PRIVATIZING MULTI-PRODUCT BANKS*

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Abstract

In October 1983, following a stock market crash, the Israeli government became the owner of most of the banking system in the country. The government is now getting ready to privatize the banks. It has been argued that the government must take advantage of the unique opportunity to affect, in fact to mold, the structure of the banking system. Using a simple general equilibrium model of imperfect competition between multi-product banks, the paper evaluates two proposals which have been raised in this context. Implications for banking reforms in other countries are briefly discussed.

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1 Introduction

In October 1983, following a stock market crash, the Israeli government became the owner of most of the banking system in the country. A large fraction of the securities on the Tel-Aviv Stock Exchange were bank stocks. These stocks were widely held by the public, constituting 17% of the public's financial assets portfolio, and had traditionally been regarded as virtually riskless. During the crash they lost approximately 50% of their value. The government (most likely for political reasons) decided to purchase the bank stocks from the public at the pre-crash prices, thus becoming the owner of almost all the equity of the four largest banks in the country, whose combined assets amounted to approximately 90% of total bank assets.[1]

The Israeli government is now getting ready to privatize the banks. In the framework of the public debate on this issue it has been argued that the government must take advantage of the unique opportunity to affect, in fact to mold, the structure of the banking system. Bank concentration is too high, goes the argument. Therefore the banks should be sold in pieces, in order to increase the number of players in the oligopolistic banking sector.

Two major proposals have been set forth. According to the first, the large banks should be split into several smaller, independent banks, and then sold. The second proposal relies on the fact that banks in Israel are Universal, and are involved in a wide spectrum of activities ranging from deposit taking and commercial lending, to mortgage origination, underwriting, pension fund management, mutual fund management, and more. According to the second proposal, entire divisions (in particular, pension funds and mutual funds) should be spun off from the banks and sold separately. This would induce greater competition and would resolve conflicts of interest resulting from the operation of banks in several markets.

My purpose in this paper is to evaluate the proposals in a simple framework. Choosing a model of competition between multi-product banks involves considerable tradeoffs between realism and focus. I therefore devote the next section to a discussion of relevant recent trends in banking, and to considerations in the choice of an appropriate model. The analysis

[1]Bank of Israel Annual Report, 1983 (in English), and financial statements of the banking groups.

is presented in section 3. Section 4 is devoted to an important extension of the model. Section 5 provides a discussion of the applicability of the approach taken here to financial markets reform in other countries. Section 6 concludes.

2 The Market Structure

Banks as multi-product Cournot oligopolists. The traditional roles of banks are the gathering of deposits and the granting of loans. According to this approach the interest rate spread constitutes the major source of bank profits. In recent years the share of the interest rate spread in profits has been declining, in the leading industrial countries, as well as in Israel.[2] This is a consequence of the fact that banks have become increasingly engaged in the provision of less traditional products and services such as leasing, import and export services, options and "option cocktails" (Sacks and Crawford 1991, p.41), interest rate and currency swaps (Ballarin 1986, pp.125-7), managing pension funds and mutual funds (Ben-Bassat 1988), issuing standby letters of credit for commercial paper and other liabilities (Bennett 1986), consulting in merger transactions and in private placements of securities (Ballarin 1986, p.9), selling insurance,[3] and underwriting securities.[4]

It is, therefore, natural to model the banking firm as a multi-product firm. Since it is generally accepted that competition between banks is imperfect, and given the high concentration of the Israeli banking system, a model of oligopolistic competition is appropriate.

[2]Yamanaka (1993, pp.6-12) reports that in the U.S. during the late eighties, the weight of non-interest income rose from about 8% to 15-20%. During the same period non-interest expenditures remained stable, indicating that the increase in the weight of non-interest income should not be attributed to an increase in the costs of operation. The phenomenon is more pronounced among large banks. A study by Keefe, Bruyette, & Woods, Inc. (KBW Bank Study, vol. 40, p.26) reports that non interest revenues for the 15 top banks in the U.S., in the first half of 1993, ranged from 25% to 71%. In Israel the weight of non-interest income rose from 22% in 1988 to about 38% in 1992. The increase in non-interest costs during this period was considerably smaller. The percentages of non-interest income for Israel are computed before any loan-loss provision (for interest income), and are therefore biased downward. (Israel's Banking System, Bank of Israel, Supervisor of the Banks, various issues, in English).

[3]In Great Britain and Germany there are no regulatory restrictions; in the U.S. there are some restrictions, whereas in Japan banks are not allowed to sell insurance (Frankel and Montgomery 1991). In Israel banks have recently been permitted to market (but not to underwrite) particular kinds of insurance.

[4]In Japan and the U.S. there are severe restrictions on these activities; not so in Great Britain and Germany (Frankel and Montgomery 1991). In Israel banks are heavily involved in the underwriting of securities, including initial public offerings.

Cukierman (1978) studies a model centered around a multi-product bank. Although he does not explicitly model strategic interactions between banks, and is interested in other issues (credit rationing and monetary policy), his analysis is related and will be discussed in section 4.

Spatial competition à la Hotelling is no doubt an appropriate analytical framework for modeling imperfect competition in the banking sector. See, for example, Matutes and Vives (1991), Chiappori, Perez-Castrillo, and Verdier (1992), Repullo (1992), and Sussman (1993). The approach is particularly suitable for the study of product innovation and the equilibrium product mix, as well as for issues related to branching. Another approach is price competition in differentiated commodities. The approach adopted here is competition à la Cournot. A common justification for making the Cournot assumption is the existence of capacity constraints: Cournot competitors can be thought of as setting up capacity (and hence committing to the supplied quantities). If we were studying traditional banking, where there are essentially two standard and homogeneous products—"deposits" and "loans," the assumption of constrained capacity would not be justified. As we are dealing with multi-product banks, that offer a wide variety of products—some of which are complex, requiring extensive planning, expertise, computing power, and sophisticated marketing and advertising—it is plausible to regard the production capacity of banks as limited in the short run. Hence, a general equilibrium multi-product Cournot model is a reasonable choice. Since product innovation is not studied here, the gains in terms of tractability and focus justify the choice. There is nothing in the analysis which crucially depends on the Cournot assumption. The results should carry over, mutatis mutandis, to other specifications of imperfect competition between multi-product banks.

