that as the bank–borrower relationship perseveres, the borrower pays lower interest and is asked to provide less collateral. They trace the difference between their results and the others to their focus on lines of credit, which, they say, are more representative of loans that depend on long-term relationship banking.

Additional studies that probe this issue in regard to the United States and various European countries do not report unequivocal results that allow us to decide between the two alternative theories. Blackwell and Winters (1997), using American data, Repetto, Rodriguez, and Valdes (2002), based on data for Chile, and Bodenhorn (2003), using a unique database including details about loans given by a bank in New York in the middle of the nineteenth century found that the longer the firm's relations with the bank last, the lower the interest rate it pays on credit. Elsas and Krahnen (1990) and Dietmar and Korting (1998), looking into data for Germany, as well as Cole (1998), found no significant correlation between duration of relations and price of credit, whereas Degryse and Van Cayseele (2000) found in regard to small Belgian firms that the price of credit actually rises over time. Examination of the correlation between concentration of the firm–bank relationship and credit price also fails to elicit unequivocal results. Elsas and Krahnen (1998) found that the greater the concentration, the lower the interest rate. Dietmar and Korting (1998) for Germany and Cosci and Melicianti (2002) for Italy found no such correlation, and Repetto, Rodriguez, and Valdes (2002) found that concentration raises the interest rate charged. Onenga and Smith (2000) review the literature on relationship banking and present tables that summarize the findings of studies in this field in regard to the characteristics of relationship banking and its effect on the firm. They, too, indicate that one cannot draw clear-cut conclusions about the effect of relationship banking on cost of credit. Most studies find, however, that closer relations with the bank improve the firm's access to credit.

[6] Agarwal and Elston (2001) find for Germany, where the characteristics of relationship banking resemble those in Japan, that firms with close relations with banks have better access to sources but pay more for bank credit—much as Weinstein and Yafeh (1998) found.

b. Opening the economy and its effect on competition in financial intermediation and on firms

During the 1990s, the Israeli economy underwent many changes that made it more open to the rest of the world. Various regulatory barriers against external borrowing were lifted at the beginning of the decade (Gottleib and Blejer, 2001). In the second half of the decade, in the aftermath of globalization and the increase in foreign investors' willingness to participate in financing Israeli firms' activities, Israeli firms became much more active in raising sources on foreign stock exchanges (Blass and Yafeh, 2001), long-term capital inflows increased, and foreign investment banks became active in the country. All these factors gave Israeli firms, especially large ones, more access to alternative sources of finance and mitigated the exclusivity of domestic banks as suppliers of sources.

The literature discusses the effect of newly established openness on the price and availability of bank financial services to firms. Weinstein and Yafeh (1998) referred directly to this question and examined how the liberalization and deregulation in the 1980s in Japan affected firm–bank relations in view of various parameters of firm activities—profitability, credit availability, and credit price. It was just then that Japanese firms were first allowed to raise capital and debt in foreign capital markets, and indeed, raising of non-banking sources, both domestic and foreign, increased significantly. The results of the study show that these changes made the banks less able to exploit their close relations with firms to charge them a higher price for loans. Yafeh and Yosha (2001) also discuss the connection between the literature on relationship banking and that on opening of economies. They showed that relationship banking can serve domestic banks as a strategy for barring additional banks from the market after the economy is opened to the rest of the world. Applying tools from the literature of industrial organization, they found that greater the potential of the entry of additional banks due to a liberalization process that makes the economy more open, the more domestic banks will invest in strengthening relations with their customers. The more market power the banks have (up to a certain level), the more they stand to gain by such an investment. Investing in long-term relations has the effect of keeping the industry structure uncompetitive. Our study ties in with these works due to our interest in examining whether the effect of relationship banking on the interest rate paid by large Israeli firms changed after Israel deregulated capital inflows.

Other studies on the opening of economies deal largely with the effects of the entry of foreign banks in the domestic market on the performance of domestic banks. In other words, the matter is observed from the perspective of the financial intermediaries' balance sheets and not by examining the effect of the influx of foreign intermediaries on economic activity at large or on that of the borrowing firms. This is a narrow way of examining the matter because it tests the effect of the literal (physical) entry of foreign banks, whereas effective change in the financial intermediation market may also occur due to a liberalization of capital flows that allows domestic firms to take credit from banks abroad. Claessens, Demirguc-Kint, and Huizinga (2001) survey the effect of the entry of foreign banks to some eighty countries in 1988–1995. The general conclusion of their analysis is that the presence of foreign banks is usually reflected in the erosion of domestic banks' profitability and narrowing of interest spreads. Denizer's far-reaching study (1997) examines the effect of the liberalization process in Turkey, which included the admission of foreign banks. Denizer found that the reforms reduced concentration in the banking market, mainly by lowering the market share of large

banks. However, the study did not find a significant change in the extent of competitiveness in banking. Wright (2002), who looked into a similar topic for Australia, which lifted restrictions on the entry of banks in 1985, found that the entry of foreign banks made the system more competitive and that riskier behavior by banks had an effect on the foreign banks' business results. In an analysis for the Philippines, Unite and Sullivan (2003) found that the entry of foreign banks coincided with a decline in profitability, narrowing of interest spreads, greater efficiency, the deterioration of credit quality, and a competition-enhancing decrease in the importance of relationship banking.

As mentioned, the effect of relationship banking on the price (or availability) of credit may depend on market structure and especially, on the number of market players. As a result of liberalization, the (effective) number of banks available to borrowers increases even if the number of domestic banks does not change. Therefore, lenders' ability to exploit their relations with firms may diminish. The main contribution to this discussion is made by Petersen and Rajan (1995), who show by means of a simple model that the interest decline that occurs as the firm–bank relationship perseveres and the firm's reputation improves is more moderate in a concentrated market than in a competitive one. In other words, one would expect the banks' incentive to finance young and risky firms to be smaller in a more competitive banking market than in a more concentrated one. They corroborate their hypotheses empirically by examining the correlation between interest rate and concentration in the banking markets of various US states.

Several studies explore the effect of economic liberalization in the Israeli context. Ribon and Yosha (1999) used macroeconomic data to examine how liberalization affected competition among banks and the cost to borrowers of bank loans. Focusing on the nonindexed domestic-currency sector, they showed that even though the number of domestic banks and their concentration did not change significantly during the decade, the banks behaved more competitively in their activities, as reflected in a decline in lending interest rate, in view of the liberalization. Thus, even though foreign commercial banks did not enter the market and lend to Israeli firms, and even though direct borrowing from foreign banks abroad did not increase, liberalization led to greater contestability and, therefore, to more competition. Ber, Lucamat, and Nachmani (2002) examined the effect of greater economic openness on a different financial field, issue underwriting services. They showed that in contrast to commercial banking, there was a meaningful influx of foreign investment banks; at the end of 2001, twenty foreign investment banks had a physical presence (an address) in Israel. By using micro data, however, they found that not all firms benefited from this influx. The foreign banks turned only to firms that raised sources of finance on foreign stock exchanges and did not take part in underwriting any issue on the domestic exchange. Due to this selective entry, the price of underwriting paid by some firms (those that obtained services from foreign banks abroad) decreased as a result of the entry of foreign financial intermediaries but firms that did not obtain service from the foreign banks paid more. Another aspect of opening the economy was examined by Ber, Blass, and Yosha (2001), who showed that in the aftermath of Israel's economic liberalization monetary policy had less of an effect on the investment decisions of externally involved firms. The authors present evidence that traces this result mainly to the increase in opportunities for some firms, occasioned by opening up the economy, to borrow externally (either directly or via domestic banks); for this reason, these firms became less dependent on the domestic price of credit.

c. Frame of analysis

Bank credit is a special product. As noted in the survey of the literature, the main characteristic of this product is information asymmetry between the borrowing firm and the lending bank. The bank sells sources of finance for a finite period at a predetermined price (interest rate) but does not know, at least initially, the exact risk of default, i.e., the likelihood that the borrower will not meet the terms of the contract and will fail to pay back the loan at the price set. Since the bank takes this parameter into account when it sets the price of the loan for any borrower, one presumes that the credit market is able to establish different prices for different customers (borrowers).[7] In differential price-setting, the bank, the seller of the product known as "credit," is able to apply monopolistic power, discriminate among customers who have different characteristics, and charge a different price for the credit that it offers them commensurate with the cost. The difference between this and the basic price-discrimination approach is that in our case some of the discrimination among customers may originate in different effective marginal costs for the "production" of credit at different risk levels, which depend on their characteristics (or the characteristics of the ventures that they are financing). Additionally, differential price-setting may occur due to different demand elasticities of different borrowers. The unique database used in this study allows us to relate to the practice of differential pricing.

