

The Macroeconomic Effects of Financial Innovation: The Case of Israel

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Abstract

This paper examines the macroeconomic effects of financial innovation in the Israeli economy. Israel, like other economies in the West, has experienced significant innovation in financial services in the 1980s. By innovation we refer to the introduction of new, liquid assets that partially replace traditional money in agents' portfolios; technological progress in banking services that reduces the costs of transactions; and changes in the regulatory environment that facilitate transactions. In Israel these innovations were made in conjunction with a high inflation process and were expressed in the increased use of foreign-exchange linked (PATAM) deposits in the period 1978-1985; the increased use of interest-bearing short-term deposits since 1982; and a decline in traditional M1 use concurrently with technological progress in banking services.

We propose a theoretical model, whereby financial innovation has effects of production and consumption in an infinitely - lived, utility-maximizing, representative agent model. Innovation affects the transactions costs of the consumer, generating a portfolio shift. This in turn either enlarges or reduces financial intermediaries resources and hence affects their lending rate to firms. The rate change induces changes in the long-run level of capital and therefore in production and consumption.

We test the implication of the model by estimating a series of VAR models. Examining cumulative impulse responses of real activity variables to shocks in the relative quantities of the different financial assets, we find that the model's predictions that increased use of PATAM deposits is contractionary while increased use of short-term deposits is expansionary are borne out by the data.

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1. Introduction

This paper examines the macroeconomic effects of financial innovation in the Israeli economy. Israel, like other economies in the West, has experienced significant innovation in financial services in the 1980s. Concurrently it experienced a high-inflation process followed by stabilization. This rich variation in the data allows hypotheses testing which is not possible in a stable environment. We document the elements of financial innovation, propose a theoretical model of their macroeconomic implications and empirically test these implications.

By the term "financial innovation" we refer to the introduction of new, liquid assets that partially replace traditional money in agents' portfolios; technological progress in banking services that reduces the costs of transactions; and changes in the regulatory environment that facilitate transactions. In Israel these innovations were expressed in the increased use of foreign - exchange linked (PATAM) deposits in the period 1978 - 1985 (a reversal of this process occurred after the 1985 inflation stabilization program); the increased use of interest-bearing short-term deposits since 1982; and a decline in traditional M1 use. All of this was accompanied by significant technological in banking services.

We propose a theoretical model whereby financial innovation has effects on production and consumption in an infinitely - lived, utility - maximizing representative agent model. Innovation affects the transactions costs of the consumer, generating a portfolio shift. This in turn affects financial intermediaries resources and hence their lending rate. The change in the interest rate induces changes in

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the long-run level of capital and therefore in production and consumption.

We test the implications of the model empirically by estimating a series of VAR models, looking at the cumulative impulse responses of various real activity variables to shocks in the relative holdings of different financial assets. The model's predictions are borne out by the data.

The paper bears upon two strands of recent literature in monetary economics : first there is a growing literature on the effects of financial innovation on money demand. Second there is a body of literature on channels of transmission of monetary policy that go beyond the traditional, textbook "money channel." The first strand studies the effects of the introduction of new instruments and new money management techniques on the demand for M1. Thus Gauger (1992) studies the portfolio redistribution impact of financial innovation for U.S. data. In the late 1970s and early 1980s new instruments were introduced (NOW and SuperNOW accounts) and there was wider use of Money Market Accounts. She finds substitution from traditional M1 (currency plus checking deposits) to the new interest-bearing checkable deposits. Arrau and de Gregorio (1992) show that the "missing money" phenomena in Chile and Mexico may be accounted for by financial innovation. Melnick (1993) uses a financial innovation variable as an explanatory variable of the demand for money in Israel, explicitly demonstrating the role of innovation in M1 demand reductions. A related paper is Guidotti (1993) which studies the effects of financial innovation in the context of monetary integration between several economies. Innovation abroad may lead to substitution out of the domestic currency into the foreign currency. This type of discussion is naturally related to the question of seigniorage, an issue examined by de Gregorio (1991) and Melnick (1993).

The second strand of literature alluded to, the "credit" view of monetary transmission¹, proposes that the asset side of bank balance sheets plays an important role in monetary transmission: following a

¹ See Bernanke and Blinder (1988, 1992), Gertler (1988), King (1986) and Romer and Romer (1990) for an extensive discussion.

tightening by the central bank (for example an open market sale), banks reduce lending. This reduces firms' borrowing, particularly for firms heavily dependent on bank loans (such as small firms). The key assumption here is that alternative, non-bank borrowing is more costly or unavailable. Firms therefore reduce investment spending and subsequently cut employment and production.

The model presented in this paper embodies both a money channel and a credit channel, focusing on financial innovation rather than on monetary policy: like the "money" view there is an effect on banks' liabilities through the change induced by innovation on the portfolio composition of consumers; this in turn affects banks' assets as the portfolio change interacts with differential reserve requirements to generate changes in loan supply, hence a credit supply effect.

We proceed as follows: Section 2 documents financial innovation in the Israeli economy, beginning in the late 1970s and relates it to relevant macroeconomic events. Section 3 presents the theoretical model while Section 4 studies the effects of financial innovation. Section 5 reports the empirical tests of the model's implications. Section 6 discusses these results and concludes.

2. Financial Innovation in the Israeli Economy

In this section we look at some key developments pertaining to financial innovation in the Israeli economy. The process of innovation in Israel was closely linked to the dynamics of the inflationary process. We therefore begin this section by briefly surveying the development of inflation (2.1); we then look at major events of financial innovation (2.2), focusing on two major and distinct innovations: the introduction of liquid, foreign-currency linked deposits, and the improvement and introduction of interest-bearing, unlinked deposits, similar to the new financial instruments offered in major Western economies. We then look (2.3) at the workings of the banking system and the credit market that have a bearing on the general equilibrium analysis which is presented in the next section.

2.1 The Inflationary Process

This process can be broken down into several sub-periods:

- (i) The build up of triple digit annual inflation: 1978 - 1983.
- (ii) An inflationary "explosion": late 1983 - June 1985.
- (iii) A major inflation stabilization program (July 1985) and its immediate aftermath.
- (iv) The post stabilization period: 1986 - 1992.

Figure 1 shows quarterly CPI inflation in the period 1977 to 1992 in annual terms.

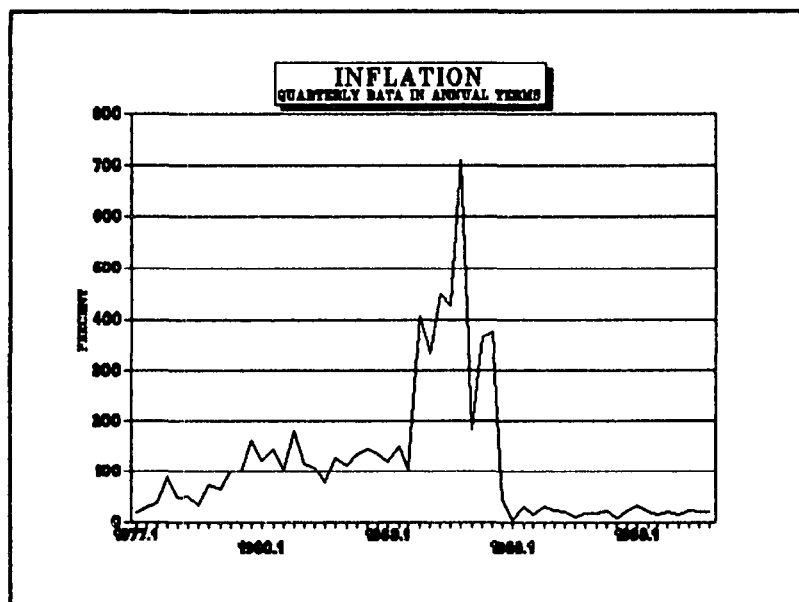


Figure 1

For detailed accounts of this process see Bruno (1993, Chapters 3, 4 and 5), Bruno and Fischer (1986), Bruno and Meridor (1991), Helpman and Leiderman (1988) and Liviatan and Piterman (1986). Here we briefly delineate the major events that accompanied changes in inflation.