An important aspect of banking markets, not addressed here, is quality competition; for example, the number and location of branches and automated teller machines. Neven (1990) points out that when competition between banks increases, their inclination to compete along the quality dimension is reduced. According to this view, both proposals for banking reform in Israel would result in a reduction in the quality of service.

Another relevant aspect of competition in banking which is not studied here, is the

threat of entry by newly formed banks, by foreign banks, and by non-banking institutions. The latter have been penetrating banking markets at a fast rate, often with innovative products. Merrill Lynch, for example, introduced to U.S. markets in the late 70's cash management accounts, a new product which combines features of a mutual fund, a checking account, and a credit line. By the end of the 80's there were approximately one million such accounts amounting to 70 billion dollars. Other companies in the U.S. have followed suit. In Israel, there is a similar trend. Insurance companies, for example, are now active in the residential housing mortgage market, and newly instituted portfolio management companies are competing with the bank managed investment funds.

The degree of substitutability or complementarity between banking products plays a key role in the analysis. A plausible hypothesis is that various forms of deposits (e.g. long- and short-term) are substitutes, and so are various forms of credit.[5] In the next section I shall focus on this hypothesis. There will be households with demand for two kinds of deposit accounts and firms with demand for two kinds of credit. However, there will be no cross-elasticity in demand between deposit products and credit products. Cukierman (1978) focuses on implications of complementarities in demand between banking products, e.g. credit and deposit products. This is indeed an important issue which will be studied in section 4.

Bank cost functions. Banks are often thought of as enjoying both economies of scale and economies of scope. Potential sources of economies of scale are the large fixed costs involved in setting up a bank and the (possibly) low marginal cost of serving an additional client. Another important factor which may contribute to economies of scale is the ability to use information acquired through contacts with one client in the transactions with other clients. Economies of scope may arise through diversification, or as a result of providing a single client with several services.

The empirical evidence in this regard is mixed. In a survey article, Evanoff and Israilevich (1991, pp.22-3) report that "a number of studies find cost advantages from size to be fully exhausted at relatively low levels of output. Even when potential economies exist

[5] A precise definition of the terms "substitutes" and "complements" is provided later.

they tend to be relatively small ... Basically, the results imply that scale advantages are fully exhausted once an institution achieves a size of approximately $100-200 million, a relatively small bank size in the United States. Higher output levels result in either constant or decreasing returns to scale." They add (p.24) that other studies have analyzed larger financial institutions, and have found that small scale advantages exist well beyond the $100-200 million range. They also report (p.25) that the evidence for economies of scope is not conclusive. Recently, Pulley and Braunstein (1992), using a new methodology, have identified substantial economies of scope.[6] In a study of the Israeli banking system for the period 1989-1991, Paroush and Ruthenberg (1994) find considerable economies of scale for the very small Israeli banks, mild economies for the medium sized banks, and virtually no economies for the two largest banks, of size $30 billion each (with joint assets constituting approximately 70% of bank assets in the country).

In the light of the inconclusive empirical evidence, and in order to keep the analysis focused, I shall at first assume that marginal cost is zero and that there are no fixed costs. Later, this assumption will be relaxed by introducing a flexible cost function, exhibiting economies or diseconomies of scale and scope, depending on the value of parameters. The implication for the results of such economies will be discussed.

3 The model

The pre-reform market. There are J consumers who derive utility from a consumption good x and two banking products q_1 and q_2. I shall refer to these products as type 1 and type 2 deposits.[7] The restriction to two products is made for simplicity. Consumer j forms demands for banking products q_1^j and q_2^j by maximizing the (quadratic and quasi-linear) utility function $x^j + a(q_1^j + q_2^j) - \frac{1}{2}[b(q_1^j)^2 + 2cq_1^j q_2^j + b(q_2^j)^2]$ subject to $x^j + p_1 q_1^j + p_2 q_2^j \leq W^j$, taking his wealth W^j and the prices p_1 and p_2 as given. These prices should be thought of as representing the real interest rates on deposits net of commissions. In equilibrium, they may turn out to be positive or negative. When the number of banks is sufficiently large (that

[6] See also Berger, Hanweck, and Humphrey (1987) and Berger and Humphrey (1991).

[7] For example, a checking account and a money market account, or a short-term and a long-term account.

is, when there is enough competition between banks) the price which depositors pay for deposits is negative, meaning that banks pay depositors for the use of their funds.[8] When the number of banks is small, and the demand for deposits is sufficiently large, the price depositors pay for deposits is positive, meaning that banks charge depositors for managing their accounts. It is assumed that $a > 0$ is large enough so that marginal utility is positive in the relevant range, and that $b > c \geq 0$ which ensures that second order conditions are satisfied. Solving for the demands, and aggregating over the J consumers, yields the inverse aggregate demand functions for banking products:

$$p_1 = a - \frac{c}{J}Q_2 - \frac{b}{J}Q_1; \qquad p_2 = a - \frac{c}{J}Q_1 - \frac{b}{J}Q_2. \tag{1}$$

It is easily verified that $\frac{\partial Q_1}{\partial p_2} = \frac{\partial Q_2}{\partial p_1} = \frac{cJ}{b^2-c^2} \geq 0$, namely the two types of deposits are gross substitutes.

There are M firms producing the (numéraire) consumption good x, with a strictly concave, quadratic production function $\alpha(q_3^m + q_4^m) - \frac{1}{2}[\beta(q_3^m)^2 + 2\gamma q_3^m q_4^m + \beta(q_4^m)^2]$ and linear cost function $p_3 q_3^m + p_4 q_4^m$. The inputs, q_3 and q_4, are banking products, which I shall refer to as type 3 and type 4 credit.[9] Firm m forms demands q_3^m and q_4^m by maximizing the profit function $\alpha(q_3^m + q_4^m) - \frac{1}{2}[\beta(q_3^m)^2 + 2\gamma q_3^m q_4^m + \beta(q_4^m)^2] - p_3 q_3^m - p_4 q_4^m$, taking as given the prices p_3 and p_4, which represent real interest rates. In order to ensure strict concavity of the production and profit functions, and an interior solution, it is assumed that $\alpha > 0$ is large enough and that $\beta > \gamma \geq 0$. Solving for the demands, and aggregating over the M firms, yields the inverse aggregate demand functions for type 3 and type 4 credit

$$p_3 = \alpha - \frac{\gamma}{M}Q_4 - \frac{\beta}{M}Q_3; \qquad p_4 = \alpha - \frac{\gamma}{M}Q_3 - \frac{\beta}{M}Q_4. \tag{2}$$

Analogously to the deposit products, the two types of credit are gross substitutes. From now on I shall simply say substitutes.