In Cournot's model of inter-bank competition, which includes the possibility of price discrimination, each firm pays a different equilibrium interest rate that depends on its particular demand factors and the bank's supply factors. The demand factors include the extent and characteristics of the firm's activities, the price of credit that the firm faces, and the firm's financing alternatives (e.g., the ability to raise sources abroad). The main supply-side factors related to the bank are the cost incurred by the bank for raising sources which depends on macroeconomic factors such as the central bank's key lending rate, the riskiness of the borrower and the information that the bank has about it, and the bank's market power vis-à-vis the borrower. The bank's market power, on the one hand, and its estimate of the lending risk, on the other hand, depend on the nature of its relationship with the firm. Stronger relations make it difficult for the firm to change banks due to the cost of developing a new relationship; for this reason, stronger relations have an upward effect on the bank's market power vis-à-vis the firm. However, stronger relations may act to reduce the risk that the bank envisages due to the bank's surfeit of information about the firm and the riskiness of its activity.

One may present the reduced form of the interest equation, as derived from the supply-demand equilibrium, in a manner similar to that in Petersen and Rajan (1994) and Weinstein and Yafeh (1998), and categorize the factors that affect the interest rate that every firm is charged. The first category is made up of macroeconomic factors, foremost the key rate. The second category is composed of characteristics of the firm—size, age, industry, etc.—that may affect both its demand for credit and the bank's assessment of the risk. The third type of variable that affects credit price is the characteristics of the firm's relations with the bank, e.g., the duration of the relationship or the number of banks with which the firm works. Beyond all these, credit price depends on the openness of the economy and, as a result, the extent of

[7] To keep matters simple, let us assume that the price of all units that the individual acquires are identical (third-degree price discrimination). See Varian (1989).

the individual firm's access to alternative sources of finance. According to our hypothesis, economic openness should be reflected in a narrowing of the average spread between the key rate and the commercial lending rate. The spread that each firm faces, however, may depend on the alternatives available to it.

The interest rate on a nonindexed loan is affected in the following ways:

β_1 The economy-wide interest rate (the central bank's key lending rate)
β_2 Firm characteristics +
β_3 Relationship characteristics +
β_4 Openness of the domestic market and the firm's access to foreign markets.

The main question in this study is whether the establishment of economic openness diminished banks' ability to apply market power against borrowers that are differentiated in characteristics (such as riskiness of their activity), as noted above. In particular, vis-à-vis borrowers who have access to external credit and firms that have strong relationships with their banks, does the domestic banks' ability to apply market power decrease because these borrowers have more alternatives?

3. SOURCES AND DESCRIPTION OF THE DATA

a. Sources of the data

The database is comprised of manufacturing firms that were traded on the Tel Aviv Stock Exchange in 1993–2000. The main information that we gathered on these firms was the price (interest rate) that each firm paid for bank loans and information about its relations with the bank. This information was culled from two main sources. The first is the notes to the firms' financial statements, which include information about the extent and cost of bank credit taken. This database was amassed manually for the years 1993–1998 by Blass and Ribon (2004), who discussed the factors that affect the proportion of foreign-exchange credit in total credit that the firm takes. For the purpose of our study, we updated the database to 2000. The main variables in this database are the types of bank credit that each firm took and the price that it paid for each type. The types of credit are divided by types of indexation: nonindexed credit in domestic currency, credit indexed to the CPI, and credit indexed to an exchange rate, itemized by currency. We chose to use only nonindexed NIS (domestic-currency) credit, as we describe below. These data were complemented by "Dukas" (the Tel Aviv Stock Exchange database), which includes main characteristics that are culled mainly from the firms' balance sheets, such as export revenue, age of firm, and so on.

We also used the Banking Supervision Department's database of "large borrowers." This confidential database—due to the confidentiality, we are unable to publish data itemized by borrowers—contains information that the banks report to the Bank of Israel about each "large borrower" as defined by the Banking Supervision Department. Banks report quarterly[8] and the

[8] Since the data from the firms' balance sheets are annual, we used only end-of-year data from the "large borrowers" database.

main data included concern the borrower's identity and industry, the amount of credit taken from each bank, whether the borrower is classified as problematic, and whether the bank has made a loan-loss provision on the borrower's account. The report is itemized by indexation sectors (nonindexed, CPI-indexed, exchange-rate-indexed, and in forex). Borrowers are included in the report on the basis of a threshold commensurate with the amount of their borrowing relative to the bank's capital. In medium-sized banks (equity of NIS 70 million–NIS 550 million on December 31, 2002), borrowing in excess of NIS 2 million must be reported. For larger banks, borrowing in excess of NIS 3.5 million must be reported.[9] The database is unique in that it includes detailed information about firms' relations with the banks from which they borrow at the individual firm level.[10] Another distinction made by the Banking Supervision Department is whether the borrower is a "single borrower." A single borrower is defined as one whose borrowing is equal to or greater than 5 percent of the bank's equity. Such borrowers, of course, are very few in comparison with the total population of large borrowers.

The database, although unique, has the disadvantage of containing only borrowers who took credit above a certain threshold, i.e., "large borrowers" as defined. Thus, a firm that took credit slightly under this threshold is not reported.

b. Description of the data

The raw database contains 1,850 observations for eight years (1993–2000). Since data about the interest rate that the firm pays are not shown in the financial statements of all firms, the number of observations declines to 1,100. Only about three-fourths of the firms are defined as "large borrowers."[11] Furthermore, we deleted from the database seventy-seven observations for which the interest rate paid for credit was more than 5 percentage points under the key rate. An examination that we performed shows that such observations exist only up to 1997—mostly in the first years of the sample, 1993–1994—and that the share of exports by these firms is significantly higher than that of the sample at large: 55 percent as against 22 percent, respectively. We preferred to delete these observations because we believe that these observations represent subsidized or directed credit that is not representative of market price.[12] In the end, our database contained about 720 observations, giving us data on 80–100 firms each year.

Table 1 shows that the average balance sheet of the traded firms that we examined is about NIS 450 million (at 2001 prices). Although we do not have data on the average balance sheet of all manufacturing firms—public and private—by comparing the number of persons

[9] There are about 12,000 borrowers in the database, as against more than 4,000,000 total borrowers from the banking system. (About 700,000 borrowers borrowed more than NIS 100,000, at 2000 prices). However, in a rough estimate by distribution of the size of bank loans (Table D5 in Annual Information on the Banking Corporations, 2000), "large borrowers" account for about 60 percent of credit quantity.

[10] Due to the confidentiality of the database, the data available to us are only aggregate data for all banks with which each firm works. Furthermore, our data describe only the average cost of a firm's total borrowing, with no itemization of the interest rate that it pays each bank.