From the beginning of 1978 until early 1980 the inflation rate climbed rapidly from around 40%

annually to 120%. The rise in inflation was associated with the liberalization of the foreign exchange market in November 1977, a large initial devaluation of the domestic currency, the introduction of the afore-mentioned PATAM deposits and a decline in demand for money. The annual inflation rate stabilized at 120 percent annual rate in the period 1980-1983. In October 1983 an acceleration occurred, initiated by a strong price shock due to a sharp nominal devaluation and a drastic rise in the prices controlled by the government. This was against the background of a profound balance of payments crisis. There followed a period in which the government had a commitment to maintain the level of the real exchange rate that was obtained after the initial devaluation. This policy required an increasing rate of nominal devaluation bringing the inflationary process to the verge of hyperinflation. Until mid-1985 there was a continuous and sharp rise in the public internal and external debts due to unsustainable deficits. A serious concern for a major collapse of the financial system developed and its main result was a shift from domestic assets to direct holding of foreign exchange. The high-inflation period led to the implementation of a radical stabilization program in July 1985. The program was successful and annual inflation rate was rapidly reduced to below 20 percent. In January 1986 a decline in the monthly CPI was recorded and though this was due to measurement problems, it was symbolic in representing the beginning of a new era. Since then the inflation rate has been remarkably stable, further declining in 1992. The fundamental change, implemented in 1985, was the balancing of the fiscal budget. The borrowing needs of the government were drastically curtailed and as a result the share of public debt to GDP steadily declined. This stable period is characterized by a process of reforms in the capital market, a process of liberalization in the foreign exchange market, and the introduction of new instruments of monetary policy and important changes in its conduct.

2.2 Financial Innovation

In this section we examine the process of innovation and related events by looking at the four sub-periods spelled out above.

The major changes occurred in the first sub-period, as inflation accelerated and settled at 120% a year:

(i) In November 1977 a capital-account liberalization plan coupled with new foreign exchange management, introduced a new asset, the PATAM deposits. Several types of foreign-currency linked deposits, demand and time deposits, paying interest close to the Euro rate, were offered. The deposits could be easily liquidated and it was possible to transfer money from one account to another. Figure 2 shows the share of PATAM accounts in M3 (which also includes currency, demand deposits and short-term deposits).

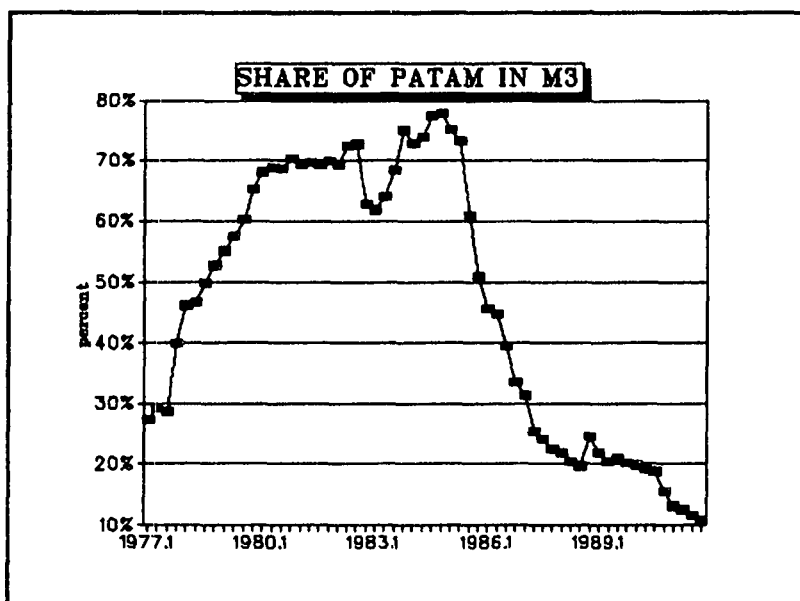


Figure 2

As seen in the figure soon after the 1977 liberalization, the PATAM became a dominant asset.

(ii) In the early 1980s the Bank of Israel announced its intention to abandon a longstanding policy of targeting the rate of return on government bonds (mostly CPI-indexed). This resulted in further substitution from government bonds into PATAM accounts.

(iii) Beginning in 1982 the Bank of Israel implemented a policy of facilitating the use of short-term, unlinked, time deposits (STD) and short term certificates of deposits (CD). This was a regulatory change which enabled the banks to create new types of such deposits and improve the conditions related to the use of existing ones. The result of this policy was a sharp increase in STD and a sharp decline in demand deposits as shown in Figure 3. The figure is drawn in terms of shares in M2, an aggregate composed of M1, STD and CD.

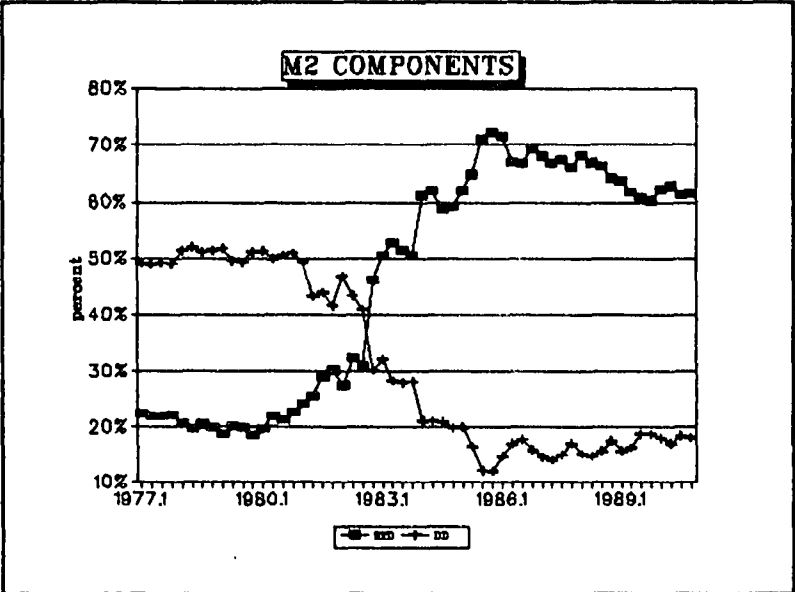


Figure 3

(iv) There was marked technological change in banking facilities: a sharp increase in the number of automatic teller machines, an expansion of credit card uses, telephone banking and automatic payment mechanisms [see the details in Melnick (1993)].

(v) These developments and the rapid rise in inflation, led to a continuous decline in the narrowly defined money aggregate, M1. This is shown in Figure 4 in terms of velocity.

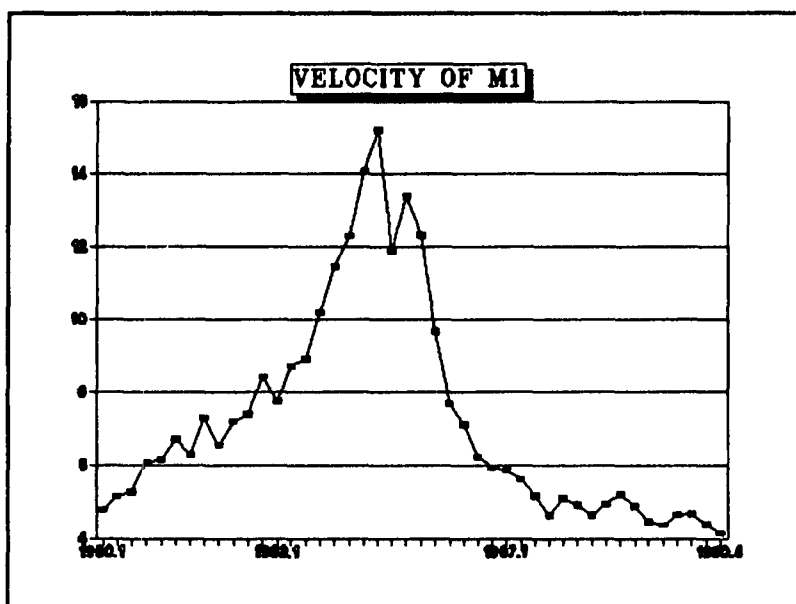


Figure 4

(vi) A change in the composition of M1 took place: the share of currency (CU) increased while the share of demand deposits (DD) declined as seen in Figure 5.