[8] It is not rare for real (inflation adjusted) interest rates on deposits to be negative, even before taking into account commissions or account management fees.

[9] For example, loans with and without restricting covenants, or short-term and long-term loans. The restriction to two banking products as the only inputs is made for simplicity.

There are N banks which accept type 1 and type 2 deposits, and extend type 3 and type 4 credit. The bank can lend or borrow the difference between total deposits and total loans on the interbank market (to which firms and depositors do not have access) at the parametric interest rate r. The exogeneity of r reflects an implicit assumption of central bank interest rate smoothing activity.[10] There is no reserve requirement, and bank operating costs are zero.[11] Bank i maximizes profits, taking as given the quantities chosen by other banks. It solves

$$\begin{aligned}\max_{\{q_1^i,q_2^i,q_3^i,q_4^i\}} \quad & [a-\tfrac{c}{J}(q_2^i+\Sigma_{k\neq i}q_2^k)-\tfrac{b}{J}(q_1^i+\Sigma_{k\neq i}q_1^k)]q_1^i \\ + \quad & [a-\tfrac{c}{J}(q_1^i+\Sigma_{k\neq i}q_1^k)-\tfrac{b}{J}(q_2^i+\Sigma_{k\neq i}q_2^k)]q_2^i \\ + \quad & [a-\tfrac{\gamma}{M}(q_4^i+\Sigma_{k\neq i}q_4^k)-\tfrac{\beta}{M}(q_3^i+\Sigma_{k\neq i}q_3^k)]q_3^i \\ + \quad & [a-\tfrac{\gamma}{M}(q_3^i+\Sigma_{k\neq i}q_3^k)-\tfrac{\beta}{M}(q_4^i+\Sigma_{k\neq i}q_4^k)]q_4^i \\ + \quad & r(q_1^i+q_2^i-q_3^i-q_4^i),\end{aligned} \tag{3}$$

where the terms in square brackets are prices, substituted from equations (1) and (2). Setting $q_\ell^i = q_\ell^k = q_\ell^\dagger$, for $\ell = 1,2,3,4$, in the first order conditions of each bank $i = 1,2,\ldots,N$, and rearranging, yields the per bank quantities of the (symmetric Cournot) equilibrium

$$q_1^\dagger = q_2^\dagger = \frac{(a+r)J}{(N+1)(b+c)}; \qquad q_3^\dagger = q_4^\dagger = \frac{(\alpha-r)M}{(N+1)(\beta+\gamma)}. \tag{4}$$

The assumptions $b > c$ and $\beta > \gamma$ ensure that the second order conditions are satisfied. Substituting the aggregate equilibrium quantities (which are N times the per bank quantities) into the inverse aggregate demand functions, (1) and (2), yields the equilibrium prices

$$p_1^\dagger = p_2^\dagger = \frac{a-Nr}{N+1}; \qquad p_3^\dagger = p_4^\dagger = \frac{\alpha+Nr}{N+1}. \tag{5}$$

Notice that the price of credit is always positive, but not so for deposits. As was pointed out above, when N is sufficiently large banks pay depositors for the use of their funds.[12]

[10] See Cukierman and Sokoler (1993) for a discussion of interest rate policy by the Bank of Israel.

[11] Incorporating a reserve requirement is not difficult, but adds little to the understanding of the question at hand. The zero costs assumption will be relaxed later.

[12] As $N \to \infty$ the price of deposits approaches negative r, whereas the price of loans approaches r, meaning that banks charge borrowers the marginal cost of borrowing, and offer depositors the same rate the banks

The computation of the equilibrium bank profits, $\Pi^\dagger$, firm profits, $F^\dagger$, and the depositors' utility level, $U^\dagger$, is straightforward, and is omitted. As depositors' utility functions are quasi-linear, social welfare at an interior equilibrium is given by $W^\dagger = N\Pi^\dagger + MF^\dagger + JU^\dagger$.

First proposal. The first proposal consists of breaking up the N (Universal) banks into $2N$ (Universal) banks, each producing all four products. The equilibrium quantities and prices, denoted q_ℓ^* and p_ℓ^*, for $\ell = 1, 2, 3, 4$, are obtained by replacing N by $2N$ in the corresponding pre-reform expressions. The ensuing profit and welfare levels are denoted Π^*, F^*, U^*, and W^*.

Second proposal. The second proposal consists of spinning off from each bank the divisions which deal with type 1 deposits and type 3 credit. This results in a total of $2N$ banks, with N banks specializing in products 1 and 3, and the remaining N banks specializing in products 2 and 4. In the context of the reform proposals for the Israeli banking system, products 1 and 3 are standard, commercial banking products, whereas products 2 and 4 are the products that would be sold by an independent pension fund, which accepts long-term deposits and invests (at least some of) the funds in long-term ventures.[13]

Bank i, which specializes in products 1 and 3, solves the following problem:

$$\begin{aligned} \max_{\{q_1^i, q_3^i\}} \quad & [a - \tfrac{c}{J}(\Sigma_{k=1}^N q_2^k) - \tfrac{b}{J}(q_1^i + \Sigma_{k\neq i} q_1^k)]q_1^i \\ + \quad & [a - \tfrac{\gamma}{M}(\Sigma_{k=1}^N q_4^k) - \tfrac{\beta}{M}(q_3^i + \Sigma_{k\neq i} q_3^k)]q_3^i \\ + \quad & r(q_1^i - q_3^i). \end{aligned} \tag{6}$$

A bank which specializes in products 2 and 4 solves an analogous problem. The equilibrium prices and quantities are

$$\hat{q}_1 = \hat{q}_2 = \frac{(a+r)J}{cN + b(N+1)}; \qquad \hat{q}_3 = \hat{q}_4 = \frac{(\alpha - r)M}{\gamma N + \beta(N+1)}, \tag{7}$$

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themselves can obtain for the funds.