[11] The problem of possible selection is discussed below.

[12] In the estimation of the equations including these observations, with a dummy variable added for them (for an intercept), the results for the remaining explanatory variables hardly change.

Table 1
Main Characteristics of the Firms[a]

			Percentile		
	Avg.	S.D.	5%	50%	95%
Balance sheet (NIS thousands, 2001 prices)	453,567	1,256,737	32,438	121,763	1,718,962
Firm age (years)	30.8	15.6	8	39	56
Pct. of exports in revenues	0.24	0.32	0	0.03	0.90
Debt/balance sheet (pct.)	0.29	0.16	0.05	0.28	0.58
NIS credit/total credit	0.33	0.30	0.002	0.25	0.97
NIS bank interest rate (over key rate, in pct. points)	1.7	2.6	-1.8	1.5	6.5
Banks with which firm works	2.4	1.6	1	2	6
Firm credit concentration (Herfindahl index)	0.66	0.28	0.25	0.60	1
Duration of relationship (in past 4 years)	3.1	1.0	1	3.6	4
Share of problem loans	0.16	0.45	0	0	1
Share of doubtful debts	0.002	0.02	0	0	0.01

[a] Analysis of observations included in the regressions (720 observations).

employed in the traded companies with those in firms at large, on the basis of the Central Bureau of Statistics manufacturing survey, we find that the former are larger than the average for manufacturing at large. In 1999, for example, average employment in the traded companies was 220 as against 40 in manufacturing at large and 120 in all establishments that employ more than 50 workers. The table also shows that these firms are relatively old—thirty years

Table 2
Main Characteristics of Firms (Average), by Number of Lending Banks, 1993–2000[a, b]

Number of banks	1	2	3	4	5–9
No. of observations (firms and years)	254	209	102	71	84
Balance sheet (NIS thousands, 2001 prices)	158,609	171,467	606,665	534,300	1,800,493
Firm age	26.4	27.1	36.1	36.4	41.9
Pct. of exports in revenues	0.21	0.26	0.24	0.23	0.33
Debt/balance sheet	0.25	0.28	0.32	0.32	0.32
NIS credit in total credit	0.40	0.31	0.29	0.30	0.25
NIS bank interest rate (over key rate, in pct. points)	2.1	1.8	1.5	1.4	0.7
Total concentration	1	0.606	0.463	0.331	0.296
Duration of relationship (in past 4 years)	2.7	3.2	3.2	3.4	3.6
Share of problem loans	0.106	0.153	0.235	0.239	0.202
Share of doubtful debts	0.003	0.001	0.003	0.003	0.000

[a] In the shaded cells, there is a significant difference (F test) at a level of at least 5 percent between firms with a different number of banks.

[b] Analysis of observations included in the regressions (720 observations).

old on average—and the mean share of exports in their output is about one-fourth. The traded firms' relations with domestic banks are quite concentrated. On average, a firm takes credit from 2.4 banks at a given time. The level of the concentration index relative to the number of banks (0.66 on average) shows that the firms do not take credit symmetrically from all banks with which they work; instead, they borrow a larger share from one bank (or several banks). Table 2 examines in greater detail the characteristics of the firms in accordance with the number of banks from which they borrow.

A salient characteristic is the positive correlation between firm size and number of banks (and concentration). Larger firms have relations (as large borrowers) with more banks. This may trace to the demand side of the firms, which have an interest in diversifying their borrowing among a large number of banks in order to reduce the banks' monopolistic power. However, it may also be due to the supply side, since an individual bank has no interest in making (and, due to regulatory restrictions, is not allowed to make) very large loans to single borrowers, thus prompting such borrower to turn to additional banks.[13,14]

The table also shows that firms that work with more banks, which are also larger, are more likely to diversify their borrowing among different types, resulting in a smaller share of nonindexed NIS credit in total credit[15] and a lower interest rate in terms of spread over the key rate. Since the size of a firm correlates with the number of banks from which it borrows, an analysis of this type cannot determine the reason for the difference in interest paid by the firm—its quality (as represented by size and other characteristics) or the nature of its relations with the financial intermediary.

Figure 1 shows the distribution of various characteristics of firms in the sample in a representative year (1997). The most salient finding in this presentation is that the firms in our sample, as stated, are mature; about half of them have been operating for thirty years or more. They tend to concentrate their bank credit very strongly: 40 percent of large firms borrow from only one bank and the duration of their relationship with the bank is lengthy: 40 percent have had relations of at least four years with the bank from which they borrow. Examination of the share of exports—which we use below as an indicator of the firm's external exposure and, therefore, its ability to raise sources from players outside the domestic banking system—shows strong variance. About half of the firms do not export at all; the others export at various levels that peak at 100 percent. The data also show strong variance in the interest rates paid by the firms (over the key rate).[16]

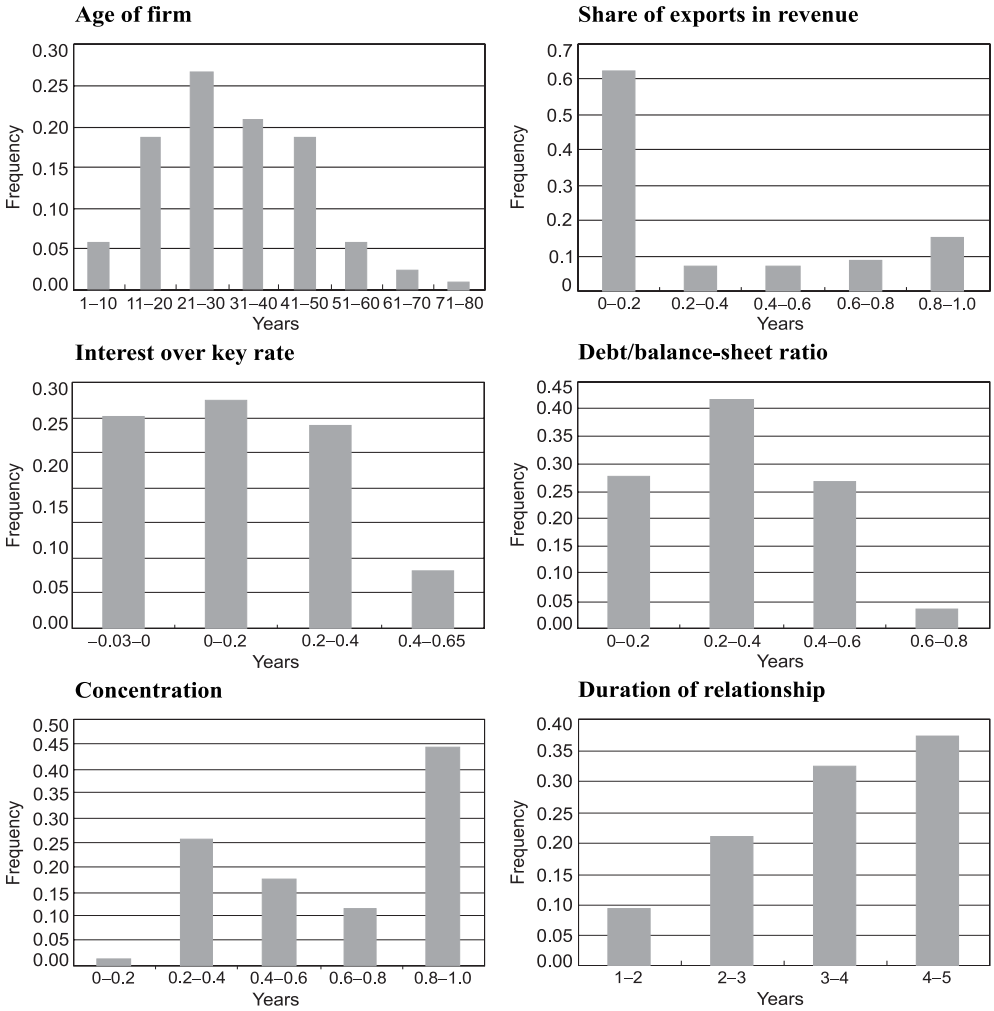
[13] We should qualify this analysis by noting that small firms may also borrow from several banks but may not appear in the database because the credit that the individual bank gives them does not meet the requirement for reporting under the "large borrower" rule.

