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THE CREDIT MARKET IN ISRAEL – EMPIRICAL TESTING OF THE CREDIT CHANNEL

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This study examines the factors that determine unindexed bank credit using panel data for banks in Israel during the period 1996-2006. The use of such data makes it possible to test the effect of bank characteristics, such as size, liquidity, capital and the proportion of doubtful debts, on the reaction of the bank to changes in monetary policy. It was found that bank characteristics do have an influence on the quantity of credit provided by the bank. However, in contrast to studies in other countries, the influence of bank characteristics on the bank's reaction to changes in monetary policy was found not to be significant. It was also found that monetary policy has more of an effect on credit when the economy is in recession than when it is in a period of strong growth. An increase in the cost of loanable funds, together with a worsening in the banks' average capital ratio, and the slowing of GDP growth between 2000 and 2005, contributed to the slowdown in the growth of credit during those years.

1. INTRODUCTION

Credit in general, and bank credit in particular, is an important component in the financing of business sector activity and in the transmission mechanisms of monetary policy. Monetary policy influences the demand for money (the "money channel") but also has an effect on the demand and supply for credit (the "credit channel"), the magnitude of which will be examined in this paper. The goal of the paper is to examine the factors that determine the banks' supply of credit, particularly the influence of monetary policy (the bank credit channel), using panel data from the balance sheets of banks operating in Israel. The empirical analysis of cross-sectional data makes it possible to identify the supply effect by examining the behavior of banks with different characteristics and their reaction to changes in monetary policy. These characteristics include, among others, the bank's size, degree of liquidity and capital, which affect its ability to obtain loanable funds. The main challenge in this regard is the ability to differentiate between the effects of supply (of the banks) and the effects of changes in the demand (of firms and individuals) within a reduced

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form framework that consists of a single equation for the quantity of credit. This constraint is due to the lack of data on the price of credit provided by the bank.

The paper is divided into six sections. Following the Introduction, Section 2 provides a brief survey of the literature. Section 3 presents the conceptual framework of the analysis. Section 4 presents the macroeconomic background and characteristics of the banking system in Israel. Section 5 discusses the estimation and its results and Section 6 concludes.

2. SURVEY OF THE LITERATURE

a. International literature

Monetary policy influences the economy through various transmission mechanisms. In addition to the traditional channel, which involves the reduction in the demand for money (the "money channel"), monetary policy also influences the demand and supply of credit (the "credit channel") and it is this effect that will be examined here. The literature discusses two sub-channels of the credit channel: The first works through corporate balance sheets (the "balance sheet channel"). According to this approach, monetary policy (in this case contractionary) can affect the value of the borrower by increasing its interest expenses, which in general is accompanied by a drop in the value of its assets and therefore a reduction in the value of its collateral. As a result, the borrower will be less able to obtain credit. Bernanke and Gertler (1989) use a theoretical model to show that borrowers' balance sheets have an effect on the business cycle. The second sub-channel operates through the supply of credit from the banks (the "bank credit channel"). Contractionary monetary policy reduces the banks' sources of loanable funds and increases the price of those funds and therefore can be expected to reduce the supply of credit. To the extent that firms are dependent on bank credit as opposed to other types of credit[1] and to the extent that there are no close substitutes for bank credit, this sub-channel gains in importance.

The basic model used in the discussion of the credit channel is presented in Bernanke and Blinder (1988). It is a simple IS-LM model except that instead of including only a single type of credit in the economy, they differentiate between bank credit and bonds and assume that they are not perfect substitutes. The demand for bank credit is therefore dependent on the alternative price of bond financing, in addition to the level of economic activity and the price of bank credit itself. In addition to the credit market, the model also includes a market for money (LM) and a market for goods. Using a simple diagrammatic presentation, they show the influence of each factor in the model, particularly that of monetary policy. In particular, they show that external (negative) shocks to the supply of bank credit will reduce its quantity. In addition, GDP will be reduced and the interest rate on bonds will decline while at the same time the interest rate on bank credit will increase.

[1] Nonetheless, it is possible that the bank's desire to smooth the level of interest, its long-term ties with borrowers and other considerations will in fact lead to a weakening of the effect of monetary policy on the banking system.

Many articles discuss the question of whether the credit channel exists. All of them make the critical assumption that bank credit is not a perfect substitute for other sources of financing, which is similar to the assumption made by Bernanke and Blinder. However, in much of the research, there is no explicit formulation of the equations derived directly from their models but rather a focus on empirically testing the behavior of bank credit for each bank. The question can be examined from the viewpoint of firm behavior or that of bank behavior and the supply of credit. The empirical significance of the credit channel is dependent on the extent to which the characteristics of the market – with respect to both the banks and the borrowers – reveal a significant deviation from the standard IS-LM model. Kashyap, Stein and Wilcoxs (1993) show that if monetary policy works through the regular money channel, then contractionary monetary policy will lead to a reduction in demand both for bank credit and for other types of credit (in the capital market). In contrast, if the credit channel is dominant, then one can expect a reduction in bank credit and its substitution (at least partial) by other sources of credit (i.e., bonds). Their empirical results for the US support the existence of a credit channel. The oft-quoted Kashyap and Stein (1995) article presents the claim that the banks, like non-financial firms, are influenced by inefficiencies in the capital market. Thus, their theoretical model shows that if a bank credit channel exists, then one can expect a bank's size to affect its reaction to contractionary monetary policy. The article presents empirical evidence in favor of this claim using quarterly balance sheet data for banks in the US. In a later article (Kashyap and Stein, 2000), they use panel data to show that banks with a smaller liquidity ratio are influenced to a greater extent by monetary policy, particularly if they are also small in size. They adopt a somewhat different approach than that which became standard in later articles. First, they estimate the relationship between changes in credit provided by the bank and an indicator of the strength of the bank's balance sheet (and the change in credit arrears). The coefficient for the strength of the balance sheet is used in the second stage of the estimation as the dependent variable which is explained by indicators of monetary policy (and the change in real economic activity). The coefficient for monetary policy is meant to reflect the influence of the bank credit channel. Alternatively, they estimate the relevant coefficients in one single stage, which is the accepted method in later articles. In other words, the coefficient for the influence of the strength of the balance sheet is multiplied by the indicator for monetary policy. The results obtained are similar for both methods. A relatively early article (Bondt, 1999) produced by the Dutch Bank, estimates an equation for six countries (Germany, France, Italy, Britain, Belgium and Holland) which links the change in credit (relative to assets) to the change in the short-term interest rate multiplied by the characteristics of the bank (i.e., size and liquidity). Strong support was found for the existence of the loan channel in some of the countries while in others there was only partial support.

In recent years, a number of articles have been published as part of a project to examine the transmission mechanisms in the EU (see the book by Angeloni, Kashyap and Mojon, eds., 2003). These articles test for the existence of the credit channel using cross-sectional data for banks in various European countries. Based on the approach in Bernanke and Blinder (1988), Ehrmann et al. (2003) estimate equilibrium equations for the bank credit market using panel data, which makes it possible to identify, if only partially, the supply

effect of monetary policy while taking into account the characteristics of each bank. In an overall test for the euro zone, they find that the size of a bank has a dominant effect on its reaction to a change in monetary policy. Larger banks reduce their supply of credit to a lesser extent when the rate of interest increases. The degree of liquidity and equity capital (relative to total assts) has less of an effect. However, when the model is tested separately for each of the four countries (Germany, France, Italy and Spain), the size of the bank is no longer a major variable while degree of liquidity becomes more significant in the explanation of the reaction of the banks to changes in the interest rate. Chatelain et al. (2003) report a number of research studies carried out as part of a project of the European Bank,[2] which tested the variation in the effect of monetary policy on the supply of credit by banks (using data on individual banks) and on the demand of firms (using the balance sheets of individual firms). The analysis of the banks is based on a model presented in Ehrmann et al. (2003). The results for nine countries showed that in most of them the degree of liquidity influences the reaction to monetary policy. Within this framework, Brissims, Kamberoglou and Simigiannis (2001) examine the question for the case of Greece but do not obtain significant results using the method of estimating a reduced form equation. In an effort to better identify the supply function, they estimate an equation that also includes deposits. This assumes that the bank, which operates in an environment of perfect competition, views the interest rate on deposits as given. They also find that large banks and banks with more liquidity reduce their supply of loans to a lesser extent in reaction to contractionary monetary policy. Farinha and Marques (2001) find evidence of the existence of the credit channel in Portugal by estimating the supply of credit using cointegrative methods and find that it is more important for banks with a small capital ratio. The existence of the credit channel in Hungary was tested by Horvath, Kreko and Naszodi (2006). They present a simple model of bank behavior in which the interaction of the bank's characteristics with the change in the monetary rate of interest influence the change in the quantity of credit (which is similar to the formulation to be presented in this paper). In addition, they attempt to identify the homogeneity of the demand side in order to facilitate the analysis of the bank supply of credit by estimating a reduced form equation for the quantity of credit. The test for homogeneity was carried out by analyzing the proportion of loans to small and medium-sized businesses from banks of various sizes. They found no significant difference in the composition of credit between the banks. According to their results, the response of total credit to the change in policy is asymmetric among banks with different characteristics while on the demand size no such asymmetry exists. Therefore they are unable to reject the hypothesis that the response of the supply of bank credit to changes in monetary policy varies according to bank characteristics. Worms (2001) also attempts to identify the demand side. He includes two indicators of demand in estimation: the average income of borrowers from the bank (calculated according to the average income for the sector weighted by the proportion of total credit from that bank to the sector as a whole) and the rate of bankruptcy (similarly weighted). He finds that banks with less liquidity exhibit a stronger reaction to contractionary monetary policy while the size of a bank has an

[2] A full description of the research appears in ECB Working Papers, no. 91 through 114. The articles were published in Angeloni, Kahsyap and Mojon, eds. (2003).

effect only in certain specifications. Overall, he concludes that there is evidence of the existence of the credit channel.