[13]The following is another possible interpretation. We can think of products 1 and 3 as "industrial" products (checking accounts and credit for large firms), and of products 2 and 4 as "retail" products (checking accounts and credit for individuals and small businesses).

$$\hat{p}_1 = \hat{p}_2 = \frac{ab - (b+c)Nr}{cN + b(N+1)}; \qquad \hat{p}_3 = \hat{p}_4 = \frac{\alpha\beta - (\beta+\gamma)Nr}{\gamma N + \beta(N+1)}. \tag{8}$$

The ensuing profit and welfare levels are denoted $\hat{\Pi}$, $\hat{F}$, $\hat{U}$, and $\hat{W}$.

Evaluating the proposals. It goes without saying that the first proposal results in a strict welfare improvement with respect to the pre-reform equilibrium. If $c > 0$ and $\gamma > 0$, the same is true for the second proposal.[14] What drives the welfare improvement resulting from the second proposal (spinning off divisions) is that type 1 deposits are substitutes for type 2 deposits, and type 3 credit is a substitute for type 4 credit. When a bank which sells all four products considers increasing by one unit the supplied quantity of one of the products, say type 3 credit, it takes into account the following factors: (a) The increase in revenue resulting from the sale of an additional unit of type 3 credit, at the prevailing price; (b) the revenue loss as a result of the decrease in the price of type 3 credit (own price effect); and (c) the revenue loss as a result of the decrease in the price of type 4 credit, which is a substitute for type 3 credit (cross price effect). A bank which sells only products 1 and 3, as in the second proposal, does not take into account cross price effects, and will therefore be more inclined to increase the supplied quantities of the products it sells.

Thus, the first proposal achieves greater competition by doubling the number of banks which offer each of the products, although—as every bank offers all four products—the cross effects keep being taken into account. The second proposal does not result in a larger number of banks offering the various products—each product is sold by N banks, as in the pre-reform market. The enhanced competition is a consequence of the fact that the banks no longer take into account the cross effects in the demand for banking products.

It is now evident that when type 1 deposits are not substitutes for type 2 deposits ($c = 0$), and type 3 credit is not a substitute for type 4 credit ($\gamma = 0$), there are no cross effects to be taken into account by banks which produce all four products. In that event the second proposal has no effect. On the other hand, if the degree of substitution between the products is very big, for example if we were to let c approach b, and γ approach β, the

[14] Namely, $\Pi^* < \Pi^\dagger$, $U^* > U^\dagger$, $F^* > F^\dagger$, and $W^* > W^\dagger$ for the first proposal, and $\hat{\Pi} < \Pi^\dagger$, $\hat{U} > U^\dagger$, $\hat{F} > F^\dagger$, and $\hat{W} > W^\dagger$ for the second proposal.

welfare improvement resulting from the second proposal would approach the improvement resulting from the first proposal. In general, when $c < b$ and $\gamma < \beta$ (that is, when cross price effects are weaker than own price effects—which we have assumed in order to ensure an interior solution), the welfare improvement resulting from the second proposal is smaller than that resulting from the first proposal. This follows from straightforward (and rather tedious) computations, which are omitted. The results are summarized in the following

Proposition *If* $c < b$ *and* $\gamma < \beta$ *then* $\Pi^* < \hat{\Pi} < \Pi^\dagger$, $U^* > \hat{\Pi} > U^\dagger$, $F^* > \hat{F} > F^\dagger$, *and* $W^* > \hat{W} > W^\dagger$, *i.e. the welfare improvement resulting from the second proposal (spinning off divisions) is smaller than that resulting from the first proposal (splitting the banks). If we let c approach b, and* γ *approach* β, *the welfare improvement resulting from the second proposal approaches the welfare improvement resulting from the first proposal.*

Simulation results. The following parameter values were used: $J = 3.6 \times 10^6$, roughly the number of Israeli currency time- and demand-deposit accounts as of December 1991;[15] $M = 6000$, which is a plausible estimate for the number of medium size and large firms in the country;[16] $a = 0.005$, $b = 1.5$, $\alpha = 0.7$, $\beta = 0.4$, $c = \gamma = 0.2$, and $r = 0.01$.

The simulation results for $N = 3$, the effective number of Cournot competitors in the Israeli banking system,[17] are presented in table 1. Quantities and prices roughly correspond to true figures.[18] The first proposal (splitting the banks) yields higher quantities and lower prices; the second proposal results in intermediate quantities and prices. The welfare levels resulting from the proposals, for different values of N, are shown in figure 1. As is apparent

[15]Annual Statistics of Israel's Banking System 1987-1991, Bank of Israel (Hebrew and English), pp.90-1; henceforth AS.

[16]If small firms and family businesses are taken into consideration, this figure underestimates the number of borrowers. If only large firms are considered, the figure overestimates their number.

[17]The two largest banks constitute approximately 35% of the market, each; the next largest bank constitutes around 15% of the market, while most of the remaining share is captured by the next two largest banks. The resulting Herfindahl index is 0.28.

[18]At the end of 1990, total non-earmarked deposits (earmarked deposits are related to government subsidized credit) were approximately \$27 billion. See AS, pp.90-91. This figure does not include \$40 billion of deposits in bank managed retirement funds, which may be regarded as long-term (15 years) time deposits. Therefore, total deposits are in the range \$27–67 billion. In 1990, total bank credit in Israeli currency to industry, trade, restaurants and hotels, transport and storage, electricity and water, and construction, was approximately \$10 billion. See AS p.108. The bank profit figures generated by the simulations are unrealistically high since we have assumed zero costs.

from the slopes of the schedules, welfare increases fast with the number of banks when the number of banks is small, but not when it is large. Also, the welfare gains from both proposals at $N = 3$ are substantial.