[14] Firms defined as single borrowers (i.e., that borrow a sum equal to at least 5 percent of the bank's equity) come to 7 percent of the firms in our database. Tests that we performed show that the distinction of whether a firm is or is not defined as a single borrower does not affect the interest rate that it is expected to pay, all other characteristics being constant, and does not change the effect of the other variables in the equation on the interest rate. According to the Sound Banking Management directives of the Banking Supervision Department, the indebteness of a borrower to a banking corporation must not surpass 15 percent of the bank's equity.

[15] Blass and Ribon (2004) found that exporting firms and larger firms tend to take a larger share of forex credit in total credit.

[16] To examine this difference, we used the average key rate for each year. The average rate paid by the firms for nonindexed NIS credit was, as expected, higher than the prime rate in most years of the sample period.

Figure 1
Main Characteristics of Firms in the Sample, 1997



Firm's age and duration of relationship are measured in years; concentration is measured according to the Herfindahl index.

4. ESTIMATION AND RESULTS

a. Description of the estimation

In view of the two corpuses of literature described above—that on the effect of relationship banking on credit price and that on how opening the economy and liberalizing capital flows affects financial intermediation—we estimated a reduced-form equation for the price of credit that the firm takes.

We chose to focus solely on the price of nonindexed NIS borrowing. Since such borrowing is relatively short in term (usually up to a year, as the data from the Banking Supervision Department on the duration of nonindexed NIS credit show), the information in firms' financial statements about what they pay for such credit pertains largely to new credit taken. In other words, although the data on nonindexed NIS credit that appear in the balance sheet pertain to the firm's credit inventory, they are a good proxy for the credit flow during the year because this credit is relatively short in term.

The reduced-form equations of the interest rate that each firm pays (average interest on nonindexed NIS credit that the firm took from all banks from which it borrowed during a given year) include variables that are expected to explain the components of these interest rates. The first component is the macroeconomic interest rate, i.e., the risk-free rate shared by all firms. The second component is made up of variables that describe characteristics of the firm that affect the risk attributed to the firm by the lender. The third component is composed of variables that affect the extent of market power that the bank can bring to bear against the firm. These variables include the strength of the firm's relations with its creditor banks and the extent of its exposure to foreign markets. The latter parameter is used to indicate the firm's ability to raise sources outside the domestic banking system, i.e., as an indicator of possible competition outside the domestic banking system. We estimated the equations for the panel data of firms in 1993–2000 using the Maximum Likelihood method and assuming the existence of random effects.[17]

As mentioned above, our final database includes only firms that meet the Banking Supervision Department's definition of "large borrowers." The population that we analyzed may be expanded by means of the Heckman procedure, which corrects for the bias that this selection of firms may cause. The results obtained are not qualitatively different from those obtained without the correction and are presented in the table in the Appendix.[18] Table 3 contrasts the main characteristics of firms classified as "large borrowers" with those of those not so defined.

The aforementioned categories include the following variables:

Key rate: We chose to use the key rate, set by the Bank of Israel, as the risk-free underlying interest rate. This rate is identical for all firms in a given year and varies from year to year. To test the effect of opening the economy on the correlation between the key rate and that paid by the firms, our regressions included separate key rates for different cohorts of years (i.e., the key rate in interaction with dummy variables for these years). Since there is no constant in the equations estimated, the interest-rate coefficient describes the ratio of the key rate to the lending rate, assuming that all other variables are constant. Thus, since we treat the key rate as a risk-free rate, the coefficient we obtain is expected to be greater than (or equal to)

[17] The validity of the estimation was examined in contrast to an estimation that assumes the existence of fixed effects. A Hausman test for the existence of a statistical difference between the two estimation methods for the main specification found no significant difference of this type. Therefore, the random-effects estimates, which are more efficient, may be used. A Hausman test cannot be performed on equations estimated using the Maximum Likelihood method without an intercept, as we estimated the original equations. Therefore, we performed the test for an identical formulation plus an intercept, without using the MLE method.

[18] Running the basic equation, without the variables obtained from the Banking Supervision Department, expands the sample from 722 observations to 982. The results obtained for the variables included in this equation are not qualitatively different from those obtained from the smaller population.

Table 3
Main Characteristics of Firms (Average) by Large-Borrower Classification, 1993–2000

	Average not-large borrowers	Average large borrowers[a]
No. of observations (firms and years)	255	720
Balance sheet (NIS thousands, 2001)	190,537	453,566
Firm age	25.7	30.8
Share of exports in revenues	0.22	0.24
Total debt	25,462	1314590
Debt/balance-sheet ratio	0.18	0.28
Share of NIS credit in total credit	0.40	0.33
NIS bank interest rate (over key rate, in pct. points)	2.0	1.7

[a] In the shaded cells, there is a significant difference (t-test) between firms defined as large borrowers and those not so defined.

1. A high coefficient indicates that the bank has considerable market power, assuming that the risk is already expressed in the other variables in the equation. If the banks charged a higher premium over the key rate at the beginning of the opening of the economy (all other characteristics of the firm being constant), we would expect the coefficient of the key rate in the equation of the interest rate that businesses paid to be greater than 1 and to be greater at the beginning of the period than at the end. We also attempted to include proxy variables for the aggregate macroeconomic risk to all firms, e.g., the spread between the key rate and the yield on Treasury bills, which reflects expectations of a rate hike, or the standard deviation of inflation during the year. Their effect, however, was not found to be significant.

Firms' characteristics: One of the most important factors of influence on the price and availability of credit is the risk attributed to the borrower. All studies in the field include variables designed to represent this unobservable variable as a control variable. In some studies, the authors have direct information about the classification of borrowers' risk as determined by banks themselves (e.g., Blackwell and Winters, 1997). In most cases, however, indirect indicators of risk are used: mainly firm's age (which has a downward effect on risk), firm's size (downward), debt/assets ratio (upward), revenue growth rate (downward), profitability (downward), cash flow (downward), and standard deviation of cash flow (upward), and other variables such as the firm's industry or its being in high-tech. We include several variables that describe firm characteristics and constitute indicators of its goodwill and risk—firm's size (in balance-sheet terms), a dummy variable for R&D activity (another indicator of firm risk), and a variable for an actualized risk, i.e., a loan-loss provision for the firm's credit. The last-mentioned variable provides a de facto reflection of the (prohibitive) price that a firm would have to pay for an additional NIS in credit after the bank discovers that it has defaulted on credit already taken. The effect of additional variables that may attest to firm risk, such as equity/balance sheet, fixed assets/balance sheet, and market capitalization/balance sheet, was not found significant.

The firm–bank relationship: We chose to use unique data that the Banking Supervision Department made available to us and selected two indicators as proxies for the strength of the firm–bank relationship:

Concentration of the relationship, calculated in the form of a Herfindahl index: the sum of the square of the share of credit taken by the firm from each of its creditor banks. The index for a firm that borrows from one bank is 1; the more banks the firm borrows from, the closer the index is to 0. Our hypothesis is that the stronger the concentration, the stronger the firm's relations are with the bank with which it works. However, the effect of this variable on the interest rate is not clear ab initio, as noted in the section of this study that describes the literature.