A recent article by Kohler, Hommel and Grote (2006) carries out similar tests for the Baltic States (Estonia, Latvia and Lithuania) and finds that the main factor influencing the reaction of banks to monetary policy is liquidity while the size of the bank does not have a significant influence. Kishan and Opelia (2000) test for the existence of the credit channel by testing the reaction of US banks of various sizes and with differing capital ratios to monetary policy. Using a simple model of a profit-maximizing bank, they show that the higher a bank's capital ratio, the less it reduces its supply of credit in response to an increase in the rate of interest. It is unclear how the bank's size affects its response to a change in policy. Since their sample of banks and observations is sufficiently large, they estimate an equation for each group of banks separately and then compare the results. They find that for every capital ratio small banks are more strongly influenced by monetary policy, which is a similar result to that found for some European countries. Gambacorta (2007) of the Bank of Italy tests the reaction of the price of bank credit, rather than its quantity as in other studies, and finds that the heterogeneity in the response of prices among the banks with respect to liquidity, equity and whether there is a long-term relationship with borrowers exists only in the short term. In a previous study, he finds that the influence of heterogeneity on the quantity of credit also exists in the long term. He claims that the use of price rather than quantity enables a more accurate identification of supply effects, which is the goal of this paper, in contrast to demand effects.

The existence of the credit channel was also tested for developing countries in the context of analyzing the importance of foreign banks in local banking. An IMF position paper (Arena, Reinhart and Vasquez, 2007) employs the conventional approach for testing whether foreign banks react differently to monetary policy than local banks. They estimate equations for the reaction of credit and deposits and their rates of interest using a sample of annual data for some 1500 banks in 20 countries. They find only weak evidence for the hypothesis that foreign banks are less sensitive to local monetary policy (since their sources of loanable funds are less restricted) and that low liquidity and low equity capital have an effect on bank behavior. In this case as well, the identification and differentiation of the supply side from the demand side is a central issue. They assume that the demand for credit from foreign banks is not systematically different from the demand for credit from local banks (and also test this assumption).

The testing of the relationship between bank characteristics and changes in credit has also been carried out in the context of financial stability. It is beyond the scope of the paper to survey this literature but it is worth mentioning Nier and Ziccihino (2005) of the Bank of England who test the influence of a bank's balance sheet on the quantity of credit it provides using data on 600 banks in 31 countries. They do not relate to the influence of monetary policy but rather focus on the relationship between the business cycle, bank quality and credit behavior. Therefore, their main equations include changes in GDP and bank characteristics as variables that explain the growth in credit. They find that credit is pro-cyclical and that a reduction in the bank's equity capital affects its ability to provide credit and that this effect is amplified in times of crisis.

b. Literature in Israel

In Israel, as in Europe, the banking system plays a central role in providing financing for the activity of the business sector. However, in recent years, there has been a downward trend in the share of the banks in total credit to the business sector, which was accompanied by a parallel increase in non-bank credit. The share of the banks in credit to the business sector fell from 77 percent in 2001 to about 57 percent in mid-2006. In particular, total credit to the business sector grew by about 10 percent in 2005 but this was the combined result of a decline of about one percent in bank credit and an increase of about 34 percent in non-banking credit. The situation was similar in 2006.[3]

A number of articles discuss the credit market in Israel from various viewpoints using aggregate or cross-sectional data on firms but to the best of my knowledge none have examined the issue using cross-sectional data on the banks in Israel.[4] An econometric model of the banking system created by Barnea, Landskroner, Parush and Rotenberg (1997) includes aggregate equations for the demand and supply of credit in the framework of a non-competitive banking market. Ribon and Yosha (1999) tested the degree of competitiveness in the credit and deposit market for the unindexed shekel sector during the period 1989-96 using aggregate data. They found the market for deposits to be competitive while they found the existence of market power in the credit market, though it declined over the sample period. Zilberfarb, Kraus and Snir (2005) discuss the connection between the level of credit risk and the business cycle in the context of the credit channel. Based on data for firms in the construction industry, they show that during a period of GDP growth banks tend to extend credit to riskier borrowers and demand less collateral. This behavior, which is likely to exacerbate the recession when it arrives, is one of the mechanisms of the credit channel.

Ber and Ribon (2005) examine the effect of the liberalization in the capital markets on the competitiveness of the market for bank credit. Using cross-sectional data on publicly-traded industrial firms, they show that during the 90s there was a decline in the market power of the banks to determine the price of unindexed shekel credit they provide to these firms. Firms that had long-term relations with the bank and non-exporting firms (who have less exposure abroad) experienced greater benefit from the opening up of the market. Rotemberg and Hecht (2006) provide an extensive review of the recommendations of the Basel II Committee in the context of the management of credit risk by the banks and estimate equations for the demand and supply of credit using aggregate data for the economy. They find that during periods of economic growth credit grew while during periods of recession it did not decline, as expected, but rather grew at a slower rate, despite the increased credit risk during these periods. In other words, the credit channel, by way of corporate balance sheets as described above, operates in only a partial manner. In the

[3] During the first three quarters. Source: Bank of Israel Annual Report 2006. Table 10 in the section on the financial system.

[4] There is an unpublished memo at the Bank of Israel written by Rinat Ashkenazi that analyzes this situation using data on individual banks.

opinion of the authors, the implementation of the Basel II principles will amplify the pro-cyclical effect of economic activity on credit.

The goal of this research is to present an analytical framework that will make it possible to study the market for bank credit in Israel. Beyond the interest in determining whether the bank credit channel exists, it is important to empirically describe the market for bank credit in recent years against the background of the changes in this market, regarding both demand and supply within a macroeconomic framework, an issue which has received little attention until now.

3. THE CONCEPTUAL FRAMEWORK

The goal of the simple model described in this section is to provide a general framework for the empirical analysis of the factors determining the change in the quantity of credit. It is similar to the framework used in recent articles, particularly the discussion paper by Horvath, Kreko and Naszodi (2006) published by the Hungarian Central Bank.

We assume that banks operate in an environment of monopolistic competition in which each bank faces a negatively-sloped demand curve for credit. We will assume that bank *j* in period *t* faces the following demand curve:[5]

(1) $i_L = l_0 + l_1 Y + l_2 i^* - l_3 L$,

where i_L is the bank's rate of interest on credit, L is the log of the quantity of credit, Y is the log of GDP or some other variable representing economic activity[6] and i^* is the cost of alternative sources of financing, particularly non-bank sources, in accordance with Bernanke and Blinder's model, or of bank credit other than that offered by bank *j*.

The market for deposits is not explicitly presented. It is assumed that in general the cost of loanable funds, i_D, which is influenced to a large extent by the interest the bank pays to depositors, is dependent on the basic interest rate, i_0, which is determined by the central bank, and the reserve requirement ρ. This cost is influenced by the characteristics of the bank, which are represented by x. The characteristics of the bank affect the bank's cost of loanable funds through, for example, the premium to depositors for the risk they attribute to the bank or according to the bank's assessment of the risk in extending credit, which affects the effective cost of providing a unit of credit,[7] or differences in the composition of the bank's sources of funds. This can be expressed by the following equation:

(2) $i_D = i_0(1-\rho)(a_0 - a_1 x) = i_0 b_0 + b_1(x\, i_0)$.

[5] To simplify the presentation, we omit the indexes for the bank and the time period.

[6] GDP appears as a factor affecting the demand for credit. Of course, changes in the supply of credit and the resulting equilibrium in the credit market are likely to have an influence on economic activity and the business cycle. The paper does not examine this effect.

[7] Alternatively, it would have been possible to include the risk in providing credit as an additional cost in the bank's profit function, which arises, for example, from the need for increased monitoring of the borrower as a function of its characteristics.

Using the equality of sources and uses in the bank's balance sheet, we obtain that the bank's total liabilities, which for simplicity are assumed to consist only of deposits from the public, are equal to the credit it has provided, other loans (bonds B) and liquid assets R held to meet the reserve requirement (such that $R=\rho D$). Thus,

(3) $D=(1/(1-\rho))(L+B)$.

The bank's profit function (ignoring operating costs) is then:

(4) $\pi=L\, i_L - D\, i_D + B\, i_0 = L\,(l0 + l_1\, Y + l_2\, i^* - l_3\, L) - (1/(1-\rho))(L+B)\, i_0\,(b_0 + b_1 x) + B\, i_0$.

Profit maximization is achieved when:

(5) $L=(1/l_3)\, i_L - (\, b_0/(l_3(1-\rho))\, i_0 + b_1/(l_3(1-\rho))(x\, i_0)$.

