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Intermediation Spreads in a Dual Currency Economy: Argentina in the 1990s

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Abstract

The currency board arrangement and widespread dollarization of the Argentine economy since 1991 have laid the basis for domestic interest rates to converge to international levels. Although such a convergence has been observed for interest rates on bank deposits, interest rates on bank lending remain well above industrial country levels. This paper examines the causes of high intermediation spreads in Argentina using a dual currency model of the banking industry, which incorporates key features of credit markets in that country. Empirical results allow inferences to be drawn on the effects of macroeconomic and financial policies on bank lending and interest rates.

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SUMMARY

Since the onset of the currency board arrangement in early 1991, interest rates on bank deposits in Argentina have gradually converged to international levels. Yet, a similar convergence has not been observed for lending interest rates, which stand well above OECD levels. This is widely perceived as having had a detrimental impact on employment in Argentina and on the external competitiveness of its domestic industry, as most firms have continued to rely on local banks for their financing.

This paper examines the determinants of the spread between deposit and lending interest rates in Argentina, seeking to answer two main questions. First, why have banking spreads remained relatively high despite the uninterrupted operation of the currency board arrangement for seven years now and the far-reaching liberalization and financial sector reforms that have boosted banking sector productivity? Second, why has there been a significant gap between interest rate spreads in domestic currency and those in foreign currency transactions, given that banks and the general public are virtually free to intermediate in either currency?

To identify the contribution of banks' operating costs and financial policy variables to intermediation spreads, this paper develops a partial equilibrium model of the banking industry in a dual currency economy with imperfectly competitive credit markets, and estimates it empirically. The evidence indicates that high intermediation spreads in Argentina persist as a result of (1) high administrative costs stemming from the low monetization of the economy, inefficiencies of the payments system, and limited consolidation of the financial system; (2) credit risk and sizable provisioning expenses associated with the large stock of non-performing loans, which partly reflect institutional barriers to the dissemination of credit information; and (3) market segmentation between domestic and foreign currency borrowers. Based on these results, the paper discusses a number of policy recommendations to reduce further banking spreads in Argentina.

I. INTRODUCTION

The banking industry in emerging market economies of the Western Hemisphere has undergone major transformations in recent years. With the sharp fall in inflation and the elimination of interest rate and credit controls, both funding costs and credit risk increased substantially, while competition among financial intermediaries became stiffer. Productivity in the banking sector improved markedly in most countries in the region. However, intermediation spreads—herewith defined as the difference between the average interest rate on bank deposits and the average interest rate on bank lending—have declined only slowly, even in those countries which have embarked on capital account liberalization and allowed domestic banks to intermediate freely in domestic and foreign currency, such as Argentina, Peru and Uruguay.[2] The persistence of high banking spreads is an important policy issue in these countries, where access to foreign savings is still relatively expensive, and investment needs associated with the process of structural transformation and catching up growth, are sizeable. In this context, the low efficiency and high cost in mobilizing national savings by the local financial sector has been shown to raise the domestic price of capital above optimal levels, restricting the access of innovative entrepreneurs to liquid funds and relegating a number of investment projects to economically inefficient scales, with clear adverse effects on external competitiveness and economic growth (King and Levine, 1993; Levine, 1997).

The depth of financial sector reforms in Argentina and the monetary discipline entailed by the currency board arrangement (CBA), make it an interesting case study on the relationship between structure and efficiency of its banking industry and domestic intermediation spreads. Following a decade of high inflation, widespread capital controls, and abundant Central Bank credit to financial institutions, Argentina's banking system was clearly oversized and undercapitalized by the early 1990s. Labor productivity had reached an all-time low, the share of problem loans in banks' portfolio exceeded twenty percent, and intermediation spreads hovered around triple-digit levels. Market discipline was introduced at a stroke with the enactment of the CBA in March 1991. Capital controls were abolished on practically all external transactions and strict limits were placed on Central Bank credit, including its role as a lender of last resort to the financial sector. A tight system of prudential regulations was gradually implemented to ensure that banks operated with high liquidity margins and capital-asset ratios, given the virtual lack of a lender of last resort; a number of public financial institutions were privatized, and considerable emphasis was placed on opening up the domestic market to foreign competition.

Responding to the new system of incentives and checks, both private and public banks underwent considerable streamlining. Employment in the financial system was cut by some 30 percent between 1989 and 1996. As deposits and the supply of banking services more than doubled in real terms, average productivity growth exceeded 10 percent a year. Yet, throughout the period intermediation spreads in Argentina remained high compared with

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[2]For the case of Peru, see Segura (1995). Intermediation spreads in Uruguay can be gauged from bank deposit and lending rates provided in IMF, *International Financial Statistics*.

OECD standards. After a sharp drop from their very high levels in late 1990, intermediation spreads declined only gradually (Figure 1); by late 1997 they stood in the neighborhood of 11 percent for the average of peso and dollar-denominated transactions. This compares with average banking spreads in the range of 1 to 4 percent for most industrial countries (IMF, 1996, p.80).

Thus, while interest rates on bank deposits in Argentina have converged to international levels —as one would expect from a currency board arrangement (Figure 2)—domestic lending rates remained far above industrial country levels. As most enterprises continued to rely on domestic bank credit as their main source of financing, the adverse effect of high banking spreads on competitiveness and employment have become increasingly apparent in recent years as a result of trade liberalization, the currency peg, and the opening up of the economy. This has motivated a number of policy initiatives to try and lower the domestic cost of financial intermediation, particularly during the early years of the convertibility regime. However, their outcome fell well short of expectations, as acknowledged by a key policy maker at the time (Cavallo, 1997).

The continuing importance of the topic and the paucity of robust empirical evidence on the determinants of intermediation spreads in Argentina, call for a more detailed investigation. This paper examines the issue in the context of a dual currency model of banking lending under imperfectly competitive credit markets, and where banks are subject to a set of binding prudential regulations. The remainder of the paper is structured along four sections as follows. Section II singles out a set of variables which appear to explain the high level of intermediation spreads in Argentina, and provides some *prima facie* evidence on the correlation between intermediation spreads and these variables over the period 1992–97. Against this background, Section III spells out an optimizing partial equilibrium model of bank lending in which individual banks behave like a profit maximizing firm under the constraints imposed by prudential regulations and a certain market structure. Section IV estimates the model empirically and discusses the extent to which it fits actual developments. On the basis of these results, the relative importance of distinct macro and microeconomic variables in the determination of banking spreads is assessed, and inferences are drawn on the impact of certain financial policies on domestic lending rates. Section V summarizes the main findings and discusses their policy implications.

II. *Prima Facie* Evidence

Table 1 provides information on selected banking indicators for Argentina and a group of OECD countries.[3] The first three lines of Table 1 show the **implicit** interest rate on loan and

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[3]Data for Peru is reported for comparison purposes since it is also a dual currency economy which have witnessed major financial sector reforms in recent years. For all countries, 1994 was chosen as the reference year due to a lack of comparable data for 1996, and also because

(continued...)

deposit operations derived from the income statements of the consolidated banking system in these countries.[4] The implicit spread between deposit and lending rates in Argentina is clearly higher than those in OECD countries, particularly when compared with the G7 group excluding Italy. Table 1 highlights some factors which account for these cross-country differences. Contrary to what one might expect, higher profit margins do not stand out as a key factor.[5] The two main culprits for high interest spreads in Argentina appear to be banks' operating costs and expenses with loan provisioning, both of which are up to three times as high as in OECD economies.

A number of hypotheses have been raised to explain the prevalence of **high operating costs** in banking among non-OECD economies (Revell, 1981; Hanson and Rocha, 1986; Segura, 1995; Vicens, 1997). A first set of factors pertains to macroeconomic and institutional disincentives to individual bank performance which have historically plagued some of these countries. In the case of Argentina, widespread subsidies to public banks, together with credit and capital controls prior to the early 1990s, helped shield financial institutions from domestic and foreign competition, reducing incentives for productivity growth. High inflation during the 1980s, by lowering the real cost of expanding the deposit base, reinforced the above factors and contributed to excessive branching.[6] As a result, Argentina embarked upon the banking sector reforms of the 1990s from a rather low **starting point**, with a financial system which was clearly undercapitalized and oversized. While the new "rules of the game" entailed by the CBA reinstated incentives for individual bank performance and productivity indicators for the banking system witnessed a marked improvement (Figure 3), on the eve of the Tequila crisis in late 1994, 205 banks still operated in Argentina compared with 219 in 1991; the two largest

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[3](...continued)
it seems a better choice than 1995 given the large exchange rate realignments amongst OECD countries during 1995 and the effects of the "Tequila" crisis on Argentina.

[4]The implicit or effective interest rate can differ markedly from the ex-ante or the contract interest rate in countries with a high incidence of nonperforming loans and refinancing operations.

[5]Although it can be rightly argued that 1994 was an atypical year regarding bank profitability, the ratio of profits to net worth of the consolidated banking sector in Argentina has not been overly high. It marginally exceeded 10 percent during the 1993 boom and averaged 7 percent in 1997 (Figure 8). The average rate of return on equity for the U.S. big banks, in comparison, has fluctuated in the range of 15 to 20 percent in recent years. See *The Economist*, April 11th–17th, 1998, pp. 55–56.