Economies and diseconomies of scale and scope. The following joint production cost function is now added to the model:

$$\begin{aligned} c(q_1, q_2, q_3, q_4) &= \delta_X(q_1 + q_2) + \tfrac{1}{2}\delta_Y(q_1^2 + q_2^2) \\ &+ \rho_X(q_3 + q_4) + \tfrac{1}{2}\rho_Y(q_3^2 + q_4^2) \\ &+ \delta_Z q_1 q_2 + \rho_Z q_3 q_4. \end{aligned} \tag{9}$$

The parameters $\delta_X \geq 0$ and $\rho_X \geq 0$ are the components of marginal cost which are independent of scale. The parameters δ_Y and ρ_Y are the components of marginal cost which interact with the scale of production. The parameters δ_Z and ρ_Z capture economies or diseconomies of scope between the two deposit products and between the two credit products respectively. A positive value of δ_Y, ρ_Y, δ_Z, or ρ_Z represents a diseconomy, whereas a negative value represents an economy.[19] Repeating the calculations performed above, we get the following pre-reform per-bank quantities:

$$q_1^\dagger = q_2^\dagger = \frac{(a + r - \delta_X)}{A_\delta}; \quad q_3^\dagger = q_4^\dagger = \frac{(\alpha - r - \rho_X)}{A_\rho}, \tag{10}$$

where $A_\delta = \frac{N+1}{J}(b + c) + \delta_Y + \delta_Z$ and $A_\rho = \frac{N+1}{M}(\beta + \gamma) + \rho_Y + \rho_Z$. The prices are obtained from the demand curves in a straightforward manner. The equilibrium quantities resulting from the first proposal are obtained by replacing N by $2N$ in the corresponding pre-reform expressions. The equilibrium quantities resulting from the second proposal are

$$\hat{q}_1 = \hat{q}_2 = \frac{(a + r - \delta_X)}{B_\delta}; \quad \hat{q}_3 = \hat{q}_4 = \frac{(\alpha - r - \rho_X)}{B_\rho}, \tag{11}$$

where $B_\delta = \frac{b}{J}(N + 1) + \frac{c}{J}N + \delta_Y$ and $B_\rho = \frac{\beta}{M}(N + 1) + \frac{\gamma}{M}N + \rho_Y$. The prices are obtained

[19] Since in this section we assume that households demand only deposit products and firms demand only credit products, much of the rationale for economies of scope between deposits and credit is lost. Hence, the assumption that there are no economies of scope between credit and deposits is appropriate.

from the demand curves in a straightforward manner.[20]

The presence of economies of scale should play in favor of the second proposal, because when specialized divisions are spun off, only N banks produce each product, rather than $2N$ in the first proposal. The presence of economies of scope between deposit products, and economies of scope between credit products, should play in favor of the first proposal, because when divisions are spun off, the ability to take advantage of these economies is reduced.

Simulation results. For the rest of this section $\delta_X = \rho_X = 0.001$. As a measure of economies of scale, I use ray scale elasticity,

$$RSCE \equiv \partial \ln c(tq)/\partial \ln t|_{t=1} = \sum_{i=1}^{4} \partial \ln c(q)/\partial \ln q_i, \tag{12}$$

where $q \equiv (q_1, q_2, q_3, q_4)$. $RSCE$ is the percent change in cost when all outputs are increased by one percent. $RSCE < 1$ implies economies of scale. Paroush and Ruthenberg (1994) find economies of scale for Israeli banks ranging from $RSCE = 0.44$ at the branch level to $RSCE = 0.92$ at the firm level.[21] As a measure of economies of scope, I use

$$SCOPE \equiv \frac{c(q_1, q_2, q_3, q_4) - [c(q_1, 0, q_3, 0) + c(0, q_2, 0, q_4)]}{c(q_1, q_2, q_3, q_4)}. \tag{13}$$

$SCOPE < 0$ implies economies of scope.[22] See Berger, Hanweck, and Humphrey (1987) for a detailed explanation of various measures of economies of scale and scope.

First, I check that the simulation results presented earlier are robust to economies of scale. Setting $\delta_Z = \rho_Z = 0$ (implying $SCOPE = 0$) and $\delta_Y = \rho_Y = -1 \times 10^{-7}$, with no further changes in parameter values, yields similar results in terms of quantities, prices, profits, and welfare, with a graph almost identical to figure 1 (and hence omitted), and with pre-reform $RSCE = 0.49$.[23]

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[20]The conditions $\frac{2b}{J} + \delta_Y > 0$, $\frac{2\beta}{M} + \rho_Y > 0$, $\frac{2}{J}(b - c) > \delta_Z - \delta_Y$ and $\frac{2}{M}(\beta - \gamma) > \rho_Z - \rho_Y$ ensure that the second order conditions are satisfied in all the calculations.

[21]They report results of earlier studies which found economies of scale in the range 0.64–0.90.

[22]I do not know of empirical estimates for Israel. As mentioned above, there is no agreement regarding the magnitude of scope economies in banking.

[23]The post-reform values of $RSCE$, for both proposals, are also in the empirically relevant range 0.45–0.90.

Next, I study the behavior of the model when economies of scale become large. I increase the absolute value of the (negative) parameter ρ_Y, making $RSCE$ small. The changes in quantities, prices, profits, and welfare are minor, and the ranking of the proposals does not change. The welfare effect is presented in table 2, confirming the intuition that when economies of scale increase, splitting the banks becomes (marginally) less attractive, whereas spinning off divisions becomes (marginally) more attractive.[24]

I turn to economies of scope. Setting $\delta_Y = \rho_Y = 0$, and varying δ_Z and ρ_Z from zero to negative 1.4×10^{-7}, generates a gradual increase in the absolute value of $SCOPE$. However, as can be seen in table 3, the changes in δ_Z and ρ_Z also cause $RSCE$ to decrease, which reduces the welfare gain from the first proposal (similarly to the effect presented in table 2). The predicted effect on the welfare gain from the second proposal is mixed. On the one hand, larger economies of scale increase the gain (as in table 2); on the other hand, larger economies of scope reduce the gain since spinning off divisions reduces the ability to take advantage of such economies. As can be seen in table 3, the second effect dominates in this simulation. The changes in quantities, prices, profits, and welfare are minor, as compared to the zero costs case, and the ranking of the proposals does not change.

4 Complementarities between Deposits and Credit

Cukierman (1978, p.165) observes that "it is widely recognized, certainly within the banking business community, that there is a positive association between the propensity of a customer to generate various businesses in the bank and the amount of credit he obtains from the bank."[25] For example, customers can use their time deposits as collateral for credit from the same bank; large borrowers obtain discounts in banking fees, and so forth. Cukierman shows that if a bank is constrained to charge customers the same interest rate, but is allowed to discriminate in the amount of credit, then customers with lower propensity

I do not want to attribute much significance to the numerical values of the post-reform elasticities, since the quadratic cost function implies that marginal cost is linear in quantities (rather than strictly convex), which may not be all that realistic.