Substituting from (1) yields:

(6) $L=c_0 + c_1\, Y + c_2\, i^* - c_3\, i_0 + c_4\,(x\, i_0)$,

where

$c_0=(l_0/2l_3)$; $c_1=(l_1/2l_3)$; $c_2=(l_2/2l_3)$; $c_3= b_0/(2l_3(1-\rho))$; $c_4 = b_1/(l_3(1-\rho))$.

Equation (6) reveals that the quantity of credit increases with economic activity. The higher the price of alternative credit, the greater is the demand for credit offered by the bank. A higher rate of interest or a more contractionary monetary policy reduces the quantity of credit. However, the more favorable the bank's characteristics (for example, it is less risky or its supply of deposits is larger at any level of risk), the more credit it can offer at each rate of interest. The inclusion of this factor – the product of the bank's characteristics and the basic cost of loanable funds – makes it possible to discuss the effects of bank characteristics on credit. If it is assumed that the demand for credit for each bank is homogeneous, then the variation in credit due to x reflects the influence of the bank credit channel.

It is worth mentioning that the price of credit to the borrower does not appear in this specification, which is the reduced form equation for the quantity of credit in equilibrium. This is necessary due to the limitations of the data which include information on quantities taken from the banks' balance sheet but not prices, thus making it difficult to identify and differentiate between demand and supply factors.

In order to ensure the stationarity of the estimated variables, the equation is estimated using differences. Thus, Equation (6) is restated as follows:

(7) $\Delta L= c_1 \Delta\, Y + c_2 \Delta\, i^* - c_3 \Delta\, i_0 + c_4\,(x \Delta\, i_0)$.

It is also possible to test the hypothesis that, in addition to the effect of the product of bank characteristics and the interest rate on the cost of loanable funds, the elasticity of supply relative to the rate of interest is also dependent on the level of economic activity. During a recession, the cost of loanable funds will be higher at every basic rate of interest

due to, for example, the higher risk on deposits (which reflects the higher risk of providing credit during a period of recession). In this case, Equation (2) is expanded as follows:

(2') $i_D = d_0 i_0 + d_1(i_0 x) + d_2(i_0 \Delta Y)$.

Equation (7) will then be approximately:

(7') $\Delta L = k_0 + k_1 \Delta Y + k_2 \Delta i^* - k_3 \Delta i_0 + k_4 (x \Delta i_0) + k_5 (\Delta i_0 \Delta Y)$.

Some studies, which are not based on an explicit model, include the effect of bank characteristics on its own, rather than multiplied by the interest rate (see, among others, the IMF working paper by Arena, Reinhart and Vazquez, 2007). The formulation of Equation (7) is then:

(7'') $\Delta L = g_0 + g_1 \Delta Y + g_2 \Delta i^* - g_3 \Delta i_0 + g_4 x$.

Formulating the equation such that the bank characteristics are not multiplied by the interest rate weakens the argument for the existence of the credit channel. This formulation implies that banks with different characteristics change their quantity of credit to different degrees but do not necessarily react differently to changes in monetary policy. Considerations of various types cause larger banks, or banks with more liquidity or equity capital, to increase their quantity of credit to a larger (or smaller) extent, ceteris paribus. The issue of identification arises here again—whether these are demand or supply effects. In order to claim that the characteristics of the bank affect supply, one needs to assume and to show that the variation in demand between the banks is sufficiently captured through other variables included in the reduced form formulation. Whether the product of monetary policy multiplied by bank characteristics should be included or not will be determined empirically.

4. THE MACROECONOMIC BACKGROUND AND THE DATA

a. The macroeconomic environment

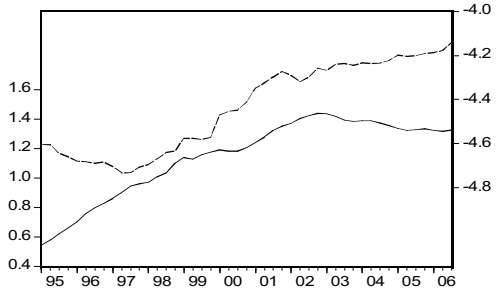
During the period studied in this paper (1996-2006), the Israeli economy experienced two business cycles. Until mid-1999, the economy was in a recession. During the short period between mid-1999 and the third quarter of 2000 (during which the Intifada broke out), the economy enjoyed a period of prosperity. From the end of 2000, the economy returned to recession due to the worsening in the security situation and the decreased global demand for hi-tech products. Only towards the end of 2003 was there an upturn in economic activity, which was characterized by rapid growth rates and continued until the end of the period.

The trends in bank credit are only partially correlated with those in economic activity and there is a clear slowdown in its rate of expansion in recent years, both during the period of economic growth and following the start of the recession. Thus, the rate of growth in credit declined from more than 15 percent (in real annual terms) at the end of the 1990s to

about 10 percent at the beginning of the 2000s. Since then, total bank credit has remained unchanged or grown very slowly, even after the economy began its recovery. The rate of expansion in total bank credit remained lower than 5 percent (Figure 1). As a result, the ratio of bank credit to GDP, which grew relatively quickly until 2003, gradually declined, though at a relatively moderate rate (Figure 2). The fluctuations in the rate of expansion of unindexed shekel credit during this period are larger and its rate of growth in recent years has been more rapid, about 10 percent; however, relative to GDP, the trend of expansion is slower than it was at the end of the 1990s. The proportion of unindexed credit, which was about 30 percent until 2000, has been continually rising and is currently about 45 percent of total bank credit.

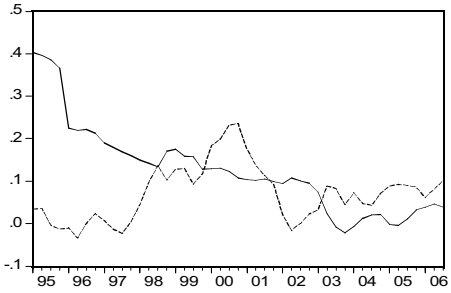
Figure 1
Bank Credit

Total Credit and Unindexed Credit Relative to GDP



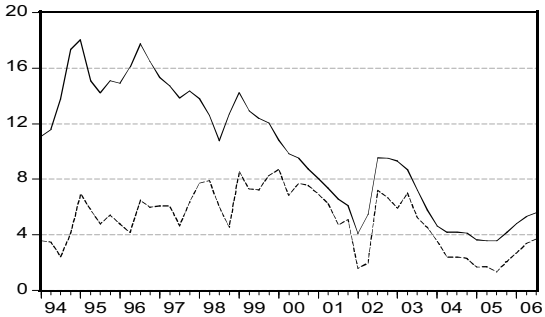
The solid line represents the log of the ratio of total bank credit to GDP. (Left axis) The broken line represents the log of the ratio of unindexed bank credit to GDP. (Right axis)

Annual Change in Total Credit and Unindexed Credit



The solid line represents the annual rate of change in the log of total bank credit. The broken line represents the annual rate of change in the log of unindexed bank credit.

Figure 2
The Nominal and Real Bank of Israel Rate of Interest



The solid line represents the nominal Bank of Israel rate of interest. The broken line represents the real rate of interest.

During this period, the Israeli economy went through a process of convergence to price stability. Inflation dropped from a level of about 10 percent in the mid-1990s to a level of 2 percent or less during the 2000s. During these years, monetary policy was implemented within a framework of inflation targets. From 2003 onward, the target was defined as price stability at between 1-3 percent inflation. The nominal rate of interest followed a downward trend that was correlated with the decline in inflation. In contrast, the real rate of interest rose during the second half of the 1990s to about 8 percent and remained relatively high with large fluctuations until mid-2003. Since then, monetary policy has been more expansionary in the sense that it is maintaining a low real rate of interest, in accordance with the level of economic activity and inflation.

Unlike other countries, Israel's business cycle is not driven mainly by monetary policy but is also influenced to a large extent by external factors, such as changes in the global economy and world trade and shocks arising from the political/security situation. Therefore, it is possible that the main influence on the ability of the banks to raise funds for the provision of credit is in fact not monetary policy but rather changes in the business cycle that are the result of external factors that affect the banks' ability (or willingness) to offer credit. For example, it is possible that a slowdown in economic activity affects the public's supply of deposits to the various banks, in accordance with its assessment of the stability of the banks. Or it is possible that banks with differing levels of liquidity and equity capital attribute different levels of risk to the provision of credit during a recession and therefore react differently to changes in the business cycle.

Table 1
Credit to the Private and Business Sectors

	2002	2003	2004	2005	2006/9
	Real Annual Rate of Change				
Total credit to the private sector (businesses + households)	2.1	0.2	3.4	7.8	3.7
Credit to the business sector*	2.4	0.5	4.1	9.5	6.2
Bank credit to the business sector	-0.1	-2.3	-4.3	-0.9	-2.3
Non-bank credit to the business sector	10.8	9.1	27.1	31.1	19.8
	Breakdown of Credit to the Business Sector (percent)				
Bank credit to the business sector	75	73	67	61	57
Non-bank credit to the business sector	25	27	33	39	43

* Credit to the business sector includes traded and non-traded loans from banks, institutional investors (insurance companies, provident funds and pension funds), foreign residents and households (through mutual funds).
Source: Bank of Israel Annual Report 2006, Table 10, Chapter 4—The Financial System.