[6]It has been shown that in high inflation countries banks tend to develop an extensive network of local branches aimed at reducing the high transactions costs in these economies (Revell, 1981; Hanson and Rocha, 1986). With the sharp drop in inflation following macroeconomic stabilization, part of this network becomes redundant. This leads to higher overhead costs per unit of loan which, in turn, prevents a faster decline in intermediation margins.

public banks comprised 22 percent of total deposits, and the ratio of deposits per employee was three to five times lower than in OECD countries. Although the consolidation process has speeded up over the past two years, with the closure of less efficient banks and further tightening in prudential regulations, recent empirical evidence indicates that the number of financial institutions operating below the optimal production frontier (the so-called "X-inefficiencies") remains very high in Argentina compared to more advanced economies (Dick, 1996).[7]

Low monetization of the economy and inefficiencies in the **payments system** have been highlighted as important causes of banks' high operating costs among non-OECD economies, and Argentina is no exception in this regard. Despite its marked rise since the end of the 1989–90 hyperinflation, the degree of monetization of the Argentine economy remains low. The ratio of broad money (M3) to GDP barely exceeded 22 percent in 1997, compared, for instance, with 59 percent for the U.S., 67 percent for Germany, and 79 percent for Spain in 1996. Lower monetization limits risk diversification and entails lower average value of deposits per bank account which, in turn, raises operational costs per unit of deposits (Levine, 1997; Vicens, 1997). Moreover, it has been noted that not only is monetization low in Argentina but also the composition of payment instruments and bank services demanded by the public has been highly skewed toward cash transactions and labor intensive tasks, which are relatively costly (Villar, 1996). The low efficiency of the interbank payments system—which, prior to the 1997 reforms, operated in a semi-manual fashion and with great reliance on cash settlements of interbank transactions—has further contributed to keep banking costs high, as physical transportation of currency and other payment instruments delays final settlement, is riskier, and entail higher insurance costs (Villar, 1996).

Prudential regulations are widely acknowledged to have an important effect on intermediation spreads, as they constitute an extra tax on financial intermediation which, *ceteris paribus*, raises the wedge between deposit and lending interest rates. Partly because of a long history of financial crises and institutional constraints faced by banking supervision,[8]

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[7]Dick (1996) estimates the level of X-inefficiencies in Argentina's banking industry at 57 percent. In other words, if less efficient banks were to disappear or start operating on the production frontier estimated for efficient banks, the average cost of financial intermediation in Argentina would decline by as much as 57 percent.

[8]For instance, an accurate assessment of the banking system's net worth in developing countries is often marred by looser accountancy practices, shallow capital markets and the prevalence of ownership concentration. As most domestic banks raise only a small fraction of their capital at stock exchanges they are not subject to extensive market monitoring and pricing of their capital base. In fact, it is not unusual to have banks' capital measured at historical book value rather than at current market prices, often entailing an overestimation of banks' actual net worth. The prevalence of ownership concentration also complicates the assessment of the aggregate net worth of the banking system insofar as large shareholders can

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partly due to the restrictions imposed by the currency board arrangement on the Central bank role as a lender of last resort, both reserve/liquidity requirements and minimum capital adequacy ratios have been significantly higher in Argentina than in most countries. During 1991–94, the Argentine financial system embarked upon a far-reaching process of re-capitalization. By late 1994, the average capital-asset ratio (measured by the standard Basle methodology) rose to 18.3 percent.[9] Regulations on minimum provisioning for problem loans were tightened further in the wake of the 1995 banking crisis, and the risk weighted capital-asset ratio for the system reached 20 percent in early 1997. With regard to reserve requirements, Figure 11 shows that reserve requirements plus banks' cash in vault[10] in peso, albeit having declined somewhat between mid–1991 and late 1997, remained above 25 percent, while reserves on U.S. dollar-denominated liabilities increased to that level. By late 1997, the average of U.S. dollar and peso legal liquidity requirements in Argentina reached 19 percent of deposits, with banks' cash in vault adding some 6 percentage points to this Figure. This is quite high by international standards and no doubt poses a significant restraint on bank lending. Its impact on intermediation spreads, however, has been mitigated since mid–1995 when legal reserve requirements started being remunerated at interest rates close to that of average bank deposits (4 to 5 percent a year), under a system of "liquidity requirements".

Banks' operating costs have also been heightened by sizeable **provisioning expenses**. The latter is a direct function of credit risk and the actual stock of **problem loans** which have been relatively high in Argentina due to a number of institutional factors and cyclical developments. With regard to institutional factors, the classical **information asymmetry** problem discussed

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[8](...continued)
offset their equity position in a bank with a liability position to the same bank or to banks owned by a related party, entailing a *de facto* reduction in capital adequacy standards (Rojas-Suarez and Weisbroad, 1995). In light of these difficulties in assessing banks' true net worth and systemic credit risk, it has been argued that reserve/liquidity requirements in developing and transition economies ought to be significantly higher than in developed countries (Fernandez and Guidotti, 1995).

[9]At the time, system averages hid significant shortfalls in capital requirements on the part of small private institutions and provincial government banks, whose fragility was brought into sharp relief by the deposit outflow of late 1994/early 1995.

[10]Prior to 1993, legal reserve requirements included banks' technical cash in vault. From March 1993, legal reserve requirements were lowered but banks' cash in vault was no longer allowed to be counted as part of the requirement. In 1995, in an effort to ease monetary conditions during the banking crisis, the authorities allowed banks to use up to 50 percent of their cash in vault to meet reserve requirements. This measure was abolished in February 1996, following the reflow of deposit into the banking system and end of the financial crisis. In order to keep the presentation consistent, the series plotted in Figure 11, adds banks' cash in vault to the legal reserve requirements throughout 1991–1997.

in the literature on banking (Jaffe and Russell, 1976; Mishkin, 1996) has been exacerbated in Argentina by the lack of a well-established nationwide credit rating system and generally loose accountancy standards, which make it even more difficult for banks to screen out "good" from "bad" borrowers (Cañonero, 1997; Vicens, 1997). At the same time, due to characteristics of the local legal system, it is not unusual for banks to face legal constraints to the enforcement of debts, and to the seizure and liquidation of the loan collateral (Corrigan, 1996). Both factors tend to increase borrowers' incentive to default which, *ceteris paribus*, fosters the incidence of problem loans. The latter have also been quite elastic to cycles in economic activity and interest rates, having declined markedly during the 1991–94 upswing and soared during the Tequila crisis in 1995, before declining again through late 1997 (Figure 5). As an inspection of Figures 1, 4 and 5 reveals, such fluctuations in problem loans and provisioning expenses have been clearly correlated with the level of intermediation spreads.

Market structure and competition among financial intermediaries are well-known factors believed to influence intermediation spreads. However, it has also been recognized that, because of the various offsetting forces at play, it is often difficult to establish the direction of the causality on theoretical grounds. On the one hand, limited competition and regional segmentation in domestic credit markets tend to hinder allocative efficiency, make it possible for X-inefficient firms to survive, and facilitate collusive behavior, enabling some to maximize profits by setting intermediation spreads above marginal costs.[11] On the other hand, it has been noted that if economies of scale and of diversification in the provision of banking services prevail, greater concentration may well lead to declining spreads through a reduction in operating costs of the banking system. Moreover, even if economies of scale in banking are relatively unimportant—as a number of studies have suggested (Berger et al., 1987; Dick, 1996; Hunter and Timme, 1995)—one could still expect a negative correlation between spreads, profitability and concentration under the so-called "efficiency-structure (or relative efficiency) hypothesis" (ESH): as market concentration is not a random event but, rather, the outcome of more efficient banks taking over or eliminating less efficient ones, a negative correlation between concentration and spreads should be expected over time.

In Argentina, no close correlation between intermediation spreads and traditional measures of market concentration is apparent. Figures 9 and 10 depict two well-known indicators of market concentration—the share of the 15 largest banks in total deposits and the "Herfindahl"

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[11]Such a positive relationship between concentration, intermediation margins and monopoly profits has been traditionally emphasized by the so-called "structure performance hypothesis" (SPH), a main source of theoretical support for anti-trust legislation in banking.

index.[12] Both show that banking concentration decreased somewhat between 1991 and 1994, but has increased considerably since. Thus, while evidence for the period 1991–94 is consistent with the traditional "structure performance hypothesis", the concomitant increase in concentration and the decline in spreads during 1996–97 lends support to the ESH. So, as in the case of other countries,[13] the empirical link between usual measures of banking sector concentration and intermediation spreads in Argentina is not straightforward, indicating that offsetting factors are indeed at play.