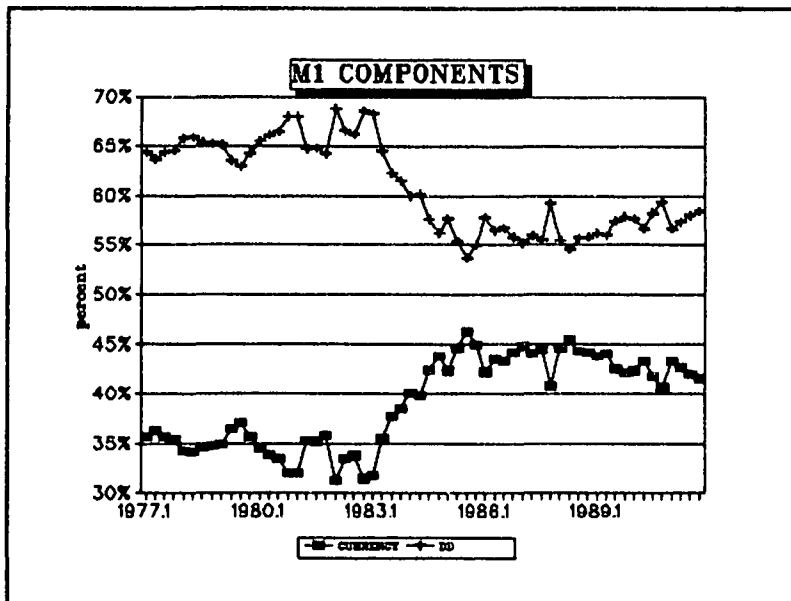


Figure 5

This change was probably due to the fact that it became very easy to get cash or transfer money from interest - bearing deposits, so the attractiveness of demand deposits which bear no interest declined.

(vii) There was a trend decline in liquidity requirements.

In the second sub-period, when inflation accelerated into hyper-inflation levels, the following events were observed:

(i) The PATAM accounts continued to be the dominant asset (see Figure 2). In addition there was widespread dollarization of the Israeli economy. Most financial contracts were linked to the US dollar and many prices were denominated in US dollars. This served to strengthen the importance of the PATAM accounts.

(ii) There was continued substitution of unlinked DD into CD and STD. The traditional, narrow money almost disappeared from the system (see Figures 3 and 4).

(iii) There was an increase in liquidity requirements.

The third sub-period, following the July 1985 stabilization plan, saw the occurrence of the

following developments:

(i) A financial dis-innovation - PATAM demand deposits could be drawn upon but new ones could not be opened. This dis-innovation resulted in major substitution from PATAM to M2. This is reflected in the decrease in velocity of M2 as seen in Figure 6.

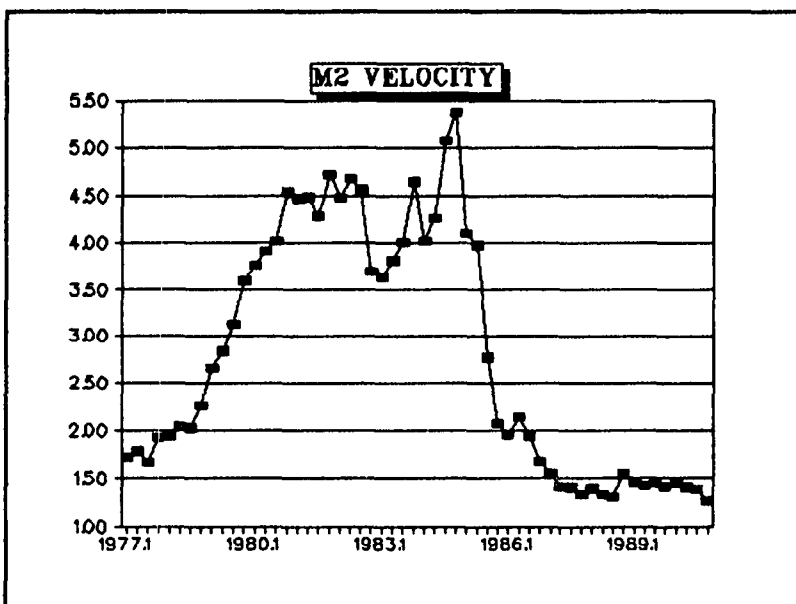


Figure 6

(ii) While the composition of M1 remained just as it was prior to the stabilization plan its velocity declined in response to the new levels of inflation (see Figures 3 and 4).

(iii) There was a rise in liquidity requirements.

The main financial developments in the fourth sub-period of stable inflation were:

(i) Continued substitution from PATAM into M2, mainly into CD and STD.
(ii) Relative stability of the velocity of different monetary aggregates after a two year period of adjustment.

(iii) Reserve requirements were sharply reduced.

(iv) There began a period of reforms in the capital market which consisted of the gradual

elimination of subsidized government credit; facilitation of direct access by private firms to the capital market; reduction in the formal requirements imposed on provident funds, pension funds and banks' savings schemes to hold government bonds; and a drastic reduction of the segmentation of the capital market.

2.3 Innovations, the Banking System and Credit

In order to appreciate the macroeconomic significance of the innovations discussed in the preceding sub-section, several issues concerning the banking system, reserve requirements and the flow of credit in Israel should be examined. An excellent discussion of these issues is provided by Cukierman and Sokoler (1993). Here we will limit ourselves to discussion of the particular issues relevant to the question of innovation.

First, one should note that short-term deposits are subject to lower reserve requirements than demand deposits, while PATAM deposits are subject to very high reserve ratios. Table 1 delineates the various reserve ratios:

Table 1

Reserve Requirements

<u>Type of Deposit</u>	<u>1980</u>	<u>1987</u>	<u>1990</u>
Demand Deposits	60%	48%	10%
CD	26%	48%	10%
One week STD	na	38%	7.5%
Two weeks STD	na	30%	7.5%
One month STD	na	20%	7.5%
PATAM	90%	100%	100%

Note: na - asset not available

Source: Bank of Israel, The Comptroller of the Banks Annual Survey, various issues.

Second, it should be noted that in creating PATAM deposits, banks basically acted as agents for the government. In fact the main difference between a PATAM deposit and a government bond linked to the dollar issued on the Tel Aviv Stock Exchange is that the PATAM is not traded. Third, savings schemes operate in a similar way: the banks were subject to very high reserve requirements. Thus the resources for lending to the private sector come mainly from the non - indexed deposits.

Combining the details about the various innovations outlined above and these characteristics, the

following scenario may be depicted:

(i) From 1982 onward there was increased use of non-indexed, interest - bearing short term deposits; the use of these did not diminish after stabilization. This acted to enlarge banks' resources for private lending.

(ii) The use of indexed PATAM deposits was prevalent in the high- inflation period and was facilitated by regulatory changes; following stabilization in 1985 demand for such deposits fell and further regulatory changes placed limits on the creation of new deposits. The expansion (contraction) of the PATAM accounts relative to the non - indexed assets, served to reduce (expand) the resources used for private lending by banks.

(iii) There was significant technological progress in banking services throughout the 1980s. This acted to reduce the demand for conventional M1. The fact that M1 did not return to its former levels following stabilization is a result of this technological change.

It is instructive to look at the evolution of interest rates for the period analyzed above. Figure 7 depicts the basic short-term lending rate and the CD rate for the period surveyed in real (ex-post) terms. Figure 8 shows the real return on the 5 - year government bond.