One of the main phenomena observed in recent years has been the change in the composition of the business sector's sources of financing and the decrease in the share of bank credit in its total quantity of loans. Table 1 presents the changes in the sources of financing of the business sector (excluding households). The proportion of non-bank credit has grown from about one quarter of total credit to almost half. During this period, bank

credit to the business sector declined in real terms. If it is assumed that households do not use non-bank sources of credit, then there was an average rate of growth of about 1.4 percent in bank credit to households. The change in the composition of credit to the business sector may reflect changes in demand as a result, for example, of the change in the relative price of bank credit or is primarily the result of changes in the banks' supply of credit due to a change in the cost of loanable funds or other changes that restrict their ability to offer credit in general, particularly to the business sector. This study, which uses data on bank credit only, will take a close-up look at the banking system in an attempt to determine whether the characteristics of individual banks, such as their size and degree of liquidity, affect the amount of credit they provide.

b. The banking system—the database

The analytical framework of this study is similar to that presented in Ehrmann et al. (2003) and differs from the approaches adopted in previous articles that analyzed the credit market in Israel. The empirical analysis is based on cross-sectional data on the commercial banks in Israel for the period 1996-2006. The maximum number of banks in the sample is twenty. The data for each of the banks is taken from their published quarterly financial reports. This includes data on quantities (stocks) but does not include data on prices (rates of interest). One of the problems in using the quarterly financial reports is that they are published on the basis of banking group rather than the individual bank.[8] Nonetheless, there do exist separate financial reports for each bank included in the banking group. Thus, it is possible to partially resolve the problem by subtracting the balance sheet values of the "smaller" banks from the values of the consolidated balance sheet. In addition, there have been changes in the list of banks participating in the market over the years. There are banks that have been opened or closed during the period or acquired by other banks. The data used for the estimation were adjusted for these changes. Similarly, very small banks and two foreign banks were removed from the sample.[9] Appendix A presents a list of the banks and changes in it over the years.

The basic data used for the estimation were taken from the balance sheet according to type of indexation. The estimation relates only to *unindexed* credit in Israeli currency provided by the bank. There are a number of reasons for this: First, in order to attribute changes in credit to its price, credit must be defined so as to be characterized by a unit price. Thus, the price of shekel credit is the unindexed shekel rate of interest. For indexed credit, there is a defined indexed rate of interest and for foreign currency credit there is an interest rate defined for that currency (its cost is also dependent on the relevant foreign exchange rate). Unindexed shekel credit is influenced directly by the bank's unindexed cost of loanable funds, which is dependent to a large extent on the monetary rate of interest set

[8] For example, the financial reports of Bank Leumi also include the Arab Israeli Bank. The banks' financial reports also include branches abroad.

[9] Citibank, HSBC, Bank Polska Kasa Ofiki, the World Investment Bank, the National Workers Fund for Credit and Savings – Netanya, Leumi for Business Promotion, Otzar Hashilton Hamekomi and the Palestine Bank were removed from the list of commercial banks.

by the Bank of Israel. Another reason for focusing on unindexed credit is that it is for the most part provided for the short term, such that its stock reflects recent flows. It does not include stock that was created by flows in the more distant past, during which different economic conditions prevailed. However, Figure 1 shows that the slowdown in the expansion of unindexed credit was more moderate than that of total credit and therefore it may be more difficult to identity the factors that influenced the change in the supply in credit, if there were any, using unindexed credit.

Since the dependent variable is unindexed credit, some of the bank-related explanatory variables relate only to this sector. It can be claimed that the behavior of a bank is dependent on its characteristics, which include all its sectors of activity; however, it appears that in view of the risk-reduction considerations related to the exposure of the bank to a particular sector of activity, there is logic in analyzing the situation of the bank in each sector separately. The data for liquid assets (securities, cash and bank deposits) relate to the unindexed shekel sector. The size of the bank (according to assets), the bank's equity capital (the difference between its assets and liabilities) and the proportion of doubtful debts relate to the total activity of the bank. The data for credit risk by sector (construction and individuals) also relate to total activity due to the lack of detailed data according to sector. As in many other studies that estimate equations of this type, the characteristics of the bank are normalized relative to the average, i.e., they are presented as deviations from the average. One method of doing this is to use the average of the banks in each individual period:

$$(8) \qquad x_{it}^{*} = x_{it} - \frac{1}{N}\sum_{1}^{N} x_{jt} \ ,$$

where N is the number of banks. Another method is to adjust the data for each bank relative to the overall average of the banks over time so that:

$$(9) \qquad x_{it}^{*} = x_{it} - \frac{1}{NT}\sum_{1}^{T}\sum_{1}^{N} x_{jt} \ .$$

When the average is also taken over time, the variable is not adjusted for the time trend. In many articles on this subject, it is conventional to calculate the average size (total assets) of the banks for each period in order to take into account the relative size of the bank in a given period and to normalize the rest if the indicators (liquidity and equity capital) using the average of the banks over time. This has also been done here. It should be mentioned that the actual difference between the two calculations is minor and does not significantly affect the results of the estimation.

In addition to data from the banks' balance sheets, the estimation also uses macroeconomic data to describe the influence of the economic environment, particularly monetary policy, on the behavior of the banks. The real change in business sector output during the past four quarters (lagged by one quarter) was used to capture changes in economic activity. In most of the specifications, monetary policy is captured by the yield on 12-month *makam* (short-term bills issued by the Bank of Israel for purposes of monetary management). Some of the specifications include the Bank of Israel interest rate. The yield on *makam* is correlated with the monetary rate of interest but can differ from it if there are

expectations of a change in monetary policy during the coming year. This yield is likely to better reflect the influence of monetary policy on the bank's cost of unindexed funds. Also available were the real yields on CPI-indexed bonds, which reflect the alternative cost of unindexed bank credit. This yield reflects the influence of the cost of alternative credit on the aggregate demand for unindexed shekel credit. Changes in the inflation expectations are likely to contribute to the explanation of the change in unindexed credit since they correct for the change in the real cost of credit that the borrower faces. The rates of interest and inflationary expectations are in original terms. In accordance with the model presented in the previous section, the estimation is carried out in terms of rates of change. Credit is expressed in real terms, i.e., deflated by the CPI, and is logged.

c. Characteristics of the banking system

As mentioned above, the sample includes up to 20 banks for each period. Of these, three are defined as large, five as medium-sized and the rest as small (see Appendix A). The table below presents the main characteristics of the banks according to group.

Table 2
Main Characteristics of the Banking System (in constant prices)

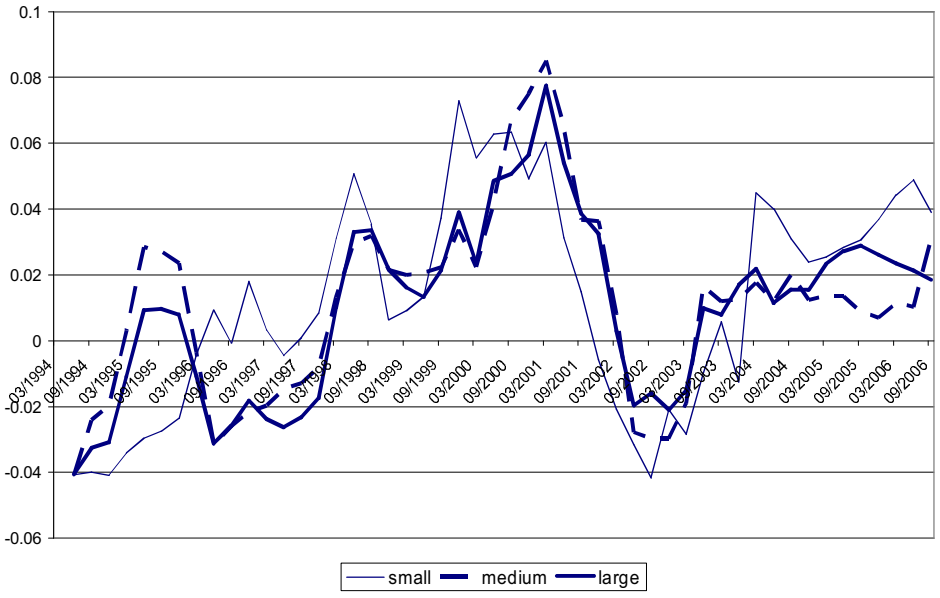
	Small Banks	Medium-Sized Banks	Large Banks
Stocks*			
Unindexed credit	6.5	80.0	346.8
Liquidity (cash and deposits and unindexed securities)	8.8	29.4	128.7
Unindexed deposits	13.6	117.6	483.7
Unindexed assets	15.6	112.1	488.6
Capital (difference between total assets and total liabilities)	2.75	17.6	103.0
Quarterly change			
Unindexed credit	0.015	0.015	0.011
Liquidity (cash and deposits and unindexed securities)	0.013	0.021	0.030
Unindexed deposits	0.018	0.024	0.021
Unindexed assets	0.014	0.016	0.014
Capital (difference between total assets and total liabilities)	0.011	0.011	0.009
Ratios			
Ratio of unindexed credit to unindexed assets	0.56	0.75	0.71
Ratio of liquidity to unindexed assets	0.42	0.23	0.26
Ratio of capital (difference between total assets and total liabilities) to total assets	0.11	0.05	0.06
Proportion of credit risk due to the construction sector within total credit risk +	0.120	0.132	0.185
Proportion of credit risk due to individuals within total credit risk	0.317	0.391	0.252
Proportion of provision for doubtful debts within total credit risk	0.010	0.007	0.009

* All quantities are in millions of shekels and are expressed in real terms.
+ Credit risk (balance sheet) = Credit to the public that is the responsibility of the bank less a specific provision for doubtful debts plus investment in bonds of the public and other assets against derivative instruments of the public.