Finally, in an economy where banks are allowed to intermediate freely in domestic or foreign currency, but the probability of a devaluation is non-negligible, spreads in domestic and in foreign currency-denominated transactions are bound to be affected in different ways by the **exchange rate risk premium**. Figure 1 shows that peso-denominated spreads have been substantially higher than those denominated U.S. dollar throughout the period, and also that such a gap between the two spreads has moved over time. Two factors seem to account for the phenomena. First, because a change in exchange rates or in the U.S. dollar denominated interest rate usually have an immediate effect on the cost of liabilities,[14] while its effects the rate of return of asset come only with a lag (which is proportional to the maturity of the loan portfolio), a devaluation or a rise in the exchange rate risk premium can severely reduce banks' profitability in the short-run.[15] Banks will thus tend to hedge themselves against such

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[12]The Herfindahl index of X is calculated as:

$$H_x = (X_1^2 + X_2^2 + \ldots + X_n^2)/(X_1 + X_2 + \ldots + X_n)^2,$$

where n is the number of banks and X usually stands for a deposit or credit variable. It is straightforward to see that the index declines as new banks enter the market, and increases as the number of institutions decreases (or their share in total deposits or credit increases). The index collapses to unity in the pure monopoly case.

[13]For evidence on Canada and the U.S., see Solvin and Sushka (1983), Smirlock, (1985), Hannan (1991), Yu (1995), and Peristiani (1997).

[14]In a country with free capital mobility and a long history of capital flight such as Argentina, depositors will arbitrage freely between interest rate at home and abroad. This implies that banks which fail to raise interest rates on deposits in line with changes in exchange rate and default risk premia will face an immediate deposit outflow.

[15]This is analogous to what happens to banks' profitability when there is an exogenous change interest rates brought about by an unexpected change in monetary policy. For a discussion of the adjustment of banks' lending and deposit interest rates to changes in monetary policy in the U.S. and the UK, see Hancock (1985) and Heffernan (1997), respectively. Empirical evidence on the hypothesis that intermediation spreads are higher where the volatility of base

(continued...)

potential losses in their peso-denominated portfolio by raising intermediation spreads in domestic currency operations. Second, one would expect intermediation spreads to increase in line with the exchange rate risk premium because of the likely contractionary effects of a devaluation in the short-run. Particularly in countries where a fixed exchange rate has become a centerpiece of macroeconomic policy, a devaluation is bound to be associated with major crises, which will drive up the share of **problem loans** in banks' portfolios. To hedge against such a potential decline in interest revenues, banks will raise *ex-ante* spreads in both currencies; the resulting mark-up in interest rates will tend to be higher for those customers whose revenues are denominated in domestic currency (nontradable sector), and for noncollateralized loans. As these customers are precisely the ones to face more restricted access to foreign borrowing and are more inclined to borrow in pesos (as their revenues are peso-denominated), domestic banks can exert some monopoly power in this segment of the market, charging a higher interest rate on peso loans. This close correlation between exchange rate risk premia, problem loans and spreads in the two currencies was clearly observed during the "Tequila" crisis. As the exchange rate risk premium rose sharply and the economy shrank by over 4 percent in 1995, problem loans peaked and bank profitability plunged (Figure 8). As shown in Figure 1, intermediation spreads in both currency rose sharply but the more so for transactions denominated in domestic currency.

In sum, X-inefficiencies, low degree of monetization of the economy, characteristics of the country's payments system, tight prudential regulations, loan default and exchange rate risk, all appear to have an important bearing on the relatively high operating costs of the financial sector in Argentina. Notwithstanding the impressive improvements on all these fronts since 1991–leading to a decline in the aggregate ratio of **operating expenses to loans** (Figure 4)–unitary costs for the consolidated banking system in Argentine remain high. This appears to be the main factor behind the wide differential between lending interest rates in Argentina and in industrial countries, as the empirical estimation of the model below will show in further detail.

III. BENCHMARK MODEL

This section develops a model of bank portfolio behavior in a dual currency economy which formalizes the interplay of the distinct variables discussed above so as to try and assess their individual impact on the cost of financial intermediation in Argentina.[16] The model constitutes a simplified version of the framework developed in Catão and Terrones (1998), which builds on previous work by Baltensperger (1980), Santonero (1984), and Yu (1995), extending it to the case of a two-currency bank firm which operates in an imperfectly competitive credit

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[15](...continued)
interest rates is greater, is provided in Ho and Saunders (1981).

[16]In this paper, a dual currency economy is defined as one in which banks carry freely their intermediation operations in domestic currency (pesos)as well as in foreign currency (U.S. dollars).

market, faces both exchange rate and default risk, and is subject to a set of prudential restrictions imposed by an outside regulator. The model is set in a partial equilibrium framework and its main objectives are to show how interest rate spreads are affected by market structure, reserve and capital requirements, as well as by key macroeconomic parameters such as devaluation risk and economic growth.

Let the economy consist of n banking firms, indexed i = 1, 2, ..., n, which freely intermediate resources in domestic and foreign currencies. Loans in domestic and foreign currencies are denoted by L_i and L_i^* and the total amount of loans are denoted by $L = \sum L_i$ and $L^* = \sum L_i^*$. Although we assume perfect capital mobility, there is segmentation in the credit market owing to the factors already discussed in Section II—notably, to the type of activity (tradable/non-tradable) the borrower is involved, and/or to information asymmetries and poor accounting practices that prevent access to the international capital markets. Thus, the respective inverse demand for loans in domestic and foreign currencies are given by:

$$r_L = r_L (L) \quad \textit{where} \quad \frac{\partial r_L}{\partial L} < 0$$

$$r^*_L = r_L (L^*) \quad \textit{where} \quad \frac{\partial r_L^*}{\partial L^*} < 0$$

and where the inverse demand functions are assumed to be linear. On the deposit side, each banking firm is assumed to face a perfectly competitive market, so that interest rates on deposits are parametrically set.[17]

At any given moment of time, a bank i holds as assets loans in domestic (L_i) and foreign currency (L_i^*), and reserves in domestic (R_i) and foreign (R_i^*) currency, and finances itself with deposits in domestic (D_i) and foreign (D_i^*) currency, and the bank's capital and reserves (K_i). Thus the bank's balance sheet is as follows:

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[17]As previously noted, in a country with a fixed exchange rate regime under free capital mobility, such as Argentina, interest rates on foreign currency denominated domestic deposits gravitate around the respective international rate. The interest rate on deposits denominated in domestic currency will be then determined by the U.S. dollar rate plus the devaluation risk and the marginal cost differential between capturing one unit of domestic denominated deposits relative to foreign currency deposits. A formal derivation of this arbitrage condition is provided in the appendix.

Bank i balance sheet

Assets	Liabilities
L_i	D_i
L_i^*	D_i^*
R_i	K_i
R_i^*	

The bank seeks to maximize expected profits denominated in the relevant foreign currency (U.S. dollars in the case of Argentina), arising from its loan operations, which are financed with deposits and own capital, and are subject to a set of reserve requirements and capital constraints imposed by prudential regulations, i.e.,

$$\begin{aligned}\textbf{Max } E(\Pi) = {} & \alpha\,[(1+r_L(L))/((1+E(\Delta e_t))-1]\; e_t\, L_i + \alpha^*\, r_L^*(L^*)\, L_i^* + \\ & [(1+r_E)/(1+E(\Delta e_t))-1]\; e_t\, R_i + r_E^*\, R_i^* - [(1+r_D)/(1+E(\Delta e))-1]e_t D_i - r_D^*\, D_i^* - \\ & \tau\,(e_t L_i + L_i^* + e_t R_i + R_i^*) - C(e_t D_i, D_i^*, e_t L_i, L_i^*; 1-\alpha, 1-\alpha^*)\end{aligned} \tag{1}$$

such that

$$L_i/e_t + L_i^* + R_i/e_t + R_i^* = D_i/e_t + D_i^* + K_i \tag{2}$$

$$\varepsilon\, D_i \le R_i \tag{3}$$

$$\varepsilon^* D_i^* \le R_i^* \tag{4}$$

and

$$\kappa(\alpha)\, L_i/e_t + \kappa(\alpha^*)\, L_i^* \le K_i \tag{5}$$

where r_L, r_L^*, r_D, r_D^* are the lending and deposit interest rates in domestic and foreign currency; ε, ε^* are the reserve requirements remunerated at interest rates r_E and r_E^*; e is the exchange rate (defined as the domestic price of a unit of foreign currency) and $\Delta e = e_{t+1}/e_{t-1}-1$ is the rate of depreciation of the currency; α, α^* are the (expected) share of performing loans in total loans;[18] $\kappa(\alpha)$, $\kappa(\alpha^*)$ are the capital adequacy ratios (denominated in foreign

[18]These parameters are expected to be mainly determined by macroeconomic variables

(continued...)

currency);[19] and τ the average tax rate on assets. In line with actual developments, we assume that $r_D > r_E$ and $r_D^* > r_E^*$.

$C(L, L^*, D, D^*; 1-\alpha, 1-\alpha^*)$ is an operating cost function which depends on the bank's intermediation activities.[20] One of the parameters of this cost function is the quality of the loan portfolio; thus, for a given level of intermediation activities, operating costs will raise in tandem with the share of nonperforming loans in the bank's portfolio.