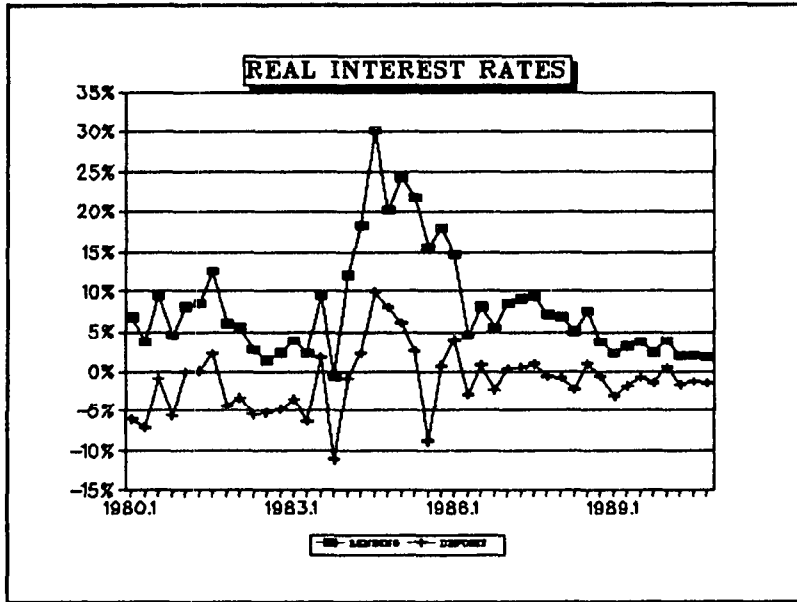


Figure 7

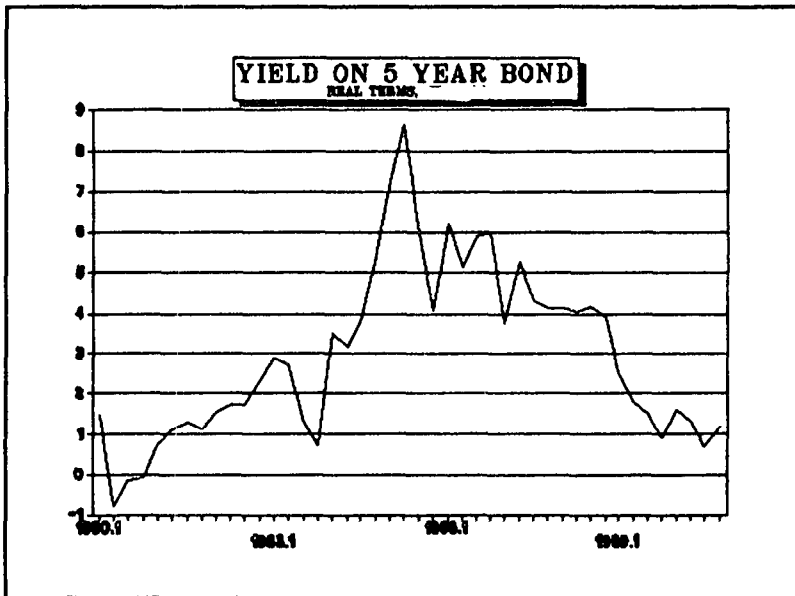


Figure 8

It is clear from Figure 8, and to some extent from Figure 7, that the real rate of interest climbed from the early 1980s till 1985 and declined since then. Note that the first half of the 1980s was dominated by the portfolio shift into PATAM deposits which contracted banks' resources for lending; moreover in the sub-period 1983-1985 reserve requirements were raised. In the second half of the decade short-term deposits with sharply lower reserve requirements became dominating while the share of PATAM declined. These developments will be important for the empirical examination of the theoretical model to which we turn now.

3. The Model

We consider a small open economy made up of a representative agent (to simplify the exposition we abstract from population growth), a representative firm, the government and financial intermediaries (banks). There are three financial assets: money, which is entirely held as demand deposits; interest-bearing short-term deposits; and bonds or savings deposits which are indexed to the price level and bear a rate of interest closely related to the foreign one. In terms of the Israeli financial system we thus lump together PATAM accounts, savings schemes and government bonds into this last category. The consumer devotes real resources to making transactions. The transactions technology is modeled as a function of demand and short-term deposits and the regulatory environment. The consumer decides on the allocation of income into consumption and holdings of demand and short-term deposits (which then implies a certain amount of savings deposits). Banks use demand and short-term deposits to lend to firms which buy capital used in production. Bonds or savings deposits are used to finance government expenditure, which is also financed by taxes and seignorage revenues from the two types of deposits held as reserves (differential reserve ratios being imposed by the government). The structure of lending and borrowing is summarized in Figure 9:

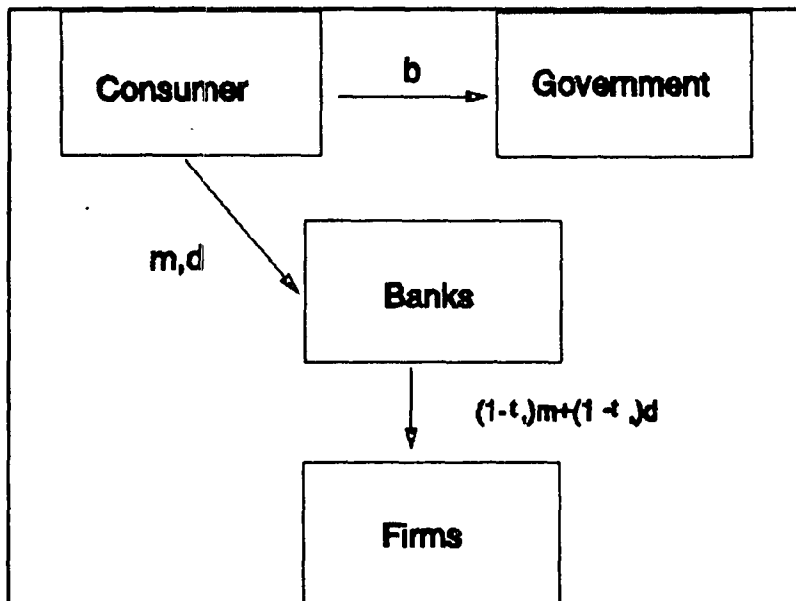


Figure 9

Where m denotes demand deposits, d denotes short-term deposits, b denotes bonds, and τ_1 and τ_2 denote the reserve ratios on m and d respectively.

In what follows we spell out formally the behaviour of these different sectors.

3.1. Transactions Technology

Numerous models in monetary theory use the notion of a costly transactions technology whereby consumers forego real resources when making transactions. Several underlying mechanisms have been proposed to support this notion. One is that the consumer incurs costs when converting bonds into cash, as in the Baumol (1952) - Tobin (1956) money demand model; another is that there is a penalty associated with a cash shortfall when making a transaction as in the Whalen (1966) money demand model. A related notion [see for example McCallum (1983)] is that the consumer sacrifices leisure in making transactions i.e. there are "shopping time" costs incurred when making purchases. Transactions costs have been

discussed in some detail by Feenstra (1986) who proposed the following properties for a transactions cost function that are consistent with a variety of models in this context: transaction costs (θ) are increasing in consumption (c) and decreasing in the amount of a liquid asset (h) held for use in making transactions.

Thus:

$$\begin{aligned}
 & \forall c \geq 0, h \geq 0 \\
 (i) \quad & \theta \geq 0, \theta(c=0) = 0 \\
 (ii) \quad & \theta_c \geq 0, \theta_{cc} \geq 0 \\
 (iii) \quad & \theta_h \leq 0, \theta_{hh} \geq 0 \\
 (iv) \quad & \theta_{hc} \leq 0
 \end{aligned} \tag{1}$$

In what follows we shall assume that two assets provide liquidity services (i.e. fulfill the role of h in the above): demand deposits (m in real terms) and short-term deposits (d). Financial innovation may affect this cost function in two ways: first it may increase the relative contribution of short-term deposits to liquidity; second, it may reduce transactions costs altogether. In the Israeli context, the former innovation relates to the introduction of STD and CD and the changes in regulation facilitating their use. The latter innovation refers to the technological progress and regulatory changes that made the PATAM accounts fairly easy to convert into liquidity. In the terminology of the Baumol - Tobin model the first type of innovation enhances the role of a near money as the liquidity aggregate while the second type reduces the costs of converting bonds into cash.

In the analysis which follows we shall sometimes assume separability between the various arguments in the transactions costs function. While this is not necessary for the analysis to go through, it makes it more tractable. We consider then the following general specification:

$$\begin{aligned}
\theta(c, m, d; \gamma, \delta) &\geq 0 \\
\theta_c &\geq 0, \theta_{cc} \geq 0 \\
\theta_m &\leq 0, \theta_{mm} \geq 0 \\
\theta_d &\leq 0, \theta_{dd} \geq 0 \\
\theta_{cm} &= 0, \theta_{cd} = 0, \theta_{md} = 0 \\
\theta_\gamma &> 0, \theta_\delta ?
\end{aligned} \tag{2}$$

The transactions costs function exhibits the properties described in (1), adding separability between the arguments and considers two parameters: the first is γ , which stands for the costs associated with transactions between liquid assets and bonds. Increases in this parameter represent increases in transaction costs. The second parameter, δ , stands for the value of liquidity services provided by short-term deposits relative to those provided by money (demand deposits). It represents the marginal reduction in transactions costs by the liquid aggregate for a given mix of money and short-term deposits.