Table 2 clearly shows the difference in the scope of activity between large and small banks. The volume of unindexed credit provided by the large banks is 50 times larger than that provided by the small banks and 4 times larger then the average volume of credit for the medium-sized banks. The average rate of growth of credit is similar for the small and medium-sized banks and somewhat lower for the large banks.

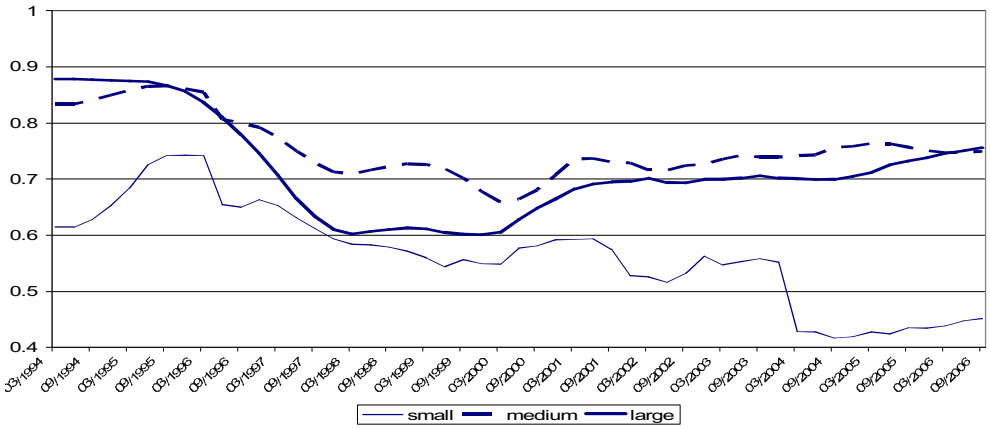
As the macroeconomic data show, also in the analysis of the banking system data by size, there is a clear slowdown in the growth of unindexed credit during the 2000s relative to the end of the 1990s.[10] The data also show that the trends in unindexed credit do not significantly differ between the groups, apart from during the mid-1990s. In order words, it appears at first glance that there is no significant difference between banks according to size. Nonetheless, an analysis of the structure of the balance sheets shows that the proportion of credit to the public within the banks' assets in the unindexed sector is smaller for the small banks (about 50 percent of total unindexed assets as opposed to more than 70 percent among medium-sized and large banks) and is characterized by a clear downward trend. This is in contrast to a moderate increase in the proportion of credit within the unindexed assets of the medium-sized and large banks in recent years (Figure 4).

Figure 3
Real Rate of Change in Unindexed Credit According to Size Group



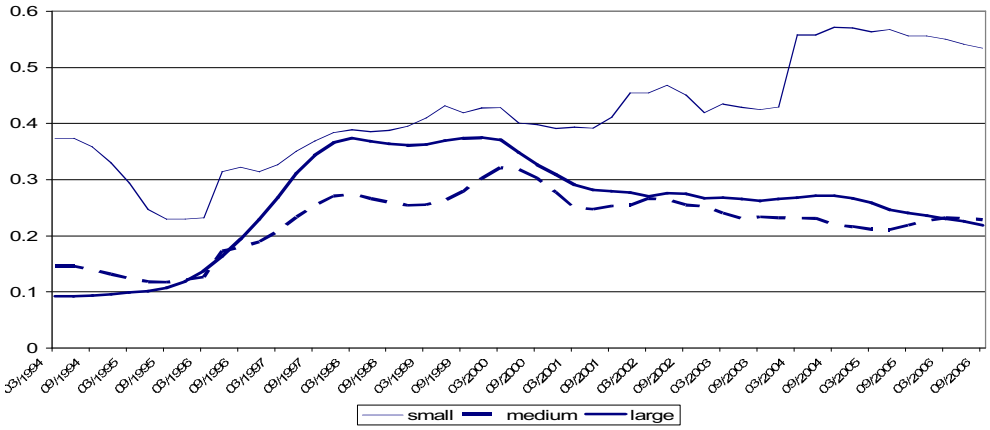
[10] The average of the rates of change for all the bank groups is not weighted according to the size of the banks but rather is calculated as a simple average. Therefore, the rates of change do not exactly match those presented for the macroeconomic data.

Figure 4
Proportion of Unindexed Credit in Total Unindexed Assets According to Size Group



The mirror image of this phenomenon is the larger proportion of liquid assets (cash and securities) within total assets in the unindexed shekel sector among the small banks as compared to the medium-sized and large banks and its upward trend (Figure 5).

Figure 5
Proportion of Liquid Assets in Total Unindexed Assets According to Size Group

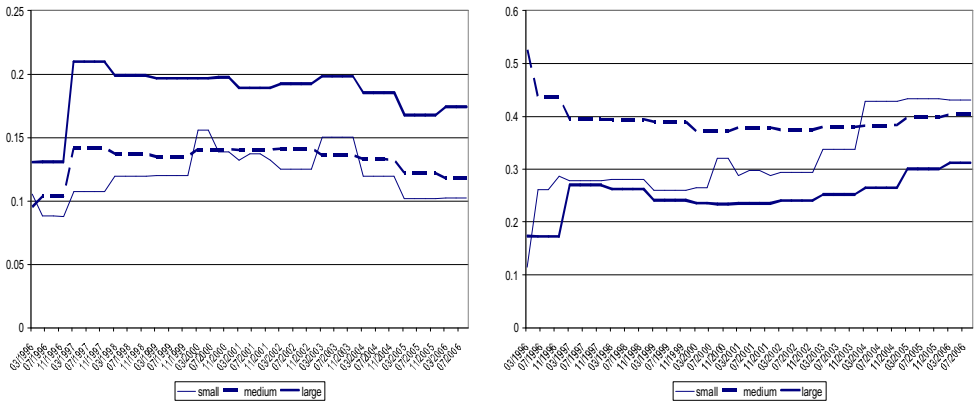


The main challenge in analyzing the credit channel is the identification of the supply side factors as opposed to the demand side factors. One of the variables that will be used to differentiate the characteristics of demand for the various banks is the composition of credit

according to sector, particularly the proportion of credit to the construction sector.[11] The data are in annual terms and relate to total bank credit to the sector, without differentiating between unindexed and other types of credit.

The proportion of credit to the construction sector among the large banks is larger than that for the smaller banks and approaches one-fifth of total credit provided by the bank. On the other hand, the proportion of the large banks in credit to individuals is relatively small and accounts for less than one third of total credit while for the medium-sized banks it accounts for about 40 percent (Figure 6).

Figure 6
Proportion of Credit to the Construction Sector (Left) and to Individuals (Right)

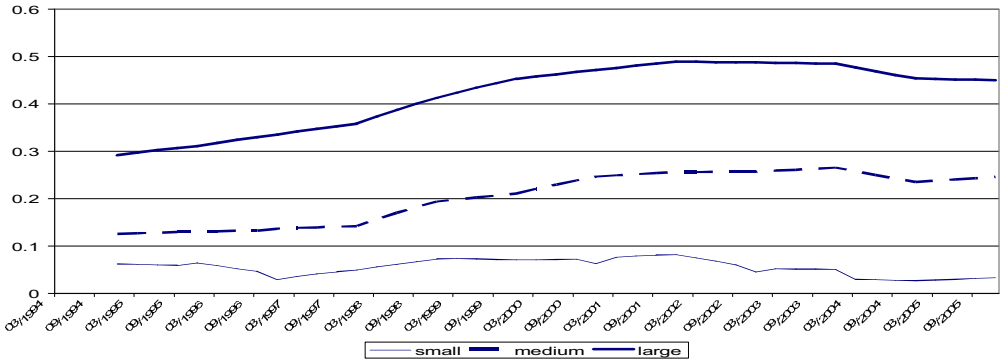


As expected, the quantity of credit to large borrowers is greater for the large banks than for the small banks. It is easy to see from Figure 7 that the proportion of credit to large borrowers (greater than NIS 40 million in constant prices to a single borrower) accounts for almost 50 percent of credit for the large banks as opposed to about 25 percent for medium-sized banks and a negligible proportion for small banks. It is interesting to note that the proportion of large loans given by the large banks has dropped somewhat in recent years following an upward trend since 1995. It is possible that this phenomenon is related to the increased restrictions on the provision of credit to single borrowers in recent years.[12]

[11] Since credit to the construction sector is characterized by a different level of risk, which is apparently higher than that of credit to other sectors, it is possible that this variable also reflects the bank's supply considerations. In addition, credit to this sector is generally for the long term as opposed to unindexed shekel credit which tends to be for the short term. In any case, it eliminates the influence of the sectoral composition of credit from the influence of the other variables.

[12] In 2003, the restrictions on liability to a single borrower or group of borrowers were made more stringent (Proper Banking Management, Supervisor of the Banks).