The level of concentration may be endogenous, i.e., dependent on the interest rate that banks offer the firm. Our tests showed that the problem of endogeneity does not exist in the case at hand. Ostensibly, if a certain bank offers a firm an interest rate that is too high, the firm will turn to other or additional banks to improve its borrowing terms and, by so doing, will reduce the concentration of its credit. An interest rate that is offered to a firm and not actualized in a loan, however, is not an observable variable (we observe only the average rate that the firm paid for loans that it took from all banks with which it works); hence, the actual extent of endogeneity of the observable variable is negligible. Just the same, we estimated the interest equation both ways—using the original concentration variable and in reference to the possibility that the variable is endogenous—by performing a two-stage estimation. (See the concentration equation in Appendix 1.) The results show no difference between the two estimation methods. (See Columns 3–4 in Table 4.) Since we estimated the concentration equation using variables that also appear directly in the main equation that explains the interest rate, a correlation that may impair the estimation is created between the estimated concentration and the other variables in the main equation. To avoid this, we also estimated a version including the residuals of the concentration equation, which, according to definition, do not correlate with the other variables in the main equation (Column 5 in Table 4).[19] The estimation results show no substantive difference in the results elicited by the three methods.

Duration of the firm–bank relationship: For each period (one year), we calculated the number of years in which a firm worked with the same bank within the past four years (the current year and the three previous years) and averaged the result for all banks with which the firm worked in the current year. The higher this index is, the longer the firm's relationship with its creditor banks and, presumably, the stronger its relationship with them. Since this index is truncated because we have data only for the past four years and because the marginal effect of relations with the bank is presumably greater at the beginning of the relationship and smaller as the relationship perseveres, we inserted a dummy variable into the equation that receives the value of 1 when the mean length of the firm's relationship with its creditor banks is at least three years.[20]

One may argue that the duration of relations, like concentration, is endogenous and dependent on the interest rate. Here, too, however, we found no evidence of the existence of an endogeneity problem.

[19] In such a formulation, the coefficients obtained for the other explanatory variables in the main equation (such as size) reflect both the direct effect of the variable and the indirect effect, by means of the effect on concentration.

[20] Use of a dummy variable for a relationship of two years or more elicits similar results. A dummy variable for relations of four years or more is not significant.

Activity abroad: We chose the share of exports in the firm's sales revenues as an indicator of its activity abroad. Our hypothesis is that this indicator may be an estimator of the firm's access to alternative external sources of finance. (Such exposure may be reflected not necessarily in more actual external borrowing but rather in the possibility that the firm will do more borrowing of this kind.) One may also find support for this in findings that Israeli firms that raised sources on American stock exchanges—i.e., found an alternative way to finance their activities—are export-oriented (Blass and Yafeh, 2001; Ber, Lucamat, and Nachmani, 2002). The share of the firm's exports may also be an indicator of its quality. We address ourselves to this possibility below.

Long-term changes: Using the model estimated, we examine the change in the extent of effect of the aforementioned variables during the relevant period in order to try to determine whether the opening of the economy and the increase in firms' financing options decreased the banks' ability to exploit market power against large firms. In particular, we ask whether the effect of relationship banking on the interest rate paid changes the more open the economy is—in other words, insofar as greater contestability is created, do firms that are oriented to domestic activity benefit from the opening of the economy? We perform this test by means of interaction variables of the firms' characteristics and dummy variables for years. Opening of the economy and globalization were not instantaneous events; they were implemented over several years. In the estimation, we found that the distinction between the 1993–1995 period and the years that followed provides the best reflection of the difference between the economic environment preceding liberalization and globalization and that which came about afterwards.

c. Results

According to the results obtained, the effect of the key rate, the firm–bank relationship, and the extent of the firm's activity abroad on the interest rate that the firm paid changed over time. These changes seem mainly to reflect the upturn in large businesses' access to alternative sources of finance as the Israeli economy was opened up to the rest of the world. The results are itemized in Table 4.

The spread between the key rate set by the Bank of Israel and the lending rate to businesses narrowed over time. According to the estimation, the coefficient of the key rate clearly declined between 1993 and 2000 (apart from 1998, when the global financial crisis appears to have affected the pricing of domestic credit).

The coefficient of the key rate in 1993–1994 was 1.25–1.3—significantly different from 1. In other words, a 1 percentage-point change in the key rate led to a 1.3 percentage-point change in the banks' lending rate to businesses.[21] The coefficient was 1.03–1.06 in the second half of the 1990s, significantly lower than the coefficient in 1993–1994.

The decline in the banks' market power, reflected in the narrowing of the spread between the interest rate paid by the firms and the key rate, is consistent with an increase in competition

[21] In the regressions in Table 4, we reduced the distribution of the interest-rate coefficients to two cohorts—1993–1994 and 1995–2000—and a dummy variable for 1998. The results are very similar to those obtained when we related to each year separately.

among banks. Thus, after the liberalization firms had more alternatives and the number of banks competing for their credit demand (including foreign banks abroad) increased in effective terms. In other words, the domestic banks faced greater elasticity of demand. This finding corresponds to the results obtained by Ribon and Yosha (1998), who looked into the behavior of macro data on interest for nonindexed NIS credit, except that the sample in the current study is made up of large businesses. Thus, in the early 1990s the banks had market power not only over medium-sized establishments and households but also over the country's largest firms.[22] However, the narrowing of the interest spread may trace to other factors, such as a decrease in credit supply caused by an upturn in the prices of banks' sources of credit or a decline in credit demand of firms due to changes in taste.

When we estimated the equation with the explained variable being the difference between the interest rate paid by the firm and the key rate, including dummy variables for years on the left side, we obtained exactly the same numerical results, as expected. Arguably, the spread between the key rate and the rate paid by the firm, in percentage points, depends on the level of interest. If so, it would be better to examine the ratio of the two rates. In other words, the bank charges the firm a premium as a percent of the interest level (or, in fact, of the interest receipts), and therefore a higher key rate is reflected in a wider spread between rates, even if the ratio between them is unchanged. By estimating the basic formulation of the equation including dummy variables for the year-end rate, with the rate paid as the dependent variable, and, alternatively, with the ratio of the rate paid and the key rate, we found very similar results in both formulations. The coefficients obtained for the effective key rate (or a dummy variable for the year) are almost identical. Examination of the estimated value of the interest rate paid by the firm, in both versions, shows that the average ratio of the two estimates is 1.005 with a standard deviation of 0.008, i.e., the results of the estimation in both formulations are very similar. In the tables, we chose to present the formulation in which the level of the nominal interest rate is the dependent variable. Moreover, examining the data for the estimated period shows that the interest rate was lower in 1993 than in 1999. Nevertheless, the premium paid by the firm was greater during the first period. The real interest rate was certainly lower in the first part of the decade and actually climbed in the second half.

A stronger firm–bank relationship has an upward effect on the interest rate, as shown in the coefficient of the concentration variable in Column 1 of Table 4. This result, as stated, expands the findings in other countries about the effect of relationship banking on the price of credit to small firms, which are typified by problems of information asymmetry, to large firms as well, such as those in our sample. Our results are compatible with those of Houston and James (1996), who showed that that large publicly traded American firms that borrow from only one bank suffer more from the captive-customer problem and pay a higher interest rate, especially when they are firms with growth potential. In regard to Germany, too, Agarwal and Elston (2001) found that large firms that have strong relations with a bank benefit from greater availability of sources of finance but pay higher interest rates.

[22] Berg and Kim (1998) show for banks in Norway that banks have significant market power in small-scale lending (to households and private borrowers) due to supply-side problems of information asymmetry and these borrowers' inability to hunt for the best offer in the market, but had much less market power over larger firms.