Additional clarity will be obtained by considering the following special case of the function described in (2):

$$\theta(c, m, d) = \gamma [\phi(c) - (\ln m + \delta (\ln d - \ln m))] \tag{2'}$$

where:

$$\begin{aligned}
\phi_c &\geq 0, \phi_{cc} \geq 0, [\phi \phi_{cc} - \phi_c^2] \geq 0 \\
0 &\leq \delta < 1
\end{aligned}$$

The innovation relating to the introduction of STD and CD is expressed as increasing δ , i.e. enhancing the role of d relative to m . The innovation that generates a reduction in transaction costs is expressed as a reduction in γ .

3.2 Consumers' Optimization

The representative agent holds the three assets delineated above: demand deposits (m), short-term deposits (d) and bonds (b). Demand deposits pay no interest and are non-indexed; this is "traditional" money; short-term deposits pay the nominal interest rate i^d ; bonds are indexed and pay the real rate of interest r^2 . The consumer receives income from labor (w) and pays taxes (t). He devotes resources to making transactions as discussed above. The consumer chooses a stream of consumption (c), money balances (demand deposits) and short-term deposits so as to maximize:

$$\text{Max} \int_0^{\infty} U(c_t) e^{-\rho t} dt \quad (3)$$

subject to the constraint:

$$\dot{a} = ra + w - c - \theta(c, m, d) - t - (\pi + r)m + (i^d - \pi - r)d \quad (4)$$

where:

$$a = m + d + b \quad (5)$$

π is the rate of inflation.

The opportunity cost of real money balances is $r + \pi$ while the real rate of return on short-term deposits is $i^d - \pi$.

The first order conditions are:

$$\begin{aligned} U'(c) &= \lambda(1 + \theta_c) \\ -\theta_m &= \pi + r \\ \theta_d &= i^d - \pi - r \\ \lim_{t \rightarrow \infty} \lambda, a, e^{-\rho t} &= 0 \end{aligned} \quad (6)$$

² The open economy assumption implies that $r = r^* + \zeta$, where r^* is the foreign real interest rate and ζ is a term reflecting risk premia and constraints on capital flows.

and the budget constraint. λ denotes the co-state variable.

We have thus defined implicit demand functions for the two liquid assets: demand for money (demand deposits) is decreasing in the rate of inflation and the real rate; short term deposits are decreasing in these variables too and increasing in the rate of interest paid on them, or alternatively they are increasing in the difference between the real rate on deposits and the real rate on bonds.

3.3. The Government

The consolidated government finances its consumption (g) and debt service (rb) by lump-sum taxes (t), by the inflation tax on reserves held at the central bank, and by bonds issuance. Reserves at the central bank relate to two types of assets: demand deposits and short-term deposits.

The government flow constraint is:

$$g + rb = t + \dot{b} + \mu[\tau_1 m + \tau_2 d] \quad (7)$$

where τ_1 and τ_2 are the reserve ratios on m and on d respectively and μ is the rate of growth of the money base.

We take the reserve ratios and the rate of growth of the monetary base as exogenous while the primary deficit ($g - t$) is adjusted so as to satisfy the stability conditions of the dynamic system³.

In the steady-state equation (7) becomes:

$$g + rb = t + \pi[\tau_1 m + \tau_2 d] \quad (8)$$

³ See the discussion in Liviatan (1983) on the dynamic stability of deficit finance under a similar set-up and in particular the discussion on adjusting government transfers to satisfy stability requirements.

3.4 The Banks

The banks receive consumers' demand and short-term deposits; they hold the required reserves at the central bank; they lend the remainder to firms charging them $i^l = \pi + r^l$ ⁴; and they pay the consumers i^d for short-term deposits. If banks are competitive and there is free entry, then the zero profit condition is :

$$i^l [(1-\tau_1)m + (1-\tau_2)d] = i^d d \quad (9)$$

or

$$(r^l + \pi) (1-\tau_1)m + (r^l - r^d)(1-\tau_2)d - (r^d + \pi)\tau_2 d = 0 \quad (10)$$

3.5 The Firms

Firms borrow each period from banks in order to finance capital used together with a fixed amount of labor (normalized to be one) in a constant returns to scale production function f . If we consider a constant depreciation rate v , then the firms borrow:

$$\dot{k} = vk = (1-\tau_1)m + (1-\tau_2)d \quad (11)$$

Thus the first order condition for profits maximization is:

$$f' \left(\frac{[(1-\tau_1)m + (1-\tau_2)d]}{v} \right) = r^l \quad (12)$$

⁴ Perfect foresight is assumed throughout the analysis.

Firms pay wages which are given by:

$$w = f - r^l \left[\frac{(1-\tau_1)m + (1-\tau_2)d}{v} \right] \quad (13)$$

3.6 General Equilibrium

We can consolidate the private and public budget constraints using the wage equation and the zero profits condition for banks to obtain the overall budget constraint for the economy:

$$f \left[\frac{(1-\tau_1)m + (1-\tau_2)d}{v} \right] = c + g + \theta(c, m, d) + k \quad (14)$$

This equation together with the three first order conditions of the consumer (the equations in 6), the government budget constraint (equation 8), the zero profit condition for the banks (equation 10) and the first order condition for firms (equation 12) constitute the seven equations which determine the seven endogenous variables of the economy in the steady-state: the amount of deposits (m and d), the value of government debt (b), the level of consumption (c), the shadow price of the consumer problem (λ) and the two interest rates r^l and r^d . The rate of inflation (π) and the reserve ratios (τ_1 and τ_2) are set exogenously. The primary deficit is adjusted so as to satisfy the budget constraint. The interest rate (r), which is the rate paid on bonds, is taken as given to the economy. Knowing the value of the seven endogenous variables we can derive the level of output, the deficit and transaction costs.

In the general case we have to solve the seven-equation system simultaneously to derive the steady-state values. However to keep the analysis tractable, we assume separability of the three arguments of the transaction costs function (consumption, demand deposits and short-term deposits). We can thus solve for the level of the two types of deposits as a function of r^d using the consumer optimization conditions and then solve for the two interest rates using the profit conditions for banks and firms.

Subsequently we can derive the level of production and consumption.

Thus separability allows the formulation of following two implied demand functions for financial assets:

$$m = m(r, \pi; \gamma, \delta) \quad (15)$$

$$d = d(r^d, r; \gamma, \delta) \quad (16)$$

Note that (15) and (16) include the parameters of the transaction function.

For the special case of the transaction costs function specified in (2') these demand equations are given as follows:

$$m = \frac{\gamma(1-\delta)}{r + \pi} \quad (15')$$

$$d = \frac{\gamma\delta}{r - r^d} \quad (16')$$

Equations (10) and (12) can therefore be rewritten with r^l and r^d as the only endogenous variables:

$$(r^l + \pi)(1-\tau_1) \frac{m[r, \pi; \gamma, \delta]}{d[r^d, r; \gamma, \delta]} + (r^l - r^d)(1-\tau_2) - (r^d + \pi)\tau_2 = 0 \quad (17)$$

$$f' \left[\frac{(1-\tau_1)m[r, \pi; \gamma, \delta] + (1-\tau_2)d[r, r^d; \gamma, \delta]}{\nu} \right] = r^l \quad (18)$$

These equations can be portrayed in r^l and r^d space as shown in Figure 10:

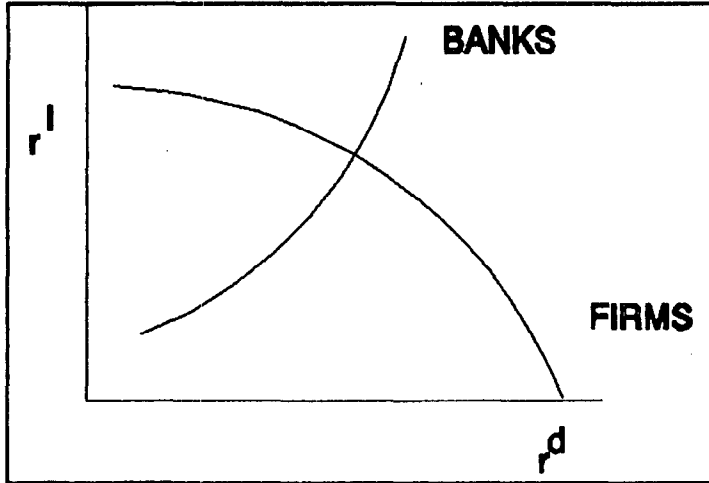


Figure 10

The slopes of the two curves are given as follows:

$$\text{BANKS: } \frac{\partial r^l}{\partial r^d} = \frac{d[r^d, r; \gamma, \delta] + \frac{\partial d}{\partial r^d} [r^d (1-\tau_2) + (r^d + \pi)\tau_2]}{(1-\tau_1)m[r, \pi; \gamma, \delta] + (1-\tau_2)d[r^d, r; \gamma, \delta]} > 0 \quad (19)$$

$$\text{FIRMS: } \frac{\partial r^l}{\partial r^d} = f''(1-\tau_2) \frac{\partial d}{\partial r^d} < 0 \quad (20)$$

The banks' zero profit condition yields an upward sloping schedule [equation (19)] as an increase in interest paid on deposits has to be matched by an increase in the interest charged on loans. The firms' optimality condition [equation (18)] yields a downward sloping curve as demand for capital declines with increases in the borrowing rate facing firms. Note that the level of capital is a positive function of the interest rate paid on deposits.

4. Financial Innovation

We turn now to look at the effects of financial innovation.

4.1 Short-Term Deposits

The first type of innovation is the introduction of new short-term deposits coupled with a change in regulations so that the liquidity services provided by them are enhanced relative to regular demand deposits. In terms of the separable function [equation (2)] discussed in section 3.1 this is expressed as increasing δ . There will thus occur a substitution away from m and into d in the consumer portfolio. This is derived from the first order conditions (equation 6) and will be reflected in the implied asset demand functions [equations (15') and (16')]. If the reserve ratio on short-term deposits is lower than that on demand deposits, as has been the case for Israel and most Western countries, then the resources available for bank loans unambiguously increase⁵. For any given level of the deposits rate (r^d) firms now face a higher supply of loans and thus the rate on loans (r^l) declines. Examination of the banks profit equation (10) indicates that the following changes:

$$\frac{\partial r^l}{\partial \delta} = [(1-\tau_1)m + (1-\tau_2)d]^{-1} \left[\frac{\partial d}{\partial \delta} (r^d + \pi\tau_2) - \frac{\partial m}{\partial \delta} \pi(1-\tau_1) - r^l(1-\tau_2) \left(\frac{\partial d}{\partial \delta} + \frac{\partial m}{\partial \delta} \right) \right] > 0 \quad (21)$$

Banks face several changes: on the one hand their revenue from the inflation tax on demand deposits

⁵ Note that m is not replaced for d one to one. If for example θ is given by the function in (2') then the change in banks resources for lending when δ increases is given by:

$$\frac{\partial [(1-\tau_1)m + (1-\tau_2)d]}{\partial \delta} = \frac{\gamma[(\tau_1 - \tau_2)r + (1-\tau_1)r^d + (1-\tau_2)\pi]}{(\pi+r)(r-r^d)} > 0$$

and banks' resources may go up even if the reserve ratio on short-term deposits exceeds the reserve ratio on demand deposits.

declines, they have to pay interest on more short-term deposits and the inflation tax on bigger reserves of short-term deposits; on the other hand their resources for lending to firms have increased. However the former effects dominate and so the expression in (21) is positive and the banks would like to raise the lending rate for any given deposit rate. In terms of Figure 10 both schedules will shift leftward. These changes are shown in Figure 11:

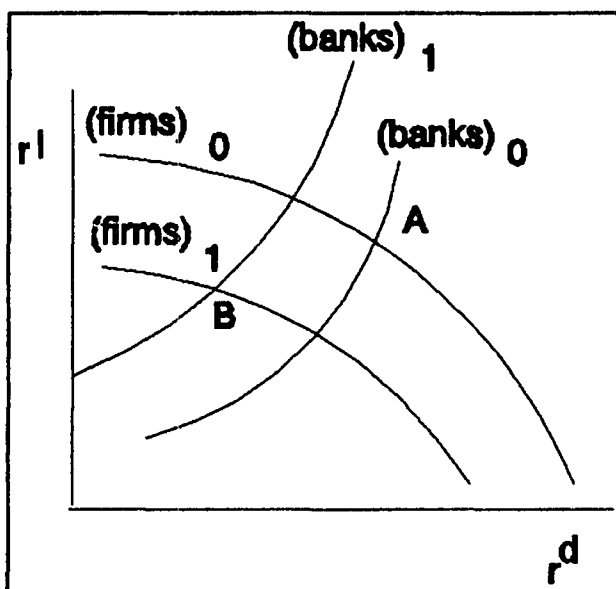


Figure 11

The fall in the deposit rate is unambiguous. However the lending rate may either fall or increase (B may be below or above A). This is so because as the banks lower the rate paid on deposits, the latter contract after their initial expansion. If the initial effect is dominant, then the introduction of short term deposits will be expansionary: firms will use more capital and production will increase.

4.2 Reduction in Transaction Costs

The second type of innovation is the introduction of new indexed assets, which combined with technological progress and regulatory changes, generates a portfolio shift out of the two types of deposits.

In terms of the discussion in section 3.1 this would be a lowering of γ . In this case resources for bank lending decrease; the firms' schedule in Figure 10 shifts up. The effect on the banks' profit condition is ambiguous and depends on the ratio of demand to short-term deposits. If this ratio remains constant, as in the case of the logarithmic and separable specification discussed above, then the banks' schedule does not shift⁶. Both rates increase and thus production and consumption decrease.⁷ This is shown in Figure 12.

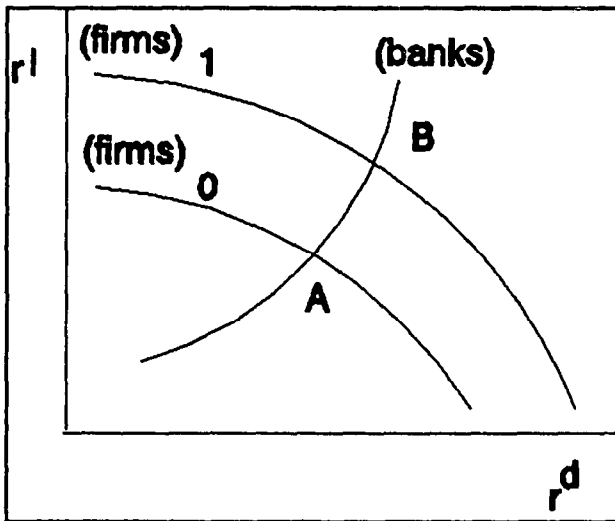


Figure 12

⁶ Algebraically this is given by:

$$\frac{\partial r^l}{\partial \gamma} = \frac{d[r^d + \pi\tau_2 - r^l(1-\tau_2)] - m[(1-\tau_1)(r^l + \pi)]}{(1-\tau_1)m + (1-\tau_2)d} = 0$$

⁷ Unless the reduction in transaction costs is of such significant magnitude so that consumption can remain constant or even increase.

4.3 Implications for Estimation

To recapitulate the basic economic mechanism that operates here (comparing steady-states situations): when financial innovation occurs consumers change their portfolio allocation. This affects banks resources for lending and hence interest rates. The change in the lending rate affects the level of capital and therefore production and consumption. Thus what begins as an effect on money demand translates into real macroeconomic effects via the banks' asset side of the balance sheet.

The model, in conjunction with the preceding discussion on the Israeli financial system, implies therefore two major macroeconomic effects:

(i) The introduction of short - term deposits with lower reserve requirements expanded banks' resources for lending and therefore led to a decrease in the short-term deposit rate and to a probable decrease in the lending rate, and thus to an increase in the capital stock, in production and in consumption in the steady - state.

(ii) The use of PATAM accounts, facilitated by regulation and technological progress, reduced the amount of non - indexed deposits in 1978 - 1985. Hence there was a contraction in banks' resources, a rise in the lending rate and a reduction in the capital stock, production and consumption in the long - run. The opposite occurred after the 1985 stabilization plan.