Figure 7
Proportion of Credit to Large Borrowers (over NIS 40 Million to a Single Borrower) within Total Credit According to Size Group



5. ESTIMATION

a. Description of the method of estimation and the variables

As in many previous articles on the subject, some of which were mentioned above, an equation was estimated for the real change in the quantity of credit using panel data for the banks. As already mentioned, unindexed shekel credit was used in the estimation. After adjusting the relevant period for each of the banks in the system (see Appendix A), 571 observations for 18 banks were available for estimation. On average, there were 32 observations per bank during the period 1996-2006. Thus, Equation (7) was estimated using GLS, which allows for heteroskedasticity among the banks and different serial correlation for each bank.[13] The explanatory variables included macroeconomic variables and variables describing the characteristics of the bank. The policy variable used was the change in yield on 12-month *makam*,[14] which represents the change in the cost of loanable funds to the bank and is identical for all the banks. The change in expected inflation is also included in order to take into account the nominal environment, which affects the real cost of loanable funds. In addition, some of the versions include the change in the real yield on 5-year government bonds as an indicator of the alternative cost of unindexed shekel credit, which can be expected to affect the demand for unindexed credit. The change in GDP during the previous four quarters is included in order to control for the change in real activity and is also expected to affect the demand for credit.

[13] In an IMF working paper, Arena, Reinhart and Vasquez (2007) report that they used this method of estimation. This paper used the STATA program for estimation.

[14] Some of the specifications include the change in the Bank of Israel rate of interest rather than the change in the yield on *makam*. These two indicators are highly correlated (0.65) but in some cases, when there are expectations of a change in policy within the next 12 months, the changes in the two indicators are not identical. Some of the results for the Bank of Israel rate of interest do not appear in the tables but are discussed later on.

b. Estimation results

A number of alternative specifications of Equation (7) were estimated using the macroeconomic variables and various combinations of bank characteristics. The results are presented in Table 3. The dependent variable, as already mentioned, is the log of the real change in unindexed shekel credit. The policy variable, which is essentially the variable that

Table 3
Estimation of Factors Affecting Unindexed Credit

Dependent Variable: Change in the log of unindexed credit (in constant prices)

	1	2	3	4	5	6	7	8	9	10
Constant	30.00	0.004	0.003	0.003	0.002	0.003	0.002	0.004	0.002	0.002
Dependent variable (-1)	**0.211**	**0.217**	**0.212**	**0.207**	**0.210**	**0.190**	**0.218**	**0.222**	**0.205**	**0.185**
Change in yield on *makam* (*Δm*)	**-0.012**	**-0.012**	**-0.012**	**-0.013**	**-0.012**	**-0.013**		**-0.012**	**-0.014**	**-0.014**
Change in Bank of Israel rate of interest (*Δi*)							**-0.007**			
Change in yield on 5-year indexed bonds (-1)	**0.022**	**0.022**	**0.022**	**0.022**	**0.021**		**0.027**	**0.021**	**0.021**	
Change in inflation expectations (-1)	**0.010**	**0.010**	**0.010**	**0.009**	**0.010**	*0.005*	**0.012**	**0.009**	**0.009**	**0.004**
Change in business output during previous four quarters	**1.162**	**1.148**	**1.148**	**1.168**	**1.190**	**1.120**	**1.220**	**1.120**	**1.163**	**1.156**
Proportion of credit to the construction sector (-1) #	**-0.170**	**-0.096**	**-0.144**	**-0.110**	**-0.113**	**-0.107**	**-0.121**	**-0.130**	**-0.114**	**-0.109**
Size of the bank (-1)	0.002				*0.003*	*0.004*	*0.004*		***0.004***	***0.004***
Liquidity (-1) ^		*0.031*			*0.031*	*0.027*	*0.033*		*0.032*	*0.027*
Difference between assets and liabilities (-1) ^			0.058		0.160	0.167	0.179		0.173	0.185
Proportion of doubtful debts (-1) #				**-0.949**	**-1.029**	**-1.145**	**-0.970**		**-1.067**	**-1.200**
Δm * size of bank (-1) #								-0.002		
Δm * liquidity (-1) ^								*-0.034*		
Δm * difference between assets and liabilities (-1) ^								-0.072		
Δm * proportion of doubtful doubts (-1) #								0.172		
Change in yield on *makam* * change in economic activity									0.365	*0.495*
Log Likelihood	**870.3**	**868.5**	**869.1**	**871.2**	**875.8**	**861.0**	**866.2**	**871.4**	**877.1**	**863.3**

Normalized with respect to the average of the banks for each period separately.
^ Normalized with respect to the average of the banks over all the periods.
Bold values are significant at 1%. *Italicized* values are significant at 5%. Underlined values are significant at 10%.

represents the influence of the macroeconomic cost of loanable funds to the bank and which does not take into account the specific characteristics of the bank, is the yield on 12-month *makam* in the specifications presented (apart from Equation (7) in Table 3).

In all the presented specifications, the policy variable was significant and negative as expected. The change in the yield on 5-year indexed bonds, which reflects the change in the demand for unindexed shekel credit in response to a change in the relative price of CPI-indexed credit, was also significant and negative in the specifications in which it was included. However, the effect of a change in the yield on bonds is larger than that of a change in the yield on *makam*, which is not a reasonable result. In addition, there is a strong linear relation between the yield on *makam*, the yield on indexed bonds and inflationary expectations which are, in general, calculated as the spread between the yields on 12-month CPI-indexed bonds and *makam*. The correlation between the change in the yield on *makam* and the change in the yield on 5-year indexed bonds is about 0.4. Therefore, in some of the specifications, which will be presented below, this variable is omitted.

In all the presented specifications, the policy variable was significant and negative as expected. The change in the yield on 5-year indexed bonds, which reflects the change in the demand for unindexed shekel credit in response to a change in the relative price of CPI-indexed credit, was also significant and negative in the specifications in which it was included. However, the effect of a change in the yield on bonds is larger than that of a change in the yield on *makam*, which is not a reasonable result. In addition, there is a strong linear relation between the yield on *makam*, the yield on indexed bonds and inflationary expectations which are, in general, calculated as the spread between the yields on 12-month CPI-indexed bonds and *makam*. The correlation between the change in the yield on *makam* and the change in the yield on 5-year indexed bonds is about 0.4. Therefore, in some of the specifications, which will be presented below, this variable is omitted.

The inflation expectations, which affect the real cost of unindexed credit, were significant and had a positive sign, as expected. In order to control for the changes in the demand for credit that depend on the business cycle, the change in output was included, which is customary in any study of this type. The growth in business output during the four previous quarters affects the demand for unindexed credit with an elasticity that is not significantly different from unity. The estimated point elasticity was somewhat larger than unity, which accords with previous tests of this relation. The next variables in the equation relate to the characteristics of each bank. The proportion of credit to the construction sector (relative to other banks and lagged by one period) was significant in all the specifications and had a negative sign. Its explanatory power could reflect either the supply side or the demand side. Since the proportion of doubtful debts is higher for the construction sector than for total credit, the larger its share of a bank's total credit, the higher is the bank's risk, which is likely to reduce its ability to offer additional credit. However, it is possible that a different trend in the demand for credit by the construction sector, together with a tendency on the part of borrowers in this sector to seek credit from certain banks, may explain the negative contribution to demand facing a particular bank. In any case, the inclusion of this variable in the equation removes the influence of the sectoral structure of credit from the influence of the rest of the variables included in the equation. Various combinations of bank characteristics were tried, both on their own and multiplied by the policy variable, as

dictated by the model and the desire to test for the effect of the credit channel. In general, one can say that the characteristics of the bank influence the change in the quantity of credit it provides while the effect of bank characteristics in interaction with monetary policy was not found to be significant.[15] These results differ from those generally obtained in the studies reviewed above. In most of those studies, the influence of the interaction of some bank characteristic – in most cases, bank size – with policy had an effect on credit.

All the equations in Table 3 (apart from Equation (8)) describe the influence of bank characteristics without interaction. It was found that a higher liquidity ratio (relative to the rest of the banks and lagged by one period) has a positive effect on total credit. Including all the characteristics (Equation (5) to (7)) shows that liquidity, the proportion of doubtful debts and equity capital (the lagged difference between assets and liabilities relative to the rest of the banks) contribute to explaining changes in credit. The specification that includes the Bank of Israel interest rate (Equation (7) and other specifications not presented in the table) gives similar results.

Equations (9) and (10) in Table 3 represent specifications that also include the effect of the interaction between the change in the *makam* yield and the stage of the business cycle, as described in Section 3. The influence of the interaction between the change in the yield and the change in GDP is found to be significant with a positive sign. In other words, the effect of the rate of interest on credit is more moderate (i.e., less negative in magnitude) when the economy is in a period of strong growth. The influence of monetary policy in reducing credit is weaker when the economy is expanding and is stronger during a recession. An attempt was made to test whether this interactive effect varies between banks of different size but the results showed no difference (not presented in the table). The size of the coefficients for the characteristics of each bank and their significance did not change measurably when the interactive variable was included and the fit of the equation improved only somewhat (a higher log likelihood ratio).