[24] Similar results are obtained when both ρ_Y and δ_Y are increased.

[25] Cukierman (1978) cites empirical evidence in this regard, as well as earlier literature which has addressed this issue.

to generate business with the bank will be rationed, and the interest rate set by the bank will be lower than the cost of producing credit, resulting in an inefficient allocation of credit among firms.

The Israeli press is replete with allegations that banks have been offering loans at attractive rates in order to encourage customers to borrow and invest in mutual funds managed by the same bank. When stock prices suddenly fell in 1994, many leveraged customers went broke. Bank managed pension funds and mutual funds, goes the argument, generate conflicts of interest and irresponsible bank behavior.[26] Spinning off bank divisions may alleviate this problem as well as the problem raised by Cukierman.

These are major issues which need to be taken into consideration when evaluating the reform proposals. The model, as presented here, is not tailored to deal with them. However, the model can be used to highlight an additional effect of relevance. A bank which faces complementarities in the demand for credit and deposits (and does not ration credit), will charge less for servicing deposit accounts in order to induce a higher demand for credit, or equivalently, will charge less for credit in order to induce a higher demand for deposits. In and of itself (i.e. other things equal), this is socially beneficial. An implication is that the welfare gain from spinning off divisions becomes smaller (as compared to the case with no complementarities), because when specialized divisions are spun off they no longer have an incentive to offer discounts on some products in order to induce greater demand for other products. In an extreme case where complementarities between credit and deposits are very strong and substitution within credit and deposit instruments is weak, spinning off divisions could even be harmful. This case is admittedly less realistic, and will be ignored from now on.[27]

In order to illustrate the effect, a third product, type 5 credit, is incorporated in depositor j's utility function, $x^j + a(q_1^j + q_2^j + q_5^j) - \frac{1}{2}b[(q_1^j)^2 + (q_2^j)^2 + q_5^j] - cq_1^j q_2^j + d[q_1^j q_5^j + q_2^j q_5^j]$,

[26] See Ben-Bassat (1988) for a discussion.

[27] The effect is similar to a well known principle in the theory of vertical control. Consider a monopoly producer of an intermediate good who sells to a monopoly producer of the final good. The socially optimal market structure is a vertically integrated one, where the producer of the intermediate good takes into account the effect of his price on the cost function of the downstream producer, and hence on the price that will be charged in the final good market. See Tirole (1989), chapter 4.

where the parameter $d \geq 0$ measures the demand cross effect between the two types of deposits and type 5 credit. For simplicity, I use the following bank cost function, $c(q_1, q_2, q_3, q_4, q_5) = \delta(q_1 + q_2 + q_3 + q_4 + q_5) + \lambda(q_1 q_5 + q_2 q_5)$, where a negative value of λ represents an economy between deposits and credit. The rest of the model is unchanged. Splitting up the banks means that $2N$ banks each produce all five products. When divisions are spun off, one set of banks specialize in products 1 and 3 (e.g. short-term deposits and short-term credit to firms) while the rest specialize in products 2,4, and 5 (e.g. long-term deposits, long-term credit to firms and long-term credit to households, which is q_5.)[28]

Simulation results. I set $\delta = 0.01$, $J = 3.6$, $M = 0.006$, $c = \gamma = 1$, $b = 4.5$, and $\beta = 1.5$. I changed the value of most parameters (and for some also the order of magnitude) because with the earlier values the simulations generate negative values of q_5.[29] The welfare gains for various values of d and λ are shown in table 4. As d increases, namely *as the demand complementarity between deposits and credit becomes stronger, spinning off divisions becomes less effective,* since the loss from not taking into account the demand complementarities increases. I do not have a simple interpretation for the positive relation between increases in d and increases in the welfare gain from the first proposal. As λ becomes more negative, namely *as economies of scope between deposits and credit increase, spinning off divisions becomes less effective,* since the loss from not taking advantage of the cost reduction driven by joint production, is greater. When λ becomes more negative economies of scale also increase, reducing the welfare gain from the first proposal (an analogous effect to that shown in table 2).

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[28]The solution yields the following equilibrium quantities: $q_3^\dagger = q_4^\dagger = [(\alpha - R - \delta)M]/[(N+1)(\beta+\gamma)]$, $q_5^\dagger = [(a-R-\delta)X(b+c)+2(a+R-\delta)Y]/[X^2 b(b+c)-2Y]$, and $q_1^\dagger = q_2^\dagger = [(a+R-\delta)+Yq_5^\dagger]/[X(b+c)]$, where $X = (N+1)/J$ and $Y = Xd-\lambda$. Replacing N by $2N$ in the expression for X yields the equilibrium quantities resulting from the first proposal. The second proposal yields: $q_3^\dagger = q_4^\dagger = [(\alpha-R-\delta)M]/[\gamma N+\beta(N+1)]$, $q_5^\dagger = [A_2B_1-A_1B_2]/[A_3B_2-A_2B_3]$, $q_2^\dagger = -[A_1+A_3q_5^\dagger]/A_2$, and $q_1^\dagger = [1/(Xb)][(a+R-\delta)-(cN/J)q_2^\dagger+(dN/J)q_5^\dagger]$, where $A_1 = (a+R-\delta)d+(a-R-\delta)c$, $A_2 = cY - dbX$, $A_3 = dY - cbX$, $B_1 = (a+R-\delta)[Nc-(N+1)b]$, $B_2 = (1/J)[(N+1)^2b^2 - N^2c^2]$, $B_3 = [(dcN^2)/J] - (N+1)bY$, $X = (N+1)/J$, and $Y = Xd - \lambda$. Prices, profits, and welfare levels are computed in a straightforward manner. For sufficiently small δ and λ, the conditions $b > c \geq 0$, $\beta > \gamma \geq 0$, and $b^2 > 2d^2$ ensure that the second order conditions are satisfied in all the calculations.

[29]Although this difficulty can be overcome by interpreting q_5 as a deviation from a baseline level, I chose to stick with the method presented in the text. In terms of prices and (appropriately rescaled) quantities the model yields plausible results, except for the price of q_5 which is stubbornly low at around 3%.