5. Estimation

We test the model's implications by estimating a series of VAR models. In each model we include the following four endogenous variables:

- (i) a real activity variable, which corresponds to f in the model.
- (ii) the deposit and lending real interest rates, corresponding to r^d and r^l .
- (iii) a financial ratio, corresponding to the ratios between m , d and b .

We also control for monetary policy responses and for the inflationary developments which are

considered exogenous in the analysis. In particular we include:

- (i) The loan from the Bank of Israel to the banks which is a key monetary policy variable. One possible interpretation in terms of the model is that it reflects changes in μ .
- (ii) The rate of inflation (π).

We use three different real activity variables: non-durables consumption, the "State of the Economy" index which is a coincident indicator for the business cycle [see Melnick and Golan (1992)] and non-residential investment. Exact data definitions are given in the appendix.

The VAR models were estimated in first differences of the levels (for the activity variable first differences of the logs). The differencing is needed since for all the levels we were not able to reject the presence of a unit root. The sample covers quarterly data from 80.1 until 90.4. Two lags were used for each variable.

In terms of the notation used in Section 3 the VAR model is as follows:

$$Y_t = A(L)Y_t + B(L) X_t + \epsilon_t \quad (22)$$

where:

$$\begin{aligned} Y_t &= [\Delta \ln f, \Delta r^l, \Delta r^d, \Delta ratio] \\ X_t &= [\Delta \pi, \Delta I] \end{aligned} \quad (23)$$

Y and X are the vectors of endogenous and exogenous variables respectively; $A(L)$ and $B(L)$ are finite lag polynomial matrices. f is the real activity variable used, $ratio$ is either $m/(m+d)$ or $(m+d)/a$ and I indicates the Bank of Israel loan.

4.1 Testing the Effects of Short-Term Deposits

We test the first proposition by using the ratio $M1/M2$ as the relevant financial ratio. A decrease in the ratio is the first type of innovation discussed in Section 4. The three graphs in Figure 13 show the cumulative impulse response responses for the three real activity variables given a negative shock to the

ratio. Responses are shown over an expanse of 12 quarters. The responses are for orthogonalized innovations imposing the ordering that contemporaneous innovations on interest rates impact all variables, while contemporaneous innovation on the activity variable impact no other variable. The financial ratio is in the middle; its contemporaneous innovation impact the activity variable but do not impact the interest rates.

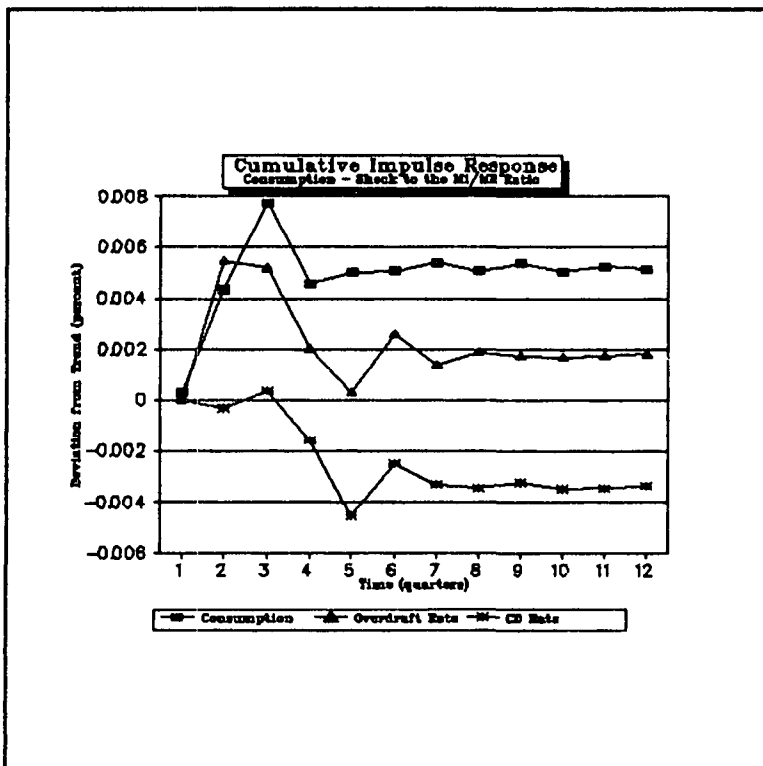


Figure 13a

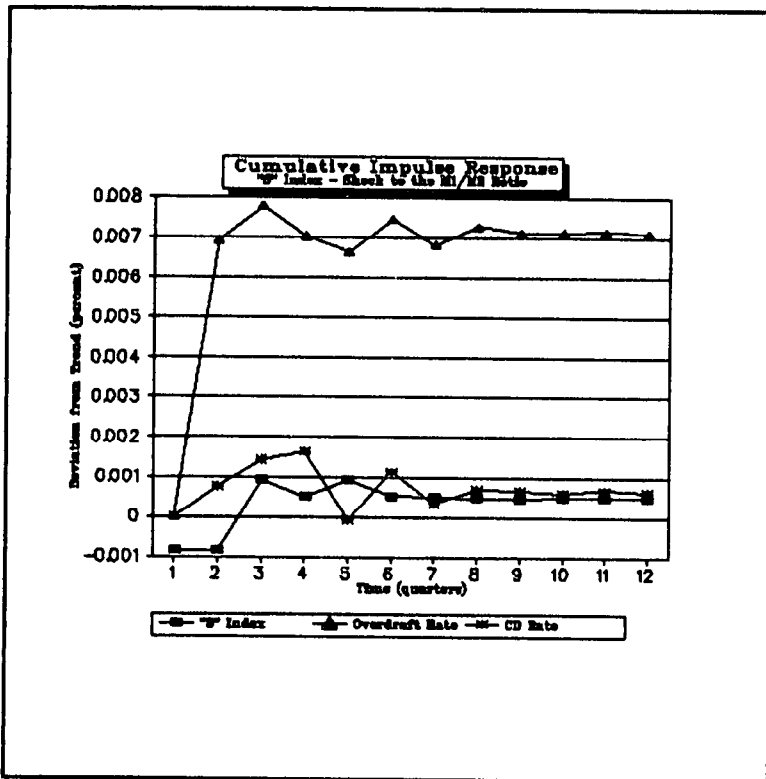


Figure 13b

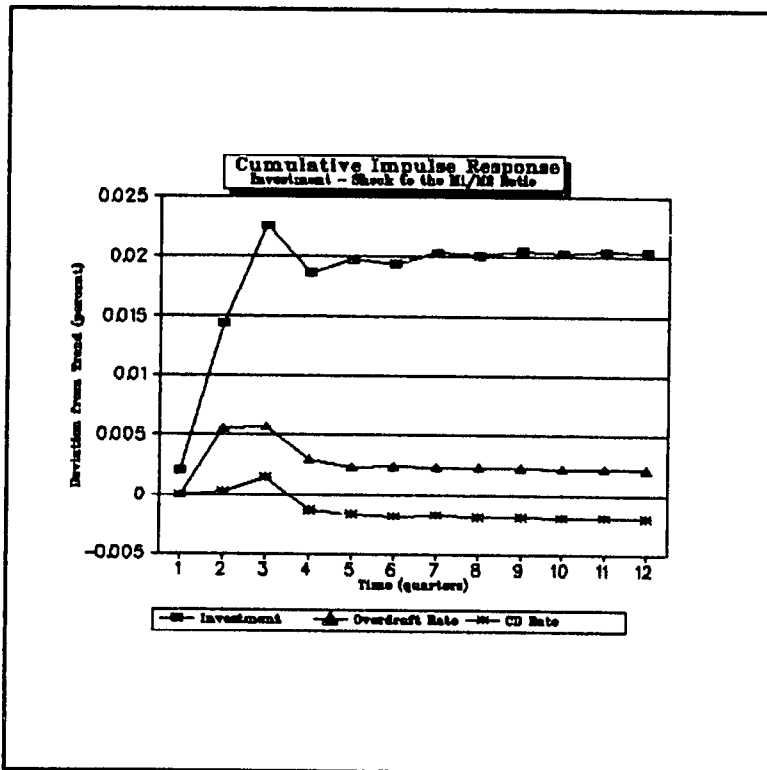


Figure 13c

The cumulative responses are as expected; this is so, except for r^1 : while the model does not have a clear-cut prediction about this rate, the positive real activity response is consistent with a fall in r^1 rather than the rise which was actually obtained.