An attempt was made to test whether the behavior of small banks that are part of a larger group (see the table in the appendix) differs from that of small independent banks. To this end, a dummy variable was added for whether the bank is independent or not and the same dummy was added in interaction with the change in the *makam* yield. However, this characteristic was not found to have any significant effect on the change in credit or the reaction to a change in monetary policy. A test was done of whether a change in liquidity provided or absorbed by the Bank of Israel through loans or deposits as part of monetary policy has an effect on the change in credit, since a deposit with the Bank of Israel is a preferred alternative to providing credit to the public and liquidity from the Bank of Israel is likely to be preferred over raising funds from the public. Therefore, we would expect the supply of liquidity from the central bank to have a positive effect on the quantity of credit. Such an influence was not in fact found, perhaps because the supply of liquidity is determined by the central bank such that the rate of interest it has set will be maintained and

[15] In both specifications, the interaction between liquidity or the difference between assets and liabilities and the change in Treasury Bill yield was found to be significant but had a negative sign, which was the opposite of what was expected.

therefore the supply of liquidity is correlated with it and does not contain additional information beyond that contained in the rate of interest or the *makam* yield.

Long-Term Coefficients: All the various versions of the estimated equation also included the dependent variable (i.e., the rate of change in credit) lagged by one period. The size of its coefficient was about 0.2 which means that a certain amount of smoothing takes place in the rate of change of credit over time. Accordingly, the size of the total effect of the explanatory variables on the dependent variable, taking into account lags, is the reported coefficient divided by 0.8, or in other words multiplied by 1.25. Therefore, the "long term" effect of the change in the *makam* yield is about 0.015. Thus, an increase in the *makam* yield by one percentage point leads in the end to a 1.5 percentage point reduction in the growth of credit. The elasticity of response of the rate of change in credit relative to a change in GDP in the "long term" is about 1.4.

c. Goodness of fit

In order to get some idea of goodness-of-fit, the expected value of the change in credit was calculated from the two preferred versions. The first was Equation 5 in Table 3 which includes all the characteristics of a particular bank and the yield on *makam*. The second was Equation 10 in the same table which includes, in addition to the variables in Equation 5, the product of the change in the yield on *makam* and the change in GDP but does not include the change in the yield on bonds. Figures 8 and 9 present a comparison of the estimated and actual values. Figure 8 presents the change in each quarter for the unweighted average of the banks and Figure 9 presents the average change in credit over the whole period for each bank separately.

Figure 8
Actual and Estimated Change in Credit, 1996–2006, Average of all Banks

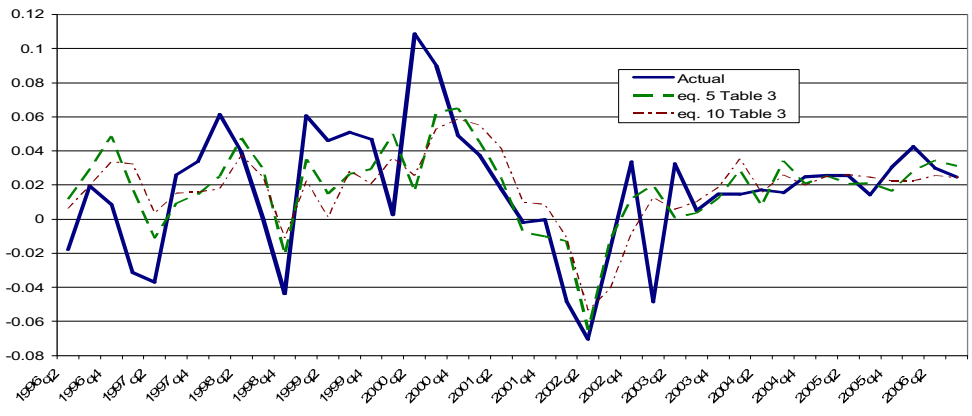
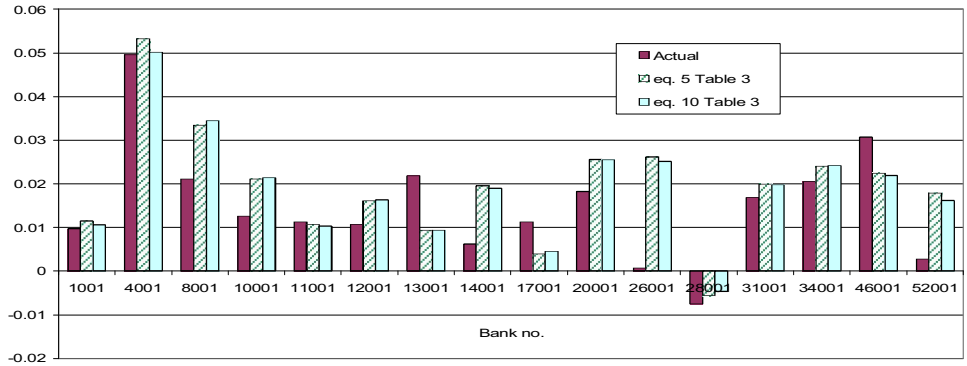


Figure 9
Average Actual and Estimated Change in Credit by Bank, 1996–2006



The two figures clearly show that overall the estimated values capture the trend in credit over time and that there is a reasonable correlation between the estimated and actual values across the banks. A statistical test shows that the estimation error (the difference between the actual and estimated values) is not significantly different from zero, whether over all the observations together or for each bank separately (except for two of the banks). The simple correlation between the actual and estimated values is about 0.40 for the whole sample and ranges from 0.3 to 0.7 for each bank separately (except for three of the banks).

d. The contribution of the explanatory variables to the explanation of the change in credit

The average rate of growth in unindexed bank credit slowed from 4.8 percent per quarter in 2000 to 2.1 percent in 2005.[16] Using the explanatory variables in the estimated equation and their coefficients, it is possible to assess the direction and importance of the contribution of the change in each of the explanatory variables to the slowdown in the growth of credit. The findings are summarized for the average of the banks and for three representative banks (large, medium-sized and small) in Tables 4a to 4d which are based on Equation 5 in Table 3. In general, it can be seen that the ability to explain the change in credit in 2000 is weaker than in 2005 and that it is underestimated. Therefore, the equation's explanation of the slowdown between 2000 and 2005 is only a partial one.

[16] This is not the rate of growth in total unindexed bank credit but rather the unweighted average of the quarterly rate of growth for each of the banks in our database. The rate of growth in unindexed credit was 5.9 percent per quarter on average in 2000 and 2.2 percent in 2005.

Table 4a
Contribution to the Explanation of the Change in Credit in 2000 and in 2005 according to Equation 5 in Table 3
Average of all the banks

	Coefficient	Value in 2000	Contribution in 2000	Value in 2005	Contribution in 2005	Difference between contribution in 2000 and in 2005
Constant	**0.002**	1.000	0.002	1.000	0.002	0.000
Dependent variable (-1)	**0.210**	0.062	0.013	0.022	0.005	-0.008
Change in yield on *makam* (Δm)	**-0.012**	-0.629	0.008	0.091	-0.001	-0.009
Change in yield on 5-year indexed bonds (-1)	**0.021**	0.162	0.003	-0.259	-0.006	-0.009
Change in inflation expectations (-1)	**0.010**	-0.771	-0.008	0.108	0.001	0.009
Change in business output during previous four quarters	**1.191**	0.024	0.029	0.018	0.021	-0.008
Proportion of credit to the construction sector (-1) #	**-0.113**	0.000	0.000	0.000	0.000	0.000
Size of the bank (-1)	**0.004**	0.000	0.000	0.000	0.000	0.000
Liquidity (-1) ^	**0.031**	0.020	0.001	0.045	0.001	0.001
Difference between assets and liabilities (-1) ^	**0.160**	0.000	0.000	-0.016	-0.003	-0.003
Proportion of doubtful debts (-1) #	**-1.029**	0.000	0.000	0.000	0.000	0.000
Dependent Variable – Estimated Value			**0.048**		**0.021**	**-0.027**
Dependent Variable – Actual Value			**0.062**		**0.024**	**-0.038**

Normalized with respect to the average of the banks for each period separately.
^ Normalized with respect to the average of the banks over all the periods.

Table 4b
Contribution to the Explanation of the Change in Credit in 2000 and in 2005 according to Equation 5 in Table 3
A Large Bank

	Coefficient	Value In 2000	Contribution in 2000	Value in 2005	Contribution in 2005	Difference between contributions in 2000 and in 2005
Constant	**0.002**	1.000	0.002	1.000	0.002	0.000
Dependent variable (-1)	**0.210**	0.061	0.013	0.031	0.005	-0.006
Change in yield on *makam* (Δm)	**-0.012**	-0.629	0.008	0.091	-0.001	-0.009
Change in yield on 5-year indexed bonds (-1)	**0.021**	0.162	0.003	-0.259	-0.006	-0.009
Change in inflation expectations (-1)	**0.010**	-0.771	-0.008	0.108	0.001	0.009
Change in business output during previous four quarters	**1.191**	0.024	0.029	0.018	0.021	-0.008
Proportion of credit to the construction sector (-1) #	**-0.113**	0.028	-0.003	0.052	-0.006	-0.003
Size of the bank (-1)	**0.004**	2.990	0.011	2.571	0.009	-0.002
Liquidity (-1) ^	**0.031**	-0.029	-0.001	-0.068	-0.002	-0.001
Difference between assets and liabilities (-1) ^	**0.160**	-0.025	-0.004	-0.021	-0.003	0.001
Proportion of doubtful debts (-1) #	**-1.029**	-0.021	0.022	0.002	-0.002	-0.023
Dependent Variable – Estimated Value			**0.072**		**0.020**	**-0.052**
Dependent Variable – Actual Value			**0.067**		**0.024**	**-0.043**

Normalized with respect to the average of the banks for each period separately.
^ Normalized with respect to the average of the banks over all the periods.