Equation (2) simply represents the balance sheet identity, while equations (3) and (4) spell out the reserve requirement regulations on domestic and foreign currency deposits. It is worth noting that the reserve requirements could differ by deposit denomination and that the denomination of these reserves are the same as that of the deposits. Equation (5) is the capital adequacy requirement which is related to the loan portfolio quality in both currencies. Thus, it is assumed that, as is the case in most countries, reserve requirements are not subject to any capital requirement.

In general, the lending decisions of a given bank i are not independent of the lending decisions of the rest of banks in the industry. Define the rest of the banking industry total lending as

$$\Lambda_i = L - L_i = \sum_{j \neq i} L_j, \tag{6}$$

and

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[18](...continued)
exogenous to the model, such as the rate of economic growth and changes in real interest rate (brought about, e.g., by devaluation expectations, changes in country risk premia, and domestic inflation or deflation).

[19]In general the capital adequacy ratios are an inverse function of the quality of the loan portfolio of the bank. It is assumed that the higher the quality of the loan portfolio is, the lower the capital adequacy ratios are.

[20]It is assumed, without loss of generality, that the operating cost function has the following characteristics:

$$\frac{\partial C}{\partial L_i} > 0, \quad \frac{\partial^2 C}{\partial L_i^2} > 0, \quad \frac{\partial C}{\partial L_i^*} > 0, \quad \frac{\partial C^2}{\partial L_i^{*2}} > 0,$$

$$\frac{\partial C}{\partial D_i} > 0, \quad \frac{\partial^2 C}{\partial D_i^2} > 0, \quad \frac{\partial C}{\partial D_i^*} > 0, \quad \frac{\partial C^2}{\partial D_i^{*2}} > 0,$$

$$\frac{\partial^2 C}{\partial L_i \partial L_i^*} = 0, \quad \frac{\partial^2 C}{\partial D_i \partial D_i^*} = 0, \quad \frac{\partial^2 C}{\partial L_i \partial D_i} > 0, \quad \frac{\partial^2 C}{\partial L_i \partial D_i^*} = 0, \quad \frac{\partial^2 C}{\partial L_i^* \partial D_i} = 0, \quad \frac{\partial^2 C}{\partial L_i^* \partial D_i^*} > 0$$

$$\Lambda_i^* = L^* - L_i^* = \sum_{j \neq i} L_j^* \tag{7}$$

Following Dixit (1986), assume each bank has "conjectural variations" that relate its levels of lending with that of the rest of the banking industry and have the following characteristics:

$$\frac{\partial \Lambda_i}{\partial L_i} = \psi (L_i, \Lambda_i), \qquad \frac{\partial \Lambda_i^*}{\partial L_i^*} = \psi^* (L_i^*, \Lambda_i^*) \tag{8}$$

It can be shown that under **perfect competition** $\psi(L_i, \Lambda_i) = \psi^*(L_i^*, \Lambda_i^*) = -1$, under **competitive collusion** $\psi(L_i, \Lambda_i) = \Lambda_i / L_i$ and $\psi^*(L_i^*, \Lambda_i^*) = \Lambda_i^* / L_i^*$—which in the particular case in which the banking firms are identical become constant and equal to n-1, and under **competitive oligopoly** of the Cournot type, $\psi(L_i, \Lambda_i) = \psi^*(L_i^*, \Lambda_i^*) = 0$.

As $L_i, L_i^*, R_i, R_i^*, D_i, D_i^*, K_i > 0$ and assuming that reserve requirements and the capital adequacy constraint are binding, the first-order conditions of the maximization problem laid out in equations (1) to (5) yield the following interest spreads and arbitrage conditions:[21]

a. Intermediation spread in domestic currency

$$r_L(L) - r_D = \frac{1}{[1 - \kappa(\alpha)][1 + \delta]} \left[(1 - \kappa(\alpha))(1 + \delta) - \alpha + \frac{\alpha S_i}{\eta} (1 + \psi) \right] r_L(L) + \frac{\varepsilon}{(1 + \delta)(1 - \varepsilon)} (r_D - r_E) - \frac{\delta [r_d(1 - \varepsilon) - 1]}{(1 + \delta)(1 - \varepsilon)} + \left[\frac{1}{1 - \kappa(\alpha)} + \frac{\varepsilon}{(1 - \varepsilon)} \right] \tau + \frac{1}{1 - \kappa(\alpha)} \frac{\partial C}{\partial L_i} + \frac{1}{1 - \varepsilon} \frac{\partial C}{\partial D_i} \tag{9}$$

where,

δ = the expected rate of devaluation, $E(\Delta e)$;

$S_i = L_i/L$ = bank's i market share in total lending in domestic currency; and

[21]These relations are obtained by substituting equation (8) in the expressions for the derivative of the Lagrangian in relation to L_i and L_i^*.

$$\eta = \frac{-\partial L/L}{\partial r_L/r_L} = \text{price elasticity of demand for loans in domestic currency.}$$

This expression states that, in equilibrium, the interest rate spread in domestic currency is a function of:

a) The quality of the loan portfolio in domestic currency, as well as capital and reserve requirements.
b) The bank's market power in the domestic currency credit market.[22]
c) The financial cost of intermediating resources in domestic currency.
d) The tax rate on the bank's assets;
e) The marginal operating costs of intermediating an additional unit in domestic currency; and
f) The expected rate of devaluation (or revaluation) of the domestic currency.

In the particular case where devaluation expectations are negligible, i.e., $\delta = 0$, equation (9) collapses to:

$$r_L(L) - r_D = \frac{1}{1 - \kappa(\alpha)} \left[(1 - \kappa(\alpha) - \alpha) + \frac{\alpha S_i}{\eta} (1 + \psi) \right] r_L(L) + \frac{\varepsilon}{(1 - \varepsilon)} (r_D - r_E) + \left[\frac{1}{1 - \kappa(\alpha)} + \frac{\varepsilon}{(1 - \varepsilon)} \right] \tau + \frac{1}{1 - \kappa(\alpha)} \frac{\partial C}{\partial L_i} + \frac{1}{1 - \varepsilon} \frac{\partial C}{\partial D_i} \qquad (9')$$

[22]In the perfect competition case, i.e. when $\psi = -1$, this term drops out.

b. Intermediation spread in foreign currency:

$$r_L^*(L^*) - r_D^* = \frac{1}{1 - \kappa^*(\alpha^*)} \left[(1 - \kappa^*(\alpha^*) - \alpha^*) + \frac{\alpha^* S_i^*}{\eta^*} (1 + \psi^*) \right] r_L^*(L^*) + \frac{\varepsilon^*}{(1 - \varepsilon^*)} (r_D^* - r_E^*) + \left[\frac{1}{1 - \kappa^*(\alpha^*)} + \frac{\varepsilon^*}{(1 - \varepsilon^*)} \right] \tau + \frac{1}{1 - \kappa^*(\alpha^*)} \frac{\partial C}{\partial L_i^*} + \frac{1}{1 - \varepsilon^*} \frac{\partial C}{\partial D_i^*} \quad (10)$$

where,

$S_i^* = L_i^*/L =$ bank's I market share in total lending in foreign currency; and

$\eta^* = \frac{-\partial L^*/L^*}{\partial r_L^*/r_L^*} =$ price elasticity of demand for loans in foreign currency.

Similar to the previous case, the interest rate spread in foreign currency is a function of:

a) The quality of the loan portfolio in foreign currency, as well as capital and reserve requirements;
b) The bank's market power in the foreign currency credit market;
c) The financial cost of intermediating resources in foreign currency;
d) The tax rate on the bank's assets; and
e) The marginal operating costs of intermediating an additional unit in foreign currency.

c. Arbitrage condition for the lending rates

In addition to the average spreads in domestic and foreign currency denominated transactions, solution to the model also yields the following equilibrium condition for peso-US$ spreads in bank loans:

$$r_L(L) - r_L^*(L^*) = \frac{1}{1 - \kappa(\alpha)}\left[(1 - \kappa(\alpha) - \frac{\alpha}{(1 + \delta)} + \frac{\alpha S_i}{\eta} (1 + \psi)\right] r_L(L)$$
$$- \frac{1}{1 - \kappa(\alpha^*)}\left[(1 - \kappa(\alpha^*) - \alpha^*) + \frac{\alpha^* S_i^*}{\eta^*}(1 + \psi^*)\right] r_L^*(L^*) + \frac{\alpha\ \delta}{(1 + \delta)(1 - \kappa(\alpha))} \qquad (11)$$
$$+ \left[\frac{1}{1 - \kappa(\alpha)} - \frac{1}{1 - \kappa(\alpha^*)}\right]\tau + \frac{1}{1 - \kappa(\alpha)}\frac{\partial C}{\partial L_i} - \frac{1}{1 - \kappa(\alpha^*)}\frac{\partial C}{\partial D_i^*}$$

This expression states that, in equilibrium, the bank will provide loans in domestic and foreign denomination so that the net marginal revenue of each type of loan become equal. Or in other terms, the spread between lending rates is a function of:

a) The quality of the loan portfolio in domestic and foreign currency and associated capital reserve requirements;
b) The market power in each of the loan markets;
c) The tax rate on the bank's asset;
d) The marginal operating costs of providing the loans in both currencies; and
e) The expected rate of devaluation (or revaluation) of the domestic currency.

IV. Empirical Estimation

Empirical estimation of the model above can be carried out in two different ways. On the one hand, one can follow the standard approach in most of the literature and run a least square regression of spreads on a set of independent explanatory variables. This approach has the advantage of trying to capture a stable relationship between spreads and their potential determinants (if any), while also allowing us to infer the respective elasticities. Its main short coming, however, is that as most of the relationships underlying the theoretical model are highly nonlinear, a simplification of the model's functional form is required prior to its econometric estimation. This has led a number of authors to estimate linear regressions using one- or two-stage least squares (e.g., Ho and Saunders, 1981; Hannan, 1991; Yu, 1995; Broda and Kaufman, 1996), ignoring the functional forms postulated by theory.

An alternative approach to empirical testing consists of calibrating the model on the basis of the actual values of its parameters and then check whether the respective predictions match actual outcomes. This approach has the advantage of preserving the model's functional form but, on the other hand, makes it difficult to disentangle the likely effects of an exogenous change in a single explanatory variable on spreads.

In light of these trade-offs, we have pursued both strategies. Consolidated banking sector data was readily available for four of the seven variables of the model—namely, the capital adequacy ratio (itself a function of the stock of problem loans, 1-α), the average reserve

requirement ratio over deposits (ϵ), the average tax ratio (τ) and the share of problem loans in total bank lending ("proloan").[23] However, some proxies had to be derived for δ, Ψ, $\Delta C/\Delta L$ and $\Delta C/\Delta D$.[24] In a country with a fixed exchange rate such as Argentina, the scenario faced by bank i regarding exchange rate risk can be described as:

$$e_t = \begin{cases} 1+\Delta e, \text{ with probability } p; \\ 1, \text{ with probability } (1-p) \end{cases}$$

where p is the probability of a devaluation. Thus, the expected value of an exchange rate jump (δ) is given by $p\,E(\Delta e)$, an stochastic variable which can be proxied by one of the standard measures of exchange rate risk, such as the yield differential between the same sovereign debt instrument denominated in pesos and in U.S. dollars.[25]

As noted earlier, the parameter $(1+\Psi)$ in equations (9) to (11) aims to capture the effect of market structure on spreads. Under perfect competition this term will vanish, and so the price elasticity of the demand for loans (η) will have no effect on spreads. In the Argentine context, both the regional and informational segmentation of credit markets as well as the substantial discrepancies in the size of financial institutions, detract any realism from the perfect competition assumption. Instead, one would expect Ψ to lie in the (-1, 0) range as a more realistic scenario. Moreover, as Figures 9 and 10 indicate, the degree of concentration of the banking industry in Argentina has changed over time and so cannot be taken as a fixed parameter. In light of these considerations, and following the practice adopted by other authors,[26] we have proxied the market structure variable $(1+\Psi)$ by the Herfindahl index. The marginal cost of operating expenses ($\Delta C/\Delta L$ and $\Delta C/\Delta D$) is estimated as follows. We assume that the cost function embodied in the model has a translog functional form on the stock of loans and the share of the non-performing loans in banks' total portfolio only, since the level of deposits is itself a function of the desired level of lending. Estimating it by OLS provides us with the elasticities of operational costs with respect to the stock of loans in foreign and in domestic currency. The respective marginal costs are simply the product of the estimated elasticities by the average cost ratios C/L and C*/L*, on which raw data is readily available. Finally, in line with the discussion of Section III, we assume that the expected share of

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[23]While the model's set up laid out in Section III is more suitable to panel data estimation, individual bank data proved difficult to obtain from official sources. Thus, the empirical evidence presented in this paper is limited to aggregate data.

[24]Since we are working with aggregate data, the share of bank i loan in total loans (the variable S_i in the model) equals one and so drops out of the model.

[25]The instrument used here to measure such yield differential is the debt consolidation bond ("BOCON"), which is relatively liquid and for which a long series on secondary market prices is available.

[26]See, e.g., Hannan (1991).

problem loans in period t will be a function of the stock of non-performing loans at t-1 as well as the likelihood of an exchange rate crisis at period t, measured by the variable p $E(\Delta e)$, i.e., $1-\alpha_t = g\ (1-\alpha_{t-1},\ p\ E(\Delta e_t))$. The share of performing loans (α) at period t-1, when the representative bank is solving its optimization problem, is given and is itself a function of a host of variables discussed earlier on—notably, cyclical developments, asymmetric information, and structural characteristics of the country's legal framework governing financial transactions. The proposed specification for the variable $1-\alpha_t$ thus implies that exchange rate risk will affect both domestic and foreign currency spreads. That is, the variable $p\ E(\Delta e_t)$ will have to be included in the estimation of equation (10) as well.

Table 2 reports the results of the OLS estimation of a linearized version of equations (9) and (10), i.e., it regresses spreads one the following set of explanatory variables:

$$r_L - r_D = f\ [\tau;\ \varepsilon(r_d - r_e),\ \varepsilon^*(r_d^* - r_e^*);\ \Delta c/\Delta l, \Delta c/\Delta l^*;\ 1-\alpha,\ 1-\alpha^*;\ E(\Delta e);\ 1+\Psi]$$

where "f' is a linear function, and the first derivatives of the dependent variable with respect to each of the explanatory variable are all expected to yield a positive sign, with the exception of market concentration whose sign can also take a negative value for the reasons discussed in Section II. Using the proxy variables discussed above and entering the tax ratio and the Herfindahl index and with a one-period lag,[27] the equation on the average of peso and U.S. dollar spreads yielded coefficients with the signs postulated by theory and which are statistically significant at 5 percent, with the exception of the Herfindahl index ($1+\Psi$) and the tax ratio.[28] A similar picture emerged from the estimates for the U.S. dollar spread equation. The low t-ratio yielded by the tax variable in both equations is not surprising since average taxes on banks have been relatively low in level and varied within a relatively narrow margin (Figure 6), while the lack of statistical significance of the herfindahl index is consistent with the ambiguous impact market concentration can have on spreads, as discussed in Section II.

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[27]The rationale for lagging the Herfindahl coefficient is that concentration usually affects spreads with a lag. Also, in the estimation we have experimented with entering the problem loan variable lagged of one month both to avoid potential simultaneity biases and to take account of the fact that banks, as discussed above, are assumed to take their provisioning and risk-adjusted decisions on setting period t spreads, based on actual default outcomes in period t-1. The respective estimates were virtually unchanged regardless whether we lagged or not the problem loan variable. Likewise, the use of current or lagged values for the tax variable was not critical: in both cases the tax/loan ratio yielded t-ratios well below the standard levels of statistical significance.

[28]Estimation was limited to the post mid–1993 period due to a statistical break in the available series on interest rates. See Central Bank of Argentina, Boletin Estadistico, several issues.

For the peso spread equation, however, the Herfindahl index was highly significant statistically, supporting the hypothesis that the structure of the peso credit market is quite distinct from that of the U.S. dollar-denominated market. That is, spreads and hence interest rates in pesos appear to be positively influenced by market concentration, reflecting the fact that most peso borrowers cannot arbitrage between domestic and foreign sources of funds, thus becoming subject to the monopoly power of local banks. This contrasts with the situation of the typical "U.S. dollar" borrower, usually epitomized by a large firm producing tradable goods, with a significant part of its revenues denominated in U.S. dollars and reasonably good accounting standards, which enable it to have a wide choice of lenders, domestically as well as abroad; or by a high income household which holds part of its wealth in U.S. dollar-denominated assets and can often pledge a standard collateral, such as real state or automobile, against their loans. For these reasons, interbank competition for the typical U.S. dollar borrower is bound to be considerably fiercer and the scope for banks to exert monopoly power over the client is therefore much reduced.

Turning to the magnitude of the estimated coefficients, the OLS results indicate that the spreads in pesos and in U.S. dollars transactions are particularly responsive to operating costs and problem loans, followed by exchange rate risk and the cost of liquidity requirements. According to these results, a 1 percentage point decrease in operating costs of the banking system appear would lead to a drop in the average spread of 0.6 to 0.8 percentage point, while a 1 percentage point increase in the share of problem loans in banks' portfolio would push up the average spread by some 0.3 to 0.5 percentage point. At the other extreme, an increase in 1 percentage point in reserve requirements would increase spreads by less than 0.05 percentage point,[29] reflecting the fact that banks' reserves at the Central Bank are remunerated at interest rates close to that of time deposits. The explanatory power of the regressions is very good—as borne out by the R^2 statistics—particularly considering that we are dealing with monthly data and with a period characterized by large shocks to the banking sector. There is no evidence of first or second order residual autocorrelation and the residuals passed the standard Dickey-Fuller tests for nonstationarity.

Figures 12a and 12b plot the actual values of intermediation spreads and those the model when calibrated as discussed above, assuming two scenarios for the interest elasticity of demand for loans (the η parameter) around the 0.66 estimate underlying previous work on the determinants of supply and demand for bank credit in Argentina (Catão, 1997). For both η=0.5 and η=0.75, the model's simulation is slightly more volatile than actual spreads but the predicted values capture very well the main trends of the data generation process—notably, the decline in spreads from mid–1993 through the eve of the Tequila crisis in late 1994,

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[29]This was calculated by first differencing the variable $\varepsilon(r_d-r_e)$, which yields $\Delta\varepsilon(r_d-r_e) + \varepsilon\,\Delta(r_d-r_e) + \Delta\varepsilon\,\Delta(r_d-r_e)$. If neither the rate of remuneration on reserve requirements nor the interest rate on deposits change, the last two terms of the latter expression will vanish. So, the estimated impact of a 1 percentage point increase in ε on spreads can be obtained by multiplying 0.01 by the estimated coefficient in the regressions times (r_d-r_e), the latter being expressed in percentage terms.

followed by a further decline in spreads once the peak of the crisis (March–April 1995). The scenario with a lower elasticity (0.5) tracks very closely actual developments through late 1995 but since then tends to overestimate the actual magnitude of spreads by some 1/2 to 1 percentage point. This gap vanishes, however, under the higher elasticity assumption, as shown in Figure 12.b. The fact that the higher elasticity case seems to fit better post–1995 developments is, in fact, hardly surprising, for it is well known that the interest rate elasticity of credit demand elasticity does tend to rise in the wake of financial crises. In any event, both model-based simulations track actual developments remarkably close.

V. Conclusions

This paper has sought to explain two main stylized facts about banking spreads in Argentina. First, why have average intermediation spreads declined slowly despite the introduction of a CBA and the far-reaching financial sector reforms since 1991? Second, why have spreads been substantially higher for peso-denominated than for U.S. dollar-denominated transactions, despite the continuing peg of the peso to the U.S. dollar for over seven years now, and that agents are allowed to intermediate freely in either currency?

This paper has argued that the persistence of high intermediation spreads in Argentina for the average of peso and U.S. dollar transactions results mainly from high administrative costs and provisioning expenses associated with credit risk and the sizable stock of problem loans in the economy, all of which remain well above OECD levels. Tight prudential requirements and exchange rate risk have also played a role, but to a much lesser extent.

Market concentration was shown to be another significant variable explaining spreads but only in the peso segment of the credit market. This result is consistent with the hypothesis of a market segmentation according to the currency denomination of bank loans—a phenomenon also observed in other countries which have embarked upon a dual currency kind of monetary arrangement (Rodríguez, 1994; Segura, 1995). Thus, as in the case of other dual currencies economies, the higher spread on local currency transactions in Argentina does **not** solely reflect devaluation risk; it also reflects the fact that local banks exercise some degree of monopoly power on non-tradable producers and households which cannot access international capital markets. Yet, limited access to international finance and devaluation risk alone cannot be the only reasons for the wide differential between peso and U.S. dollar spreads. Even under restricted foreign competition, one would expect that greater competition among domestic banks alone would tend to arbitrage part of this differential away. There is persuasive evidence, however, that low dissemination of information on the credit history of individuals and enterprises in Argentina has limited competition even among banks operating in the same region in the country (Cañonero, 1997; Vicens, 1997). As a result, firms and households that cannot borrow internationally and which are unable to pledge a standard collateral, often face a rather restricted choice of lenders and, thus, much higher interest rates.

A number of key policy implications follow. First, insofar as intermediation spreads are very sensitive to problem loans and the latter are mostly a function of economic growth and the level of interest rates, macroeconomic policies which lead to sustainable growth and a reduction in exchange rate and default risk—such as fiscal consolidation and the monetary discipline entailed by the existing currency board arrangement—are bound to reduce domestic banking spreads over time.

Second, structural policies and prudential regulations aiming at eliminating the market segmentation between peso and U.S.-dollar credit markets can be highly effective in reducing spreads. Important steps have already been taken in this area in the wake of the 1995 banking crisis. These include the creation of a credit information bureau at the Central Bank gathering information on borrowers of the financial system—so as to help banks discriminate between solvent and insolvent clients—as well as a host of regulations to force banks to disseminate information on their performance, so as to foster competition for "good" costumers amongst financial institutions.

Third, this paper has shown that both peso and U.S. dollar denominated spreads have been heightened by banks' administrative costs. It is well known that the latter varies widely across different groups of banks in Argentina. As long as there are a number of public and small private banks operating with substantially higher unitary costs, further declines in intermediation spreads are bound to depend on the speed of the consolidation process. Institutional arrangements which facilitate take overs and the orderly liquidation of less efficient institutions could, therefore, be highly instrumental in reducing aggregate lending rates.

Finally, monetary developments since the 1995 banking crisis suggest that the policy of keeping tight prudential regulations on banks and the unequivocal commitment to the currency board arrangement were effective in shoring up confidence in the domestic financial system, laying the basis for further declines in spreads. Private sector deposits have risen by over 20 percent a year, markedly increasing the monetization of the economy. Insofar as higher monetization lowers banks' average costs for the reasons discussed in Section II, one. should expect this monetization trend to induce further declines in banking spreads. Adherence to the "rules of the game" entailed by the CBA has also been instrumental in attracting foreign banks into Argentina. Should the recent trend toward greater internationalization of the domestic financial system continue, its impact on operating efficiency and competition in credit markets will tend to lower spreads over the medium-term.

ARBITRAGE CONDITION FOR INTEREST RATES IN DOMESTIC AND FOREIGN CURRENCY DEPOSITS

In addition to the arbitrage condition between lending rates in pesos and in U.S. dollars (Equation 11), the model also allows us to derive the equilibrium condition between peso- and U.S. dollar-denominated interest rates on bank deposits. This is given by the following equation:

Spread between domestic and foreign currency deposits:

$$r_D - r_D^* = \frac{(1+\delta)}{(1-\varepsilon^*)}\frac{\partial C}{\partial D_i^*} - \frac{(1+\delta)}{(1-\varepsilon)}\frac{\partial C}{\partial D_i} + \frac{\varepsilon^*}{1-\varepsilon^*}[r_D(1+\delta/\varepsilon^*)] - r_E^*(1+\delta)] - \frac{\varepsilon}{1-\varepsilon}[r_D - (r_E - \delta)] + \left(\frac{\varepsilon^*(1+\delta)}{1-\varepsilon^*} - \frac{\varepsilon(1+\delta)}{1-\varepsilon}\right)\tau \quad (12)$$

This expression states that, in equilibrium, and given that deposits in different currency denomination are substitutes from the bank's stand point, the interest rate spread between these deposits is a function of:

a) The difference of marginal costs of obtaining these deposits;
b) The difference between the deposit interest rates and the remuneration to reserve requirements;
c) The tax rate on the bank's assets;
d) The reserve requirement rates;[30]
e) Devaluation expectations.

Since under a currency board with free capital mobility, the U.S.-dollar denominated deposit rate will converge to the parametric "world" interest rate, equation (12) yields the equilibrium interest rate paid by local banks on peso-denominated deposits.

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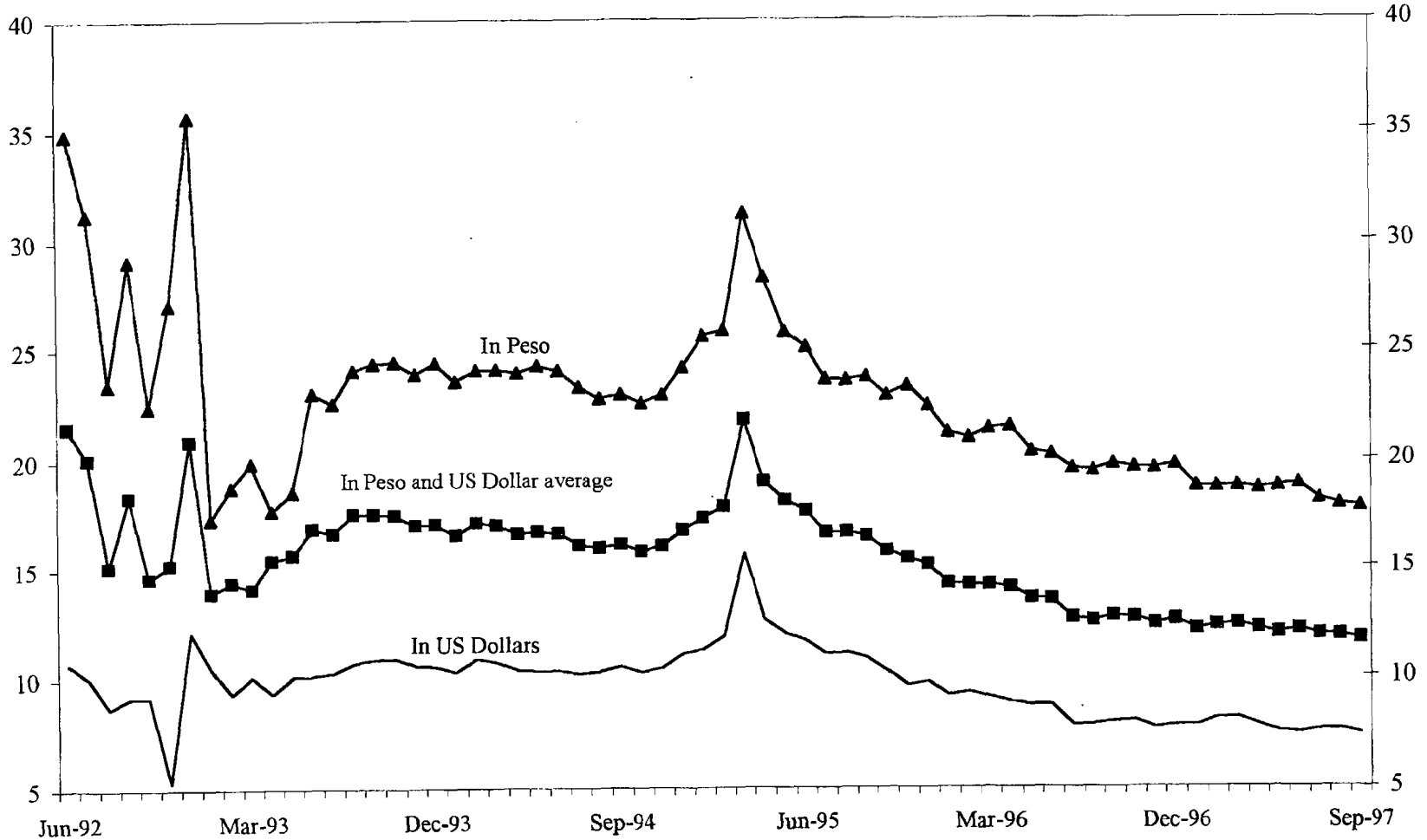
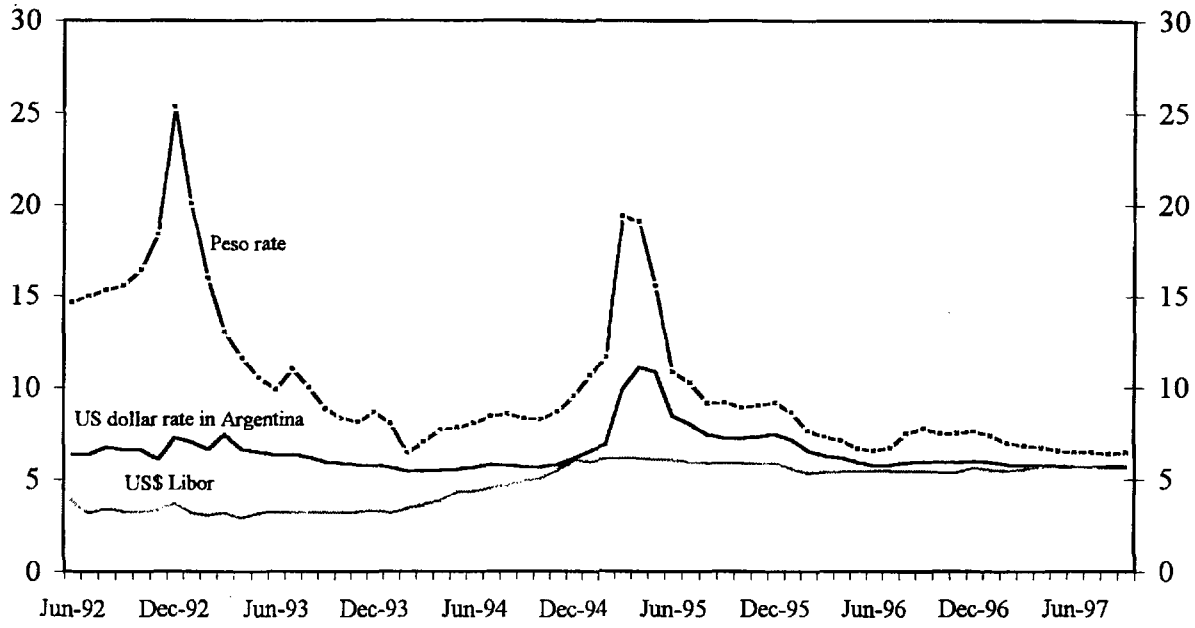
[30]In the particular case in which the reserve requirements are equal across currencies, i.e. $\varepsilon = \varepsilon^*$, the asset tax rate drops out.

Figure 1. Argentina: Intermediation Spreads of the Banking Sector
(in percent)



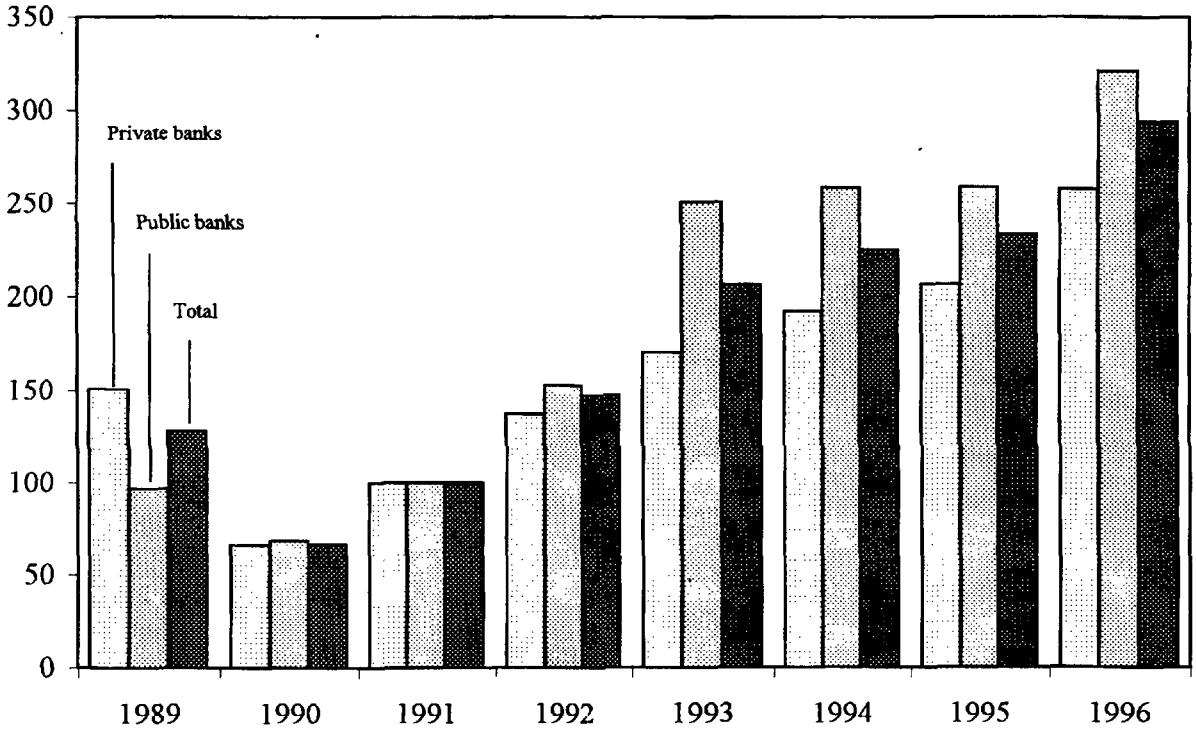
Sources: Central Bank of Argentina; and Fund Staff estimates.

Figure 2. Argentina: Interest Rate on 30-day Term Deposits and US$ Libor
(in percent per annum)



Sources: Central Bank of Argentina; and Fund Staff estimates.

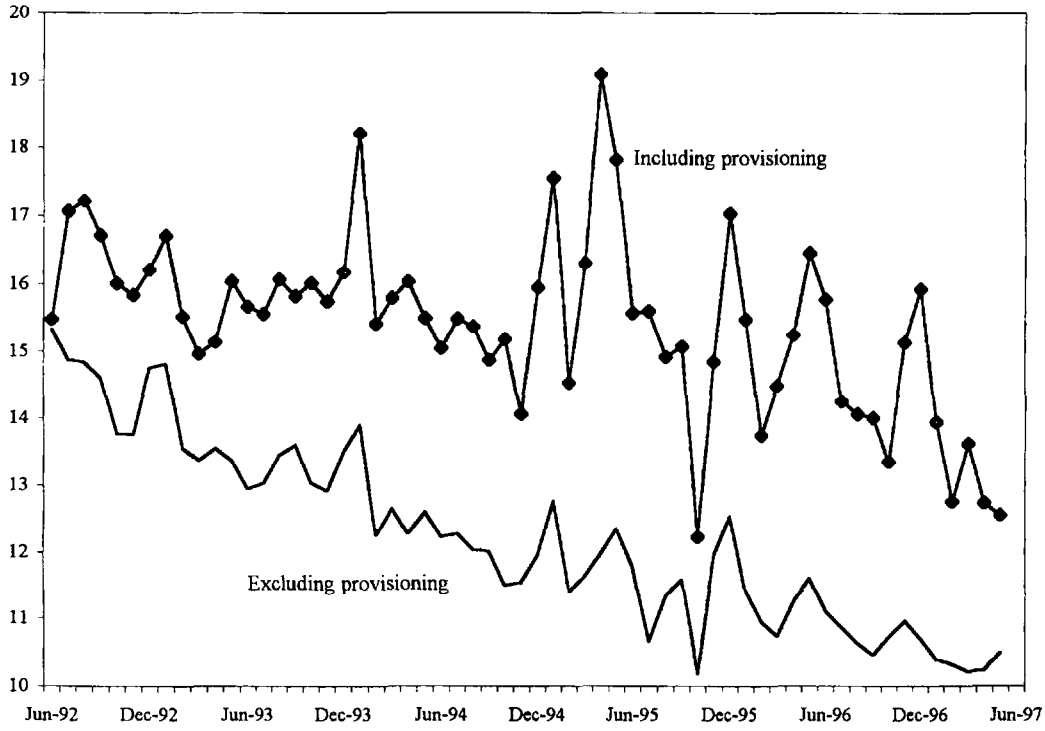
Figure 3. Argentina: Deposits by Employee in Real Terms[1]
(1991=100)



Sources: Central Bank of Argentina; and Fund Staff estimates.

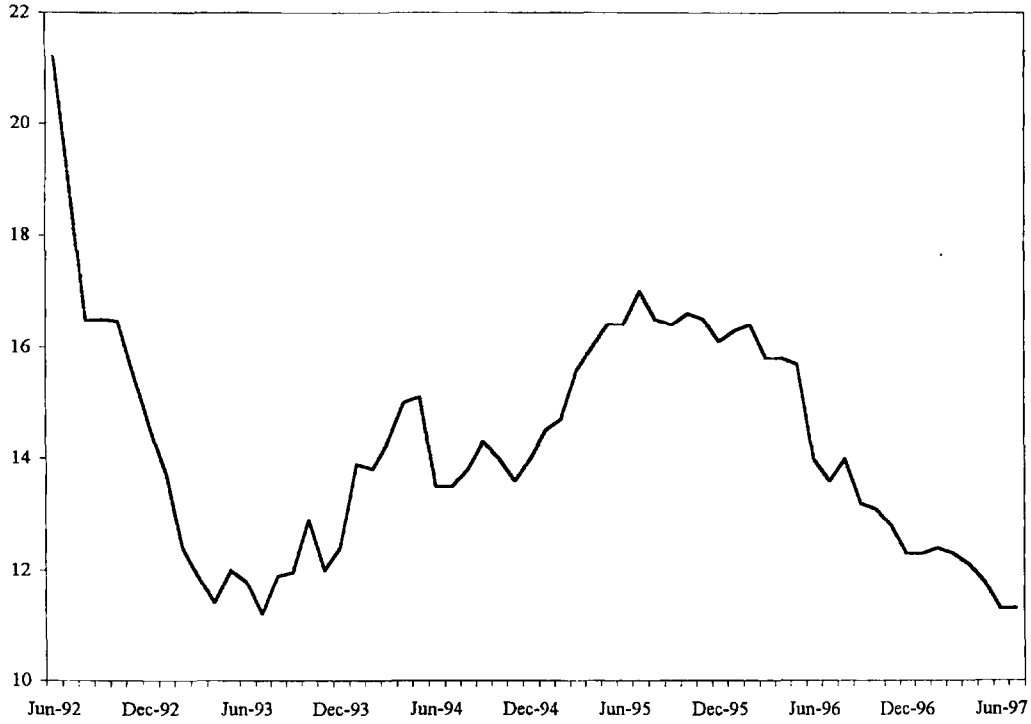
[1] Data refer to end-of-period balances.

Figure 4. Argentina: Operational Expenses of the Banking Sector
(in percent of total loans)



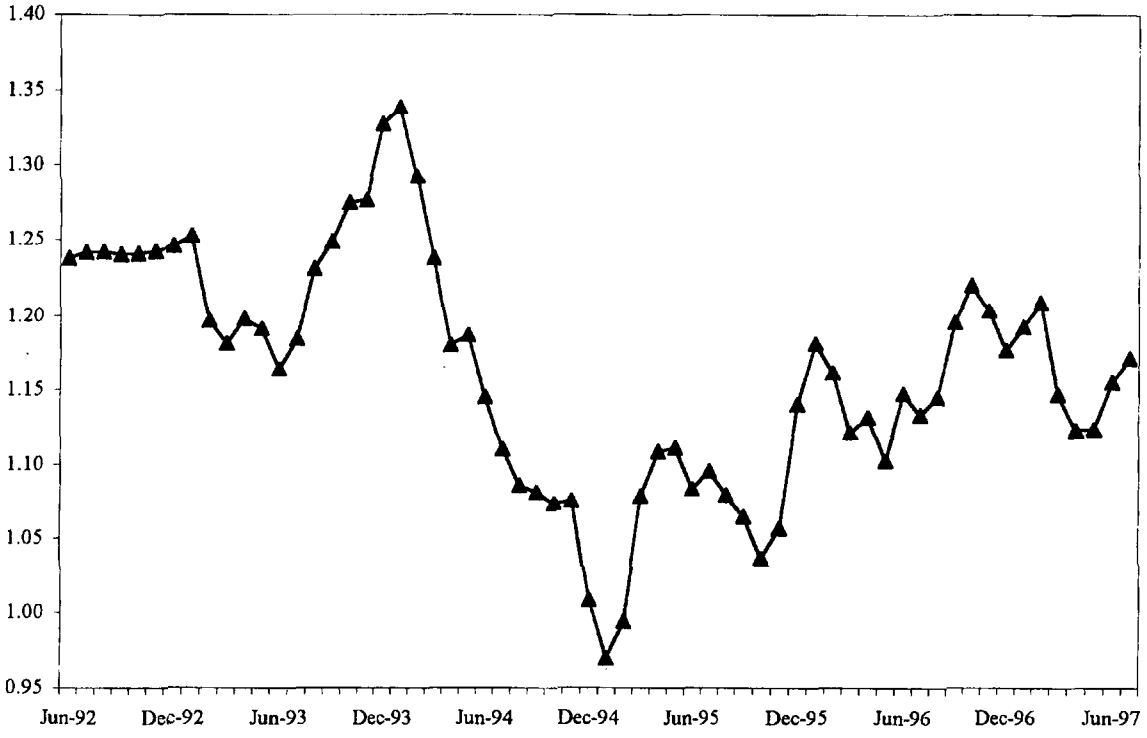
Sources: Central Bank of Argentina; and Fund Staff estimates.

Figure 5. Argentina: Problem Loans of the Banking Sector
(in percent of total loans)



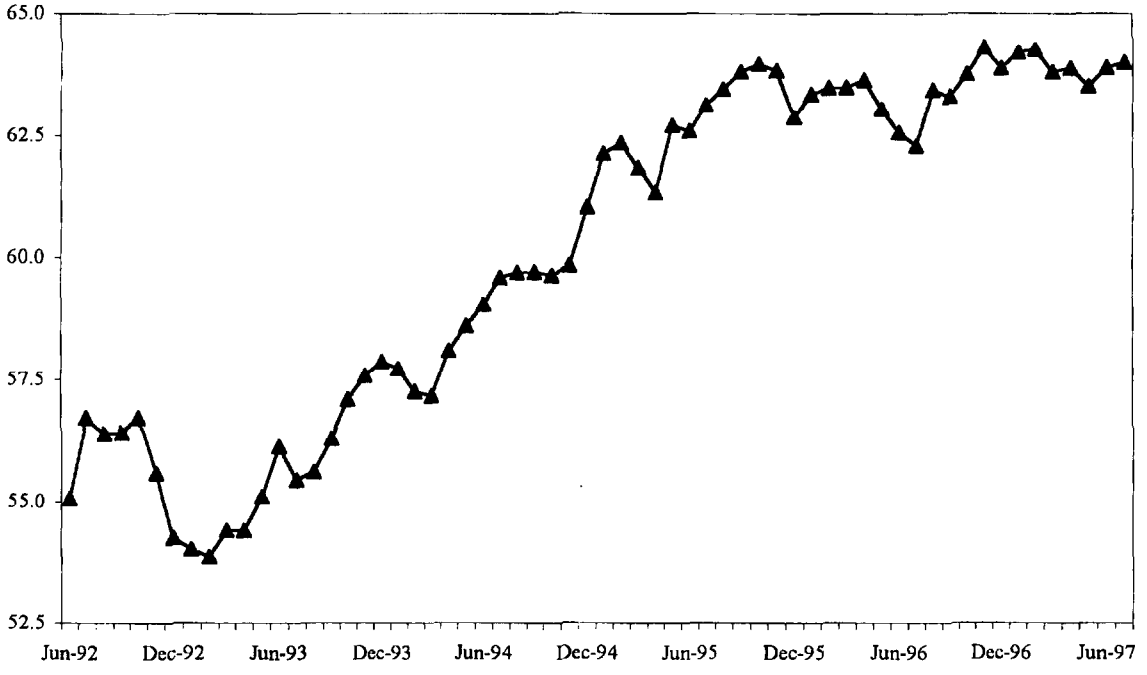
Sources: Central Bank of Argentina; and Fund Staff estimates.

Figure 6. Argentina: Tax Expenses of the Banking Sector
(in percent of total loans, annualized)