An alternative indicator of bank–firm relations is the duration of the relationship. As stated, our estimation included a dummy variable that received a value of 1 for a relationship of at least three years. This variable was not significant in the estimation for the entire period.[23]

Examination of the effect of both variables—concentration and duration of relations—over time shows that their effect on interest rate paid by the firm changed during the decade. As evidence of this, the coefficient of the concentration variable was significantly greater at the beginning of the decade than later on (Columns 2–4 in Table 4). A specification including only the extent of concentration (irrespective of duration of relations) showed that concentration had no significant effect on the interest rate paid by the firm in the second half of the decade. Thus, the banks had no market power vis-à-vis firms that concentrated their activities with only a few (domestic) banks. According to the coefficient obtained, a firm that chose to borrow from only one bank paid an interest rate that was 0.9 percentage point higher than the rate paid by a firm with identical attributes that chose to borrow from three banks. The effect of duration of relations also changes when the period is divided into subperiods: significant at the beginning of the decade, duration of relations had no effect on the interest rate paid by the firm at the end of the decade (Columns 2 and 5 in Table 4). The estimation results showed that a firm that has longer relations with its bank, as we have defined them, will pay a higher interest rate by about half a percentage point than an identical firm that has no such relations. These results may be construed as resulting from the process of opening the economy, which increased the firms' external exposure and, therefore, diminished the banks' ability to charge a rent for strong relations with the firm.

The effect of share of exports on the interest rate paid by the firms, on average throughout the estimation period, is negative and significant, as Column 1 in Table 4 shows. This result may be interpreted in two ways. First, the fact that a firm exports gives it access to sources of finance from foreign banks or stock exchanges, forcing domestic banks to compete more vigorously for its custom and to charge it a lower interest rate for credit. An alternative explanation is that exporting firms are higher in quality and lower in risk, for which reason the bank charges them a lower rate. Although it would seem impossible to differentiate fully between these two interpretations, we included in the estimation additional variables for firm quality (such as profitability) and firm risk (such as size and age). If these variables are adequate, the first interpretation will be easier to support.

We found that effect of the share of exports and sales in firm revenues changed over time. As Columns 2–6 of Table 4 show, the export coefficient has a significant effect on the interest rate that the firms paid in 1993, a smaller but still significant effect in 1994–1995, and an insignificant effect afterwards. At the beginning of the decade, an exporting firm benefited from an interest rate lower by up to 4 percentage points (for a 100 percent share of exports in revenues) than that paid by a firm that sold to the domestic market only. This may indicate that at the beginning of the process of opening the economy, only firms that were active abroad had an alternative to the domestic banking system in raising sources of finance and that this induced domestic banks to lower the interest rates that they charged them. However,

[23] When the duration of the relationship was defined by a dummy that received value of 1 for a relationship of at least two years, the coefficient obtained was 6 percent significant. We believe, however, that this variable is less indicative of the essence of firm–bank relations.

Table 4
Interest Rate Paid by Large Businesses—Results of Panel Regressions

	Constant long-term effects only (apart from key rate)	Did the effects of exports and relationship banking change?				Test of change in effect of profitability
	1	2	3	4	5	6
Key rate						
1993–1994	1.282*	1.264*	1.284*	1.223*	1.324*	1.303*
1995–2000	1.056*	1.037*	1.051*	1.002*	1.077*	1.048*
1998	1.229*	1.208*	1.223*	1.172*	1.250*	1.213*
Firm characteristics						
Industries—dummy variable	yes	yes	yes	yes	yes	yes
Firm size	–2.2E–7*	–2.2E–7*	–2.1E–7*	–1.8E7**	–2.6E–7*	–2.2E–7*
Firm age	–0.0	–0.0	–0.0	–0.0	–0.0	–0.0
R&D	0.5**	0.5**	0.5**	0.5**	0.5**	0.5**
Profitability	–1.2*	–1.2*	–1.3*	1.3*	–1.2*	
In 1993–1995						-1.0
In 1996–2000						–1.4**
Actualized risk	6.5**	7.1*	7.4*	7.3*	7.2*	6.8*
Intensity of firm-bank relationship						
Concentration	0.7*					0.8*
In 1993–1995		1.3*#	1.3*#			
In 1996–2000		0.6*#	0.5*#			
In 1993–1995 (*estimated)*				2.4*#		
In 1996–2000 (*estimated*)				1.6*#		
Duration of relationship: at least 3 years	0.3^					0.3
In 1993–1995		0.5*			0.4**	
In 1996–2000		0.2			0.0	
External exposure						
Exports (share in revenues)	–0.92*					
In 1993		–4.0*	–4.0*	–3.4*	–3.9*	–3.9*
In 1994–1995		–1.5*	–1.5*	–1.4*	–1.4*	–1.2*
In 1996–2000		–0.1	–0.1	–0.1	–0.1	–0.3
No. of observations	722	722	722	696	722	722
Log likelihood	–1554.4	–1536.3	–1537.9	–1487.6	–1541.7	–1539.6

The estimation period is 1993–2000. The dependent variable is the NIS interest rate, in percentage points, for nonindexed credit that the firm paid on average to banks during a given year. The key rate is the marginal rate on monetary lending, identical for all firms during a given year. The size of a firm is measured in constant NIS '000 of 2001. The age of a firm is measured in years. The R&D variable is a dummy variable that receives the value of 1 when the firm has R&D expenses. Profitability is operating profit relative to the balance sheet. Actualized risk is the ratio of the total loan-loss provision for the firm to the firm's total borrowing. Concentration of relationship is measured by the Herfindahl index for the firm's total bank credit. The estimated concentration is the estimated value of concentration according to the equation in Appendix 1. Duration of relations is a dummy variable that receives the value of 1 when the average duration of relations between the firm and the banks from which it borrowed that year is at least three years. The export variable is the share of export revenues in total revenues.

A value marked with ** is 10 percent significant. One marked with * is 5 percent significant.

^ When the duration of relations is less than two years, the coefficient is 10 percent significant.

The value of the coefficient declines significantly between the two subperiods.

the opening of the economy benefited domestically oriented firms, of all things—evidently because it allowed them to do more borrowing abroad. It should be borne in mind, of course, that all the firms in the sample are large and reputable, inasmuch as they are traded on the domestic stock exchange.

This result, pointing to a change in the importance of exports during the period, reinforces the belief that share of exports is an indicator of the opening of the economy to the rest of the world and, to a lesser extent, an indicator of a firm's quality. To support this claim, we examined the effect of the firm's profitability—which, as expected, was negative on average for the entire period—on the interest rate that the firm paid in the two subperiods, 1993–1995 and 1996–2000. As Column 6 in Table 4 shows, the effect of a firm's profitability on the interest rate did not decline during the second subperiod.[24] In view of these results, it seems possible to interpret the export variable, for which the coefficients during the various periods are very stable in many formulations that we tried (not shown), as an indicator of firms' access to external sources.

Correction for selection: To correct for the selection that exists in the sample of large borrowers, as stated, we subjected the panel data in the first stage to a probit regression for the likelihood of being a "large borrower." The regression found that the extent of borrowing by firms has a positive and significant effect on this probability, as expected, and that dummy variables for small firms have a negative effect (Appendix 2). The inclusion of the selection-correction variable in the regressions shows that the main results obtained do not change (Appendix Table 3). The Mills Ratio variable receives a positive sign and is significant. In accordance with these results, in which the variables that explain the interest rate that the firm pays remain essentially unchanged even after the selection correction, one may infer that the relationships found for "large borrowers" exist for a wider population of all manufacturing firms traded on the stock exchange.