Table 4c
Contribution to the Explanation of the Change in Credit in 2000 and in 2005 according to Equation 5 in Table 3
A Medium-Sized Bank

	Coefficient	Value in 2000	Contribution in 2000	Value in 2005	Contribution In 2005	Difference in contributions in 2000 and in 2005
Constant	**0.002**	1.000	0.002	1.000	0.002	0.000
Dependent variable (-1)	**0.210**	0.046	0.010	0.017	0.004	-0.006
Change in yield on *makam* (Δm)	**-0.012**	-0.629	0.008	0.091	-0.001	-0.009
Change in yield on 5-year indexed bonds (-1)	**0.021**	0.162	0.003	-0.259	-0.006	-0.009
Change in inflation expectations (-1)	**0.010**	-0.771	-0.008	0.108	0.001	0.009
Change in business output during previous four quarters	**1.191**	0.024	0.029	0.018	0.021	-0.008
Proportion of credit to the construction sector (-1) #	**-0.113**	0.025	-0.003	0.044	-0.005	-0.002
Size of the bank (-1)	**0.004**	0.262	0.001	-0.209	-0.001	-0.002
Liquidity (-1) ^	**0.031**	-0.166	-0.005	-0.192	-0.006	-0.001
Difference between assets andliabilities (-1) ^	**0.160**	-0.034	-0.005	-0.019	-0.003	0.002
Proportion of doubtful debts (-1) #	**-1.029**	-0.001	0.001	0.001	-0.001	-0.002
Dependent Variable – Estimated Value			**0.032**		**0.005**	**-0.027**
Dependent Variable – Actual Value			**0.052**		**0.005**	**-0.047**

Normalized with respect to the average of the banks for each period separately.
^ Normalized with respect to the average of the banks over all the periods.

Table 4d
Contribution to the Explanation of the Change in Credit in 2000 and in 2005 according to Equation 5 in Table 3
A Small Bank

	Coefficient	Value In 2000	Contribution In 2000	Value In 2005	Contribution in 2005	Difference in contribution in 2000 and in 2005
Constant	**0.002**	1.000	0.002	1.000	0.002	0.000
Dependent variable (-1)	**0.210**	0.119	0.025	0.025	0.005	-0.020
Change in yield on *makam* (Δm)	**-0.012**	-0.638	0.008	0.091	-0.001	-0.009
Change in yield on 5-year indexed bonds (-1)	**0.021**	0.162	0.003	-0.259	-0.006	-0.009
Change in inflation expectations (-1)	**0.010**	-0.771	-0.008	0.108	0.001	0.009
Change in business output during previous four quarters	**1.191**	0.024	0.029	0.018	0.021	-0.008
Proportion of credit to the construction sector (-1) #	**-0.113**	-0.153	0.017	-0.129	0.015	-0.003
Size of the bank (-1)	**0.004**	-0.733	-0.003	-0.932	-0.003	-0.001
Liquidity (-1) ^	**0.031**	0.410	0.013	0.399	0.013	0.000
Difference between assets and liabilities (-1) ^	**0.160**	-0.038	-0.006	-0.031	-0.005	0.001
Proportion of doubtful debts (-1) #	**-1.029**	-0.004	0.004	-0.005	0.005	0.001
Dependent Variable – Estimated Value			**0.085**		**0.046**	**-0.039**
Dependent Variable – Actual Value			**0.129**		**0.017**	**-0.112**

Normalized with respect to the average of the banks for each period separately.
^ Normalized with respect to the average of the banks over all the periods.

The macroeconomic variables are common to all the banks and most of them contributed to the slowdown in the growth of credit, both on the demand side and the supply side. The change in yield on *makam* is positive in 2005 in contrast to a negative change in 2000 and thus, it contributed to raising the bank's cost of loanable funds and reducing supply. A decrease in the yield on indexed bonds raises the relative price of unindexed credit and reduces demand. In contrast, increased expectations of inflation in 2005 reduced the price of unindexed credit (relative to the real alternative cost) and thus in fact contributed to an increase in demand. These two effects cancelled each other out. The rate of growth in business output, which is large and positive in both years, is nonetheless lower in 2005 and therefore contributed to the slower growth of credit.

Regarding the factors that are specific to each bank, it appears from the average of the banks that a change for the worse in the capital of the banks contributed not insignificantly to the explanation of the slowdown in the growth of the supply of credit. An analysis of the trends for the three representative banks presented in the tables shows that for all three the proportion of credit to the construction sector grew, which therefore contributed to the reduction in the growth of credit. As already mentioned, this may have influenced both the demand side and the supply side. The changes in liquidity have a negative effect on the supply of credit for some of the presented banks. The growth in doubtful debts of the large and middle-sized banks contributed to the reduction in credit. Overall, it can be said that both demand and supply factors are part of the explanation of the slowdown in the growth of credit between 2000 and 2005.

6. CONCLUSION

This study has analyzed the market for bank credit using detailed data on banks in Israel for the last decade. Its goal is to characterize the factors determining the quantity of unindexed bank credit. This involves an attempt to identify the supply factors, particularly the influence of monetary policy on the supply of credit. The analysis uses microeconomic data on individual banks, which makes it possible to relate a bank's characteristics to its reaction to changes in monetary policy and thus provides a way to test the influence of the supply side in general and the existence of the bank credit channel in particular.

The conventional method of estimation, which was also adopted here, uses a reduced form equation for the changes in the quantity of credit, which includes variables for monetary policy and for the characteristics of the individual banks that may affect the bank's reaction to policy changes. It is common to include the size of the bank, its liquidity and its capital among these variables. However, since the equation is in a reduced form and due to the lack of data on the price of credit, it is impossible to clearly differentiate between changes in credit that are the result of changes in the supply of banks with differing characteristics and changes that are the result of a heterogeneous reaction in the demand for credit for the various banks. The inclusion of variables that characterize the demand for credit may help in this regard.

The results of the estimation show that bank characteristics – liquidity, capital and the proportion of doubtful debts – have an effect on the change in the quantity of credit. In other words, the characteristics have an influence on the behavior of the bank, given the policy variable. At each rate of interest, banks with more liquid assets relative to unindexed assets, more equity capital relative to total assets and less doubtful debts within their total credit will increase their total credit by a greater extent. In contrast to the results of other studies worldwide, the interaction of the policy variable and bank characteristics was found not to have a significant effect in general. In other words, a bank's characteristics did not affect its reaction to monetary policy. In a small number of the specifications, the product of capital (the difference between assets and liabilities) or liquidity and the change in the yield on *makam* was found to have a significant effect. However, the effect was negative which was not as expected.

It was found that the effect of the interaction between the change in the yield on *makam* and the change in economic activity was positive and significant. In other words, monetary policy has a stronger effect on credit when the economy is in recession than when it is in a period of strong growth. There was no significant difference in the reaction of banks of different size to this interactive variable.

An analysis of the contribution of each of the variables to the slowdown in the growth of credit in 2005 relative to 2000 shows that the increase in the yield of *makam* between 2000 and 2005, which reflects the change in the banks' cost of loanable funds, contributed to the reduction in the supply of credit, alongside a worsening in the bank's capital ratio. The slower growth of GDP in 2005 relative to 2000 contributed to the slowdown in the demand for credit.

Appendix A
Composition of the Banking System 1996-2006

	Size	Name of the Bank	Period in Existence	Period included in the Sample[17]	Group to which it belongs
1	S	Eurotrade	Until 10/2004	Until 2003 IV	
2	S	Yahav for Government Workers	Whole period	From 1996 II	Hapoalim
3	S	Industrial Development Bank	Starting sale of assets in 8/2002	From 2000 III until 2002 I	
4	S	Hasapanut	Until 2/2003	Until 2002 IV	
5	L	Leumi	Whole period	Whole period	
6	L	Discount	Whole period	Whole period	
7	L	Hapoalim	Whole period	Whole period	
8	M	Igud	Whole period	From 1996 II	
9	M	Otzar Hahayal	Whole period	Whole period	From 2000 I within Hapoalim; from 2006 III within First International
10	M	Mercantile-Discount	Whole period	Whole period	
11	M	Mizrahi-Tephahot	Whole period	Whole period	
12	S	American-Israeli	Until 1999	Until 1999 II	
13	S	Ubank	Whole period	Whole period	From 2004 IV within First International
14	S	Continental Poalim	Until 3/2004	Until 2003 IV	From 2004 I within Hapoalim
15	S	Trade	Until 1/2002	Until 2001 III	
16	M	First International	Whole period	Whole period	
17	S	Arab Israeli	Whole period	From 2000 III	Included within Leumi
18	S	Masad	Whole period	From 2000 III	Included within Hapoalim
19	S	Poalei Agudat Yisrael	Whole period	From 2000 III	Included within First International
20	S	Jerusalem	As a commercial bank from 1/2002	From 2002 I	

[17] The period included in the sample can be shorter than the period in which the bank has existed due to missing data.

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