4.2 Testing the Effects of PATAM Deposits

We test the second proposition by using the ratio M2/M3 as the relevant financial ratio. A decrease in the ratio is the second type of innovation discussed in Section 4. The three graphs in Figure 14 show the cumulative impulse response responses for the three real activity variables given a negative shock to the ratio. Responses are shown over an expanse of 12 quarters.

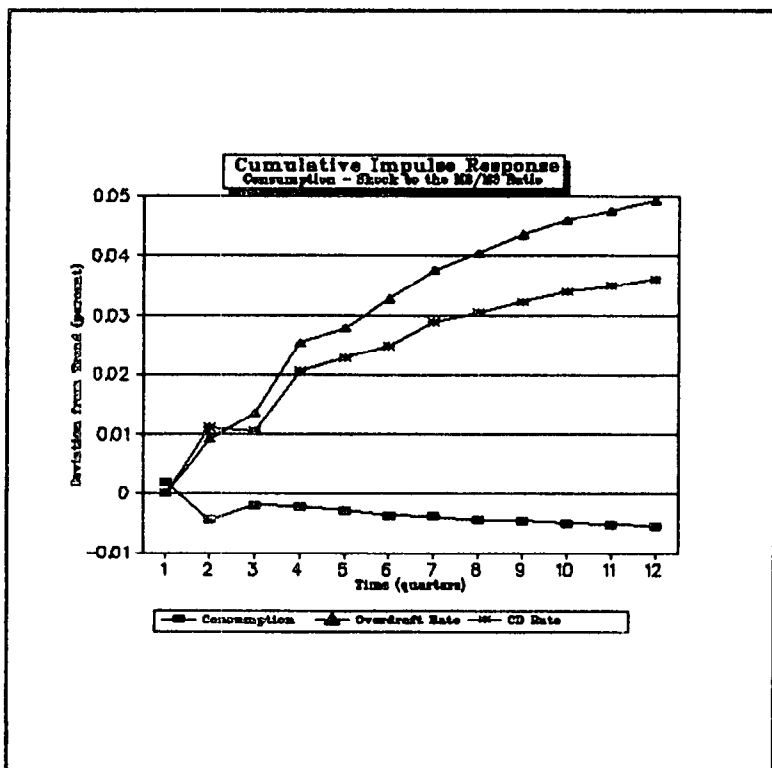


Figure 14a

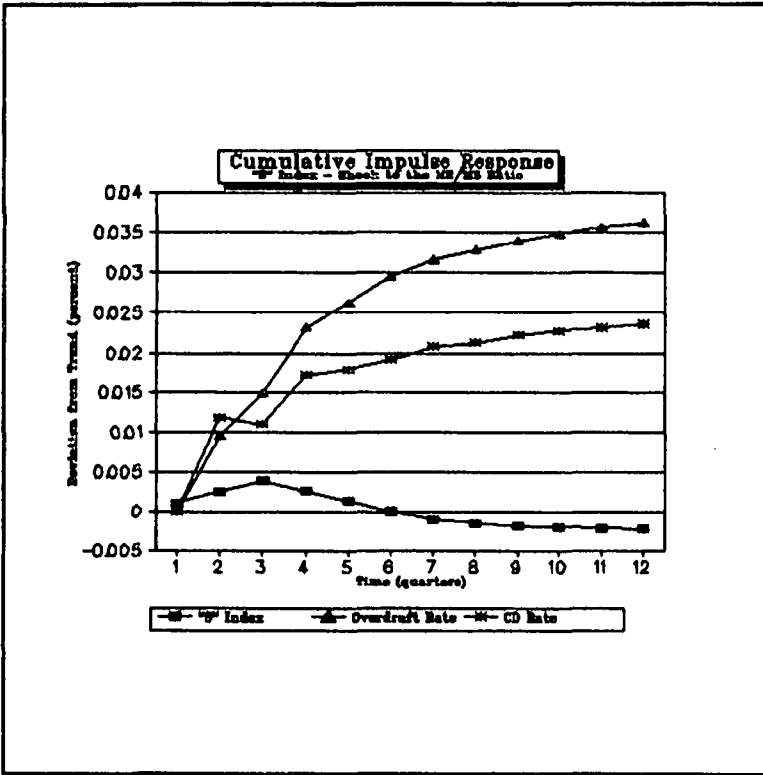


Figure 14b

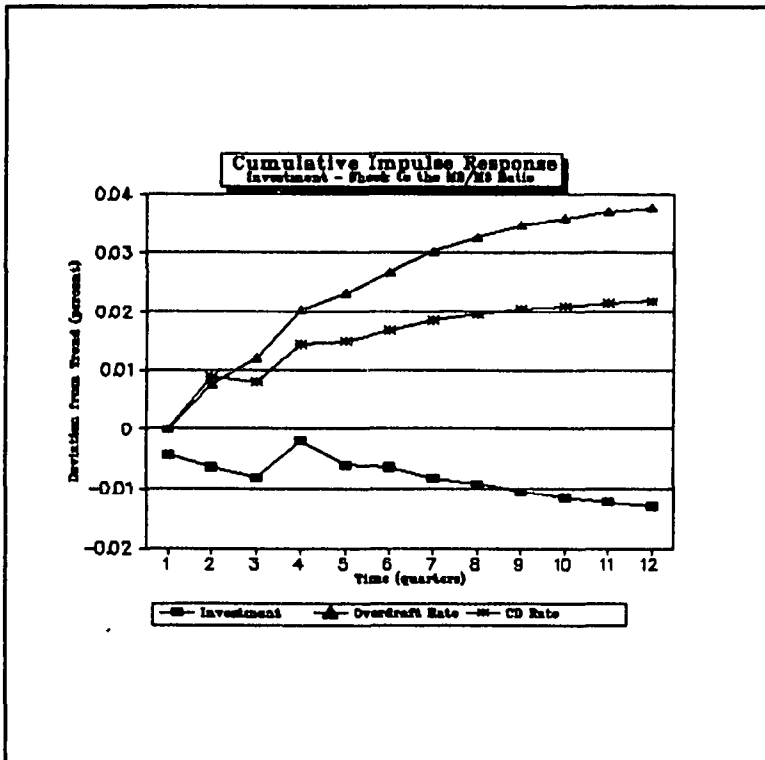


Figure 14c

The results are fully consistent with the model's predictions: a contraction in activity and a rise in both interest rates.

A summary of the cumulative impulse responses is presented in Table 2.

Table 2

Cumulative Impulse Responses After 12 Quarters

	<u>M1/M2</u>	<u>M2/M3</u>
Consumption	-	+
r^r	-	-
r^d	+	-
"S" Index	-	+
r^r	-	-
r^d	-	-
Investment	-	+
r^r	-	-
r^d	+	-

6. Conclusions

The effects of financial innovation in Israel in the 1980s may be summarized as follows:

(i) The introduction of the PATAM indexed deposits, as part of the 1977 liberalization program, coupled with technological progress and regulatory change, had a contractionary effect on real activity as it reduced banks' resources for lending. This was the dominant development in the high-inflation years 1978-1985. With inflation stabilization in July 1985, regulation changed and the share of PATAM in financial assets declined, generating an expansionary effect.

(ii) Since 1982, the use of short - term deposits increased at the expense of regular demand deposits. The 1985 stabilization did not change the bigger role played by these deposits. This innovation has expansionary effects.

This paper demonstrated that there are real macroeconomic effects to financial innovation. A major question that remains open to further analysis is the endogenous derivation of the innovation process itself.

Appendix

The data series used and their sources are as follows (CBS indicates Central Bureau of Statistics; BOI indicates Bank of Israel):

Consumption - non - durables consumption, constant prices (National Accounts, CBS)

Investment - non - residential investment, constant prices (National Accounts, CBS)

"S" index - an index of coincident indicators for the business cycle, based on industrial production, vacancies, retail sales and imports net of investment goods, fuel and diamonds (BOI).

Monetary Aggregates - BOI data

Inflation - CPI rates of change (CBS)

Lending rate - The overdraft rate charged by banks; we use the ex-post real rate using actual inflation (BOI).

Borrowing rate - The rate on Bank CDs; we use the ex-post real rate using actual inflation (BOI).

Bank of Israel Monetary Loan - The value in NIS of the loan made by the Bank of Israel to commercial banks (BOI).

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