5. SUMMARY AND CONCLUSION

This study used micro-level data to examine the factors that affect the interest rate that large Israeli firms paid to domestic banks for credit. The purpose was to determine whether the banks have market power vis-à-vis these firms and, if they do, to determine whether this market power has changed during a decade of opening the economy to the rest of the world and making more financing alternatives available. We asked, in particular, whether the opening of the economy affected different firms differently, i.e., whether one group of firms benefited more from this process than the others. Israel's capital inflows and outflows increased immensely in the 1990s. Israeli firms raised capital on foreign stock exchanges and large foreign commercial banks established representative offices in Israel toward the end of the decade. These factors, taken together, may create a competitive financial environment even if the number of domestic banks does not change. Indeed, our study found a perceptible change

[24] The effect of firm size (another indicator of firm quality) on the interest rate that the firm paid was also found unchanged during the decade (not shown).

in the way banks priced credit during the decade; we interpret these findings as evidence of a decline in market power that occurred in view of liberalization and globalization. Thus, we found that the rent (premium) that banks charged large firms for credit (beyond the risk-free interest rate) in view of the firms' characteristics contracted significantly during the decade. We also showed, by means of the unique data in our possession, that some firms benefited more than others from the change in market conditions. In the beginning of the 1990s, the banks exploited their close relations with firms to charge a rent for credit (evidently due to the captive-customer phenomenon) but from mid-decade on, firms with close relations with banks paid less for the loans they took. Furthermore, the decrease in interest rate during the decade was greater for domestic-oriented firms (non-exporters) than for exporters. Thus, in the early 1990s exporting firms had an advantage in borrowing from domestic banks and paid a lower interest rate (all other factors being constant). This result is consistent with the fact that at the beginning of the decade (1993–1994) exporting firms also had an alternative way of raising sources due to their external activities and, for this reason, the goodwill that they had amassed in relations with foreign banks. Later in the decade, however, export activity gave firms no advantage in the price of credit that domestic banks charged them. Thus, concurrent with the increase in capital inflows, non-exporting companies acquired more alternatives to domestic banks in raising sources of finance. An alternative explanation for this finding about changes during the decade in the effect of export activity on the price of credit that a firm paid is that when the opening of the economy began, the foreign banks performed a selection among companies and lent only to high-quality/efficient firms (exporters). As the decade progressed, however, Israel's reputation in global markets improved as more Israeli firms issued shares on foreign stock exchanges. Thus, firms of lesser quality were also able to borrow from foreign banks.

In sum, the current study strengthens the belief that the banks' market power vis-à-vis large customers decreased greatly during the 1990s, even though the number of domestic banks operating in Israel did not change during that time. Thus, opening up the economy made banks behave more competitively in the credit market. These findings, of course, do not imply that the banks became more competitive in lending to small firms and households. In fact, we showed that at the beginning of the liberalization and globalization period, when firms did not have many alternatives to the domestic banking system for borrowing, the banks exploited this fact to charge the firms a rent. This finding raises the suspicion that today, too, the banks are exploiting the paucity of alternatives of small firms and households to charge them a steep rent for their borrowing.

APPENDIX

Table A.1
Credit Concentration Equation

Dependent variable	Credit concentration
Constant	1.089[a]
Firm size (log)	–0.034
Dummy for small firm (< NIS 100,000)	0.131[a]
Age	–0.0016[b]
Market cap/balance sheet	0.017[a]

[a] 1 percent significance.
[b] 10 percent significance.

The estimation period is 1993–2000. The dependent variable is the concentration of bank–firm relations, measured by means of a Herfindahl index for total bank loans taken by firm. Firm's size is measured in constant 2001 NIS thousands. The age of the firm is measured in years.

Random Effects GLS Regression N = 997, no. of groups = 201.
R^2 between = 0.214
R^2 overall = 0.200

The variables that were not found to have a significant effect on concentration are firm profitability, share of exports in revenues, R&D expenditure, and dummy variable for years (1993–2000).

Table A.2
Results of Estimation to Correct for Selection of Large Borrowers (Heckman Correction)

Dependent variable	1=large borrower; 0=other
Constant	1.549[a]
Industry	–
Dummy for small firm (< NIS 100,000)	0.000013[a]
Age	–0.644[a]
Market cap/balance sheet	–1.444[a]

[a] 1 percent significance.
Random Effects probit, N-1662, no. of groups=265.

Table A.3
Interest Rate Paid by Large Businesses—Results of Panel Regression with Correction for Selection

	Constant long-term effects only (apart from key rate)	Did the effects of exports and relationship banking change?		
	1	2	3	4
Key rate				
1993–1994	1.275*	1.258*	1.279*	1.304*
1995–2000	1.052*	1.032*	1.046*	1.061*
1998	1.224*	1.203*	1.219*	1.233*
Firm characteristics				
Industries—dummy variable	–	–	–	–
Firm size	–1.7E–7*	–1.6E–7*	–1.6E–7*	–1.8E–7**
Firm age	–0.0	–0.0	–0.0	–0.0
R&D	0.5**	0.5**	0.5**	0.5**
Profitability	–1.2*	–1.2*	–1.2*	1.1*
In 1993–1995				
In 1996–2000				
Actualized risk	6.7**	7.6*	7.3*	7.1*
Intensity of firm-bank relationship				
Concentration	0.6**			
In 1993–1995		1.1*	1.1*	
In 1996–2000		0.5	0.4	
In 1993–1995 (*estimated)*				
In 1996–2000 (*estimated*)				
Duration of relationship: at least 3 years	0.3			
In 1993–1995		0.5*		0.5*
In 1996–2000		0.2		0.0
External exposure				
Exports (share in revenues)	–0.8*			
In 1993		–4.0*	–4.0*	–3.9*
In 1994–1995		–1.5*	–1.4*	–1.4*
In 1996–2000		–0.1	–0.1	–0.1
Mill's Ratio	0.7**	0.7*	0.7*	1.0*
No. of observations	722	722	722	722
Log likelihood	–1552.6	–1533.9	–1535.7	–1537.5

The estimation period is 1993–2000. The dependent variable is the NIS interest rate, in percentage points, for nonindexed credit that the firm paid on average to banks during a given year. The key rate is the marginal rate on monetary lending, identical for all firms during a given year. The size of a firm is measured in constant NIS thousands of 2001. The age of a firm is measured in years. The R&D variable is a dummy variable that receives the value of 1 when the firm has R&D expenses. Profitability is operating profit relative to the balance sheet. Actualized risk is the ratio of the total loan-loss provision for the firm to the firm's total borrowing. Concentration of relationship is measured by the Herfindahl index for the firm's total bank credit. The estimated concentration is the estimated value of concentration according to the equation in Appendix 1. Duration of relations is a dummy variable that receives the value of 1 when the average duration of relations between the firm and the banks from which it borrowed that year is at least three years. The export variable is the share of export revenues in total revenues. Mill's Ratio is calculated by means of a Heckman regression for estimation of the probability of being a large borrower. (See Appendix 2.)

A value marked with ** is 10 percent significant. One marked with * is 5 percent significant.

REFERENCES

Agarwal, Rajshree, and Julie Ann Elston, 2001, "Bank-Firm Relationship, Financing and Firm Performance in Germany," *Economic Letters*, 72(2), 225-232.

Banking Supervision Department, Bank of Israel, Annual Information on the Banking Corporations, various years.

Ber, Hedva, Asher Blass and Oved Yosha, 2001, Monetary Transmission in an Open Economy: The Differential Impact on Exporting and Non-Exporting Firms, Discussion Paper No. 2001.01, Bank of Israel.

Ber, Hedva, Lucamat, Rennat, and Ehud Nachmani, 2002, "Entry of Foreign Investment Banks into Israel and Its Effect on Competitive Equilibrium in the Underwriting Market, *Economic Quarterly* 49, 773–805. (Hebrew).