Substitution and complementarity between banking products. The Israeli experience in recent years suggests that there are complementarities between credit and deposits at the aggregate level. The huge amount of credit granted by banks to the public entailed an increase in demand for deposit instruments, especially mutual funds.[30] I am not aware of systematic studies of the degree of complementarity between credit and deposits, nor of the degree of substitution within credit instruments and deposit instruments. My conjecture is that short- and long-term credit are substitutes, and that the elasticity of substitution is big. When the price of short-term credit falls relatively to the price of long-term credit, firms will use the former to finance part of their long-term needs. When prices move in the opposite direction, firms will borrow long-term and use the funds for current expenditures. This behavior involves, no doubt, interest rate risk. The extent to which firms actually engage in it is an interesting, unexplored, empirical question, with clear implications for the issue at hand.

As for the degree of substitution between deposit instruments I have found indirect, anecdotal evidence. The first piece of evidence suggests that savings accounts indexed to foreign currency and savings accounts indexed to the local rate of inflation are substitutes. In 1983 strong expectations for a devaluation of the local currency developed in Israel. The fraction of assets in the public's portfolio that were indexed to foreign currency rose from 15% at the end of 1982 to 30% at the end of 1983, peaking at 41% in June 1985. The trend reversed itself in the second half of 1985 following a large devaluation at the end of June 1985, and the adoption of a credible stabilization program by the Israeli government.[31] The second piece of evidence suggests that bank certificates of deposit and money market funds are substitutes. Between 1989 and 1993, interest rates on bank certificates of deposit in the U.S. declined steadily, reaching 2-3% and even less. The public reacted by shifting large amounts of money from certificates of deposit to money market funds.[32]

[30]There are also complementarities driven by market frictions—a consumer with an account in a particular bank will find it costly to search for a loan in other banks. This effect is not captured by the model presented here.

[31]Developments in Capital Markets, Monetary Department, Bank of Israel, various issues (Hebrew).

[32]Large time deposits in commercial banks and thrift institutions, in billions of dollars: 549 in 89, 490 in 90, 424 in 91, 357 in 92. Money market funds in billions of dollars: 109 in 89, 136 in 90, 182 in 91, 202 in 92. Statistical Abstract of the United States, 1993, U.S. Department of Commerce, Bureau of the Census,

401(k) plans. The Revenue Act of 1978 in the U.S. established 401(k) plans, which like IRAs, are deferred compensation plans for wage earners. After 1981, when clarifying rules were issued, participation in 401(k) plans expanded rapidly. Poterba, Venti, and Wise (1992) provide a detailed treatment, and report that 401(k) plans did not serve as substitutes for IRA plans and for other forms of saving.[33] Further, they find that IRA contributions did not replace other savings.[34] It is not obvious that this indicates that the degree of substitution between saving instruments is low. Rather, it may serve as evidence that there was a demand for a new product which had not been available before.

5 Implications for Banking Reform in other Countries.

There are many countries where a concentrated, Universal, government owned banking system is about to be privatized. In Greece, for example, the state controls approximately 86% of bank assets. The three largest banks (owned by the state) control approximately 75-80% of total lending and deposits. There is agreement among political parties in Greece that some privatization should be promoted.[35]

Consider Poland. In 1982 the National Bank of Poland (BNP) was separated from the Ministry of Finance. In 1989 the nine regional offices of the BNP became autonomous, and were given Universal charters. The charters of three other banks were amended to allow them to operate as commercial banks. The Polish government plans on privatizing all the banks in the near future.[36] At the end of the process, Poland will find itself with a banking system of (roughly) a dozen, mostly regional, Universal banks.[37]

In Russia, the evolution of the banking market structure has taken a different path. Until 1987 the banking system in the Soviet Union consisted of a main (commercial) bank, several subordinate savings banks, a construction bank, and a foreign trade bank. In 1987

Table 821, p.518.

[33]They argue that IRA plans were curtailed by the 1986 tax reform, not by the introduction of 401(k) plans.

[34]See also Venti and Wise (1990).

[35]See Lioukas (1993).

[36]One regional bank and two other banks have already been privatized. Privatization of the other banks is planned to be completed by the end of 1996.

[37]See Hoshi, Kashyap, and Loveman (1993) and Bonin (1993a) for a detailed treatment of the Polish case.

it was reorganized into a system of six state-owned banks: The main (commercial) bank, a savings bank, a bank for foreign transactions, a construction bank, a bank for agriculture, and a bank for social development which also served small enterprise. Since 1990 there is a process of commercialization of the state banks, as well as entry of new banks. By the end of 1991 there were approximately 1500 banks in Russia alone.[38]

The Bulgarian case is also special. By 1990 Bulgaria found itself with 59 Universal commercial banks and seven development banks. Recently, the World Bank and a private consulting firm recommended bank consolidation. The current proposal is to create ten major Universal banks from the seventy-odd existing banks.[39]

Clearly, the above countries have had very different experiences. This gives rise to the following question: *What is the desired market structure of the banking sector following a privatization process?* To the best of my knowledge, this question has not been systematically studied for any of the above countries (nor for any other country), in the specific context of banking reform. It has been addressed, though in the context of privatization programs in other industries (e.g. British Coal and British Rail). See Vickers and Yarrow (1991) and Dana and Spier (1994).[40]

Although each of the above East European countries is special, and deserves separate treatment, the methodology used here for the Israeli case, appropriately modified for each country, can be of help in evaluating the various privatization programs. For example, it can help address questions such as: Is a system of (roughly) a dozen Universal banks adequate for Poland, or should some, say half, specialize in particular services? Are 1500 Universal banks adequate for Russia? And so forth.

Consider, for example, the question whether competition between regional banks is more desirable than competition between sectoral banks. The answer depends on how easily a firm in a particular region can obtain loans from a bank in another region, namely whether credit products of two banks in different regions are substitutes; and on how easily savers

[38]See Ickes and Ryterman (1992) and Johnson, Kroll, and Horton (1992).

[39]See Bonin (1993b).

[40]Dana and Spier (1994) focus on the trade-off between revenue and market structure objectives in the presence of asymmetric information. They study government mechanisms for auctioning production rights, where the post-privatization market structure is a function of the bids.

in one region can hunt for certificates of deposit issued by banks in other regions. The model must be tailored for the particular country under consideration, but the basic logic is similar.