Berg, Sigbjørn Atle and Moshe Kim, 1998, "Banks as Multioutput Oligopolies: An Empirical Evaluation of the Retail and Corporate Banking Markets," *Journal of Money Credit and Banking*, 30(2), p. 135-153.

Berger, N. Allen and Gregory F. Udell, 1995, "Relationship Lending and Lines of Credit in Small Firm Finance," *Journal of Business*, 68(3), 351-381.

Blackwell, David D. and Drew B. Winters, 1997, "Banking Relationships and the effect of Monitoring on Loan Pricing," *Journal of Financial Research*, 20(2), 275-289.

Blass, Asher and Sigal Ribon, 2004, What Determines a Firm's Debt Composition – An Empirical Investigation, Discussion paper No. 2004.04, Bank of Israel.

Blass, Asher and Yishay Yafeh, 2001 "Vagabond Shoes Longing to Stray: Why Foreign Firms List in the United States," *Journal of Banking and Finance*, Vol. 25, No. 3, p. 555-572.

Blejer, Mario and Daniel Gottlieb, 2002, "The Liberalization in Israel's Capital Account" in Ben-Bassat, A. (ed.), *The Israeli Economy 1985-1998, From Government Intervention to Market Economics: A Research Project* in Memory of Michael Bruno.

Bodenhorn, Howard, 2003, "Short-Term Loans and Long-term Relationships: Relationship Lending in early America," *Journal of Money, Credit and Banking*, 35(4), p.485-505.

Boot, W. A. Anoud and Anjan V. Thakor, 1994, "Moral Hazard and Secured Lending in an Infinetly Repeated Credit Market Game," *International Economic Review*, 35(4), 899-920.

Boyd, J. and E. Prescott, 1986, "Financial Intermediary Coalitions," *The Journal of Economic Theory*, Vol. 38, 211-232.

Central Bureau of Statistics, *Statistical Abstract of Israel*, various years.

Claessens, S., A. Demirguc-Kunt and H. Huizinga, 2001, "How Does Foreign Entry Affect Domestic Banking Markets ?" *Journal of Banking and Finance*, Vol. 25, 891-911.

Cole, A. Rebel, 1998, "The Importance of Relationships to the Availability of Credit," *Journal of Banking and Finance*, 22, 959-977.

Cosci, Stefania and Valentina Meliciani, 2002, "Multiple Banking Relationships: Evidence from the Italian Experience," *The Manchester School Supplement*, 37-54.

Denizer, C., 1997, The Effect of Financial Liberalization and New Bank Entry on Market Structure and Competition in Turkey, memo, Macroeconomic and Growth Development Research Group, World Bank.

Degryse, Hans and Patrick Van Cayseele, 2000, "Relationship Lending within a Bank-Based System: Evidence from European Small Business Data," *Journal of Financial Intermediation*, 9, 90-109.

Dietmar, Harhoff and Timm Korting, 1998, "Lending Relationship in Germany – Empirical Evidence from Survey Data," *Journal of Banking and Finance*, 22, 1317-1353.

Elsas, Ralf and Jan Pieter Krahnen, 1998, "Is Relationship Lending Special ? Evidence from Credit-file Data in Germany," *Journal of Banking and Finance*, 22, 1283-1316.

Gheva, David, 1979, "Cost of Credit to Firms in Israel in Revolving Credit Facilities, Issues in Banking, 2, Bank of Israel, Banking Supervision Department, Research Unit. (Hebrew).

Greenbaum Stuart I., George Kanataz and Itzhak Venezia, 1989, "Equilibrium Loan Pricing Under the Bank-Client Relationship," *Journal of Banking and Finance*, 13, 221-235.

Houston, Joel and Christopher James, 1996, "Bank Information Monopolies and the Mix of Private and Public Debt Claims," *The Journal of Finance*, Vol. 51, 1863-1889.

Klemperer, Paul, 1987, "The Competitiveness of Markets with Switching Costs," *Rand Journal of Economics*, 18(1), 138-150.

Klemperer, Paul, 1987, "Competition when Consumers have Switching Costs: An Overview with Applications to Industrial Organization, Macroeconomics and International Trade," *Review of Economic Studies*, 62, 515-539.

Kim, Moshe, Doron Kliger and Bent Vale, 2003, "Estimating Switching Costs: the Case of Banking," *Journal of Financial Intermediation*, 12, 25-56.

Leland, H. E. and Pyle D. , 1977, "Informational Asymmetries, Financial Structure and Financial Intermediation", *The Journal of Finance*, Vol. 32, 371-387.

Lummer, S. L. and J. J. McConnlell, 1989, "Further Evidence on the Bank Lending Process and Capital Market Response to Bank Loan Agreements," *Journal of Financial Economics*, 25(1), 99-122.

Onenga, Steven and David C. Smith, 2000, "Bank Relationship: A Review," in: P. Harker and S. A. Zenios, ed., *Performance of Financial Institutions*, Cambridge University Press, 221-258.

Paroush, Jacob, and David Ruthenberg, 2001, Measurement of Competition in the Banking Industry in Israel, Discussion Paper 01.01, Banking Supervision Department, Bank of Israel. (Hebrew)

Paroush, Jacob, and David Ruthenberg, 2002, Risk Premium and Market Power in Israeli Banking, Discussion Paper 02.02, Banking Supervision Department, Bank of Israel. (Hebrew).

Petersen, Mitchell A. and Raghuram G. Ragan, 1994, "The Benefits of Lending Relationships: evidence from Small Business Data," *The Journal of Finance*, Vol. 49, no.1, p. 3-37.

Petersen, Mitchell A. and Raghuram G. Ragan,, 1995, "The Effect of Credit Market Competition on Lending Relationships," *The Quarterly Journal of Economics*, Vol 10, 407-443.

Rajan, Raghuram G., 1992, "Insiders and Outsiders: The Choice between Informed and Arm's-Length Debt," *Journal of Finance*, 47(4), 1367-1400.

Repetto, Andrea, Sergio Rodriguez and Rodrigo O. Valdes, 2002, Bank Lending and Relationship Banking: Evidence from Chilean Firms, memo, Prepared for the 6th Annual Conference of the Central Bank of Chile "Banking Industry and Monetary Policy Transmission".

Ribon, Sigal and Oved Yosha, 1999, "Financial liberalization and competition in banking: an empirical investigation," Bank of Israel, Research Department Discussion Paper Series, no. 99.05.

Sharpe, Steven A., 1990, "Asymmetric Information, Bank Lending and Implicit Contracts: A Stylized Model of Customer Relations," *Journal of Finance*, 45(4), 1069-1087.

Unite, Angelo A. and Michael J. Sullivan, 2003, "The Effect of Foreign Entry and Ownership Structure on the Philippine Domestic Banking Market," *Journal of Banking and Finance*, 27, 2323-2345.

Varian, Hal R. 1989, "Price Discrimination" in *Handbook of Industrial Organization*, Vol I, ed. Schmalensee R. and Robert Willig.

Weinstein, D. and Y. Yafeh, 1998, "On the Costs of a Bank-Centered Financial System: Evidence from the Changing Main Bank Relations in Japan," *The Journal of Finance*, No. 2, pp. 635-672.

Wright, April, 2002, "The Impact of Competition on the Operations of Foreign Banks in Australia in the Post-Regulation Period," *Journal of International Financial Markets*, Institutions and Money, Vol. 12, p. 359-375.

Yafeh Y. and O. Yosha, 2001, "Industrial Organization of Financial Systems and Strategic Use of Relationship Banking," *European Finance Review*, 5, p. 63-78.