6 Summary

Using a simple model of imperfect competition between banks, two proposals for the privatization of banks in Israel have been studied. The analysis yields the following basic result: Spinning off divisions from existing banks is welfare improving, provided that banking products are substitutes. The stronger the degree of substitution, the greater the welfare improvement. When the degree of substitution is very high, spinning off divisions is almost equivalent (in welfare terms) to splitting up the existing banks. Implications of demand and cost complementarities in banking products have been studied. The major finding is that spinning off divisions is relatively less effective in the presence of such complementarities. The relevance of the model for the debate on banking reform in other countries has been briefly discussed.

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	Aggregate deposits[a]	Deposits per capita	Price of deposits	Aggregate credit[b]	Credit per firm	Price of credit
pre-reform	\$47.6 bil.	\$6620	-0.6%	\$10.4 bil.	\$862,000	18.2%
1st proposal	\$54.5 bil.	\$7560	-0.8%	\$11.8 bil.	\$986,000	10.9%
2nd proposal	\$49.1 bil.	\$6820	-0.7%	\$11.3 bil.	\$941,000	13.5%

[a]Type 1 and type 2.

[b]Type 3 and type 4.

Table 1. Simulated quantities and prices when bank costs are zero and $N = 3$.

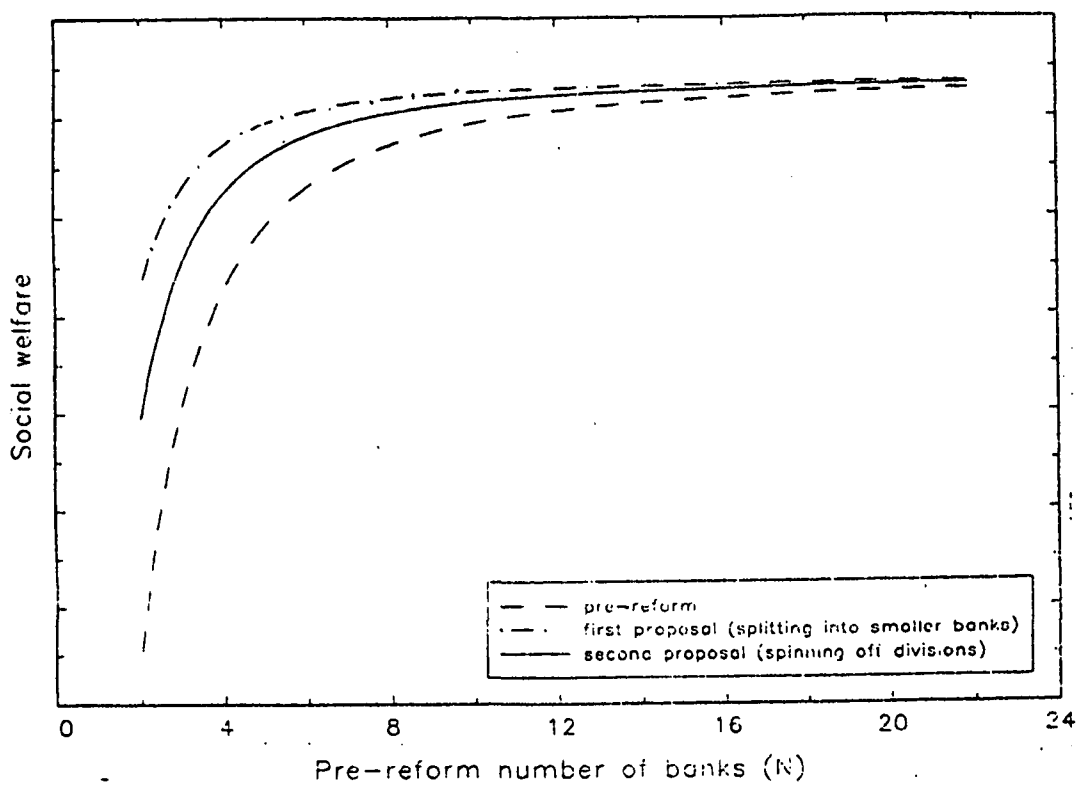

Figure 1. Simulated welfare levels when bank costs are zero and $N = 3$.

ρ_Y	pre-reform	Welfare gain	
	$RSCE$	1st proposal	2nd proposal
$-(1 \times 10^{-7})$	0.49	204.7	145.2
$-(3 \times 10^{-7})$	0.42	203.5	145.4
$-(5 \times 10^{-7})$	0.34	202.3	145.6
$-(7 \times 10^{-7})$	0.25	201.1	145.8
$-(9 \times 10^{-7})$	0.14	200.0	146.1

Table 2. Simulated welfare gains when there are large economies of scale and no economies of scope.

δ_Z , ρ_Z	pre-reform		Welfare gain	
	$RSCE$	$SCOPE$	1st proposal	2nd proposal
0	1.00	0.00	217.3	144.3
$-(2 \times 10^{-8})$	0.93	-0.07	215.0	139.0
$-(4 \times 10^{-8})$	0.85	-0.15	212.5	133.6
$-(6 \times 10^{-8})$	0.75	-0.25	210.0	128.1
$-(8 \times 10^{-8})$	0.64	-0.36	207.4	122.4
$-(10 \times 10^{-8})$	0.49	-0.50	204.7	116.6
$-(12 \times 10^{-8})$	0.31	-0.69	201.9	110.6
$-(14 \times 10^{-8})$	0.07	-0.93	198.9	104.5

Table 3. Simulated welfare gains when there are economies of scale and scope.

d	λ	Welfare gain	
		1st proposal	2nd proposal
0.01	0	1.48×10^{-4}	9.7×10^{-5}
0.10	0	1.49×10^{-4}	9.6×10^{-5}
0.50	0	1.52×10^{-4}	9.0×10^{-5}
1.00	0	1.59×10^{-4}	8.2×10^{-5}
1.00	(-5×10^{-3})	1.58×10^{-4}	8.1×10^{-5}
1.00	(-1×10^{-2})	1.57×10^{-4}	8.0×10^{-5}

Table 4. Simulated welfare gains when there are demand complementarities and economies of scope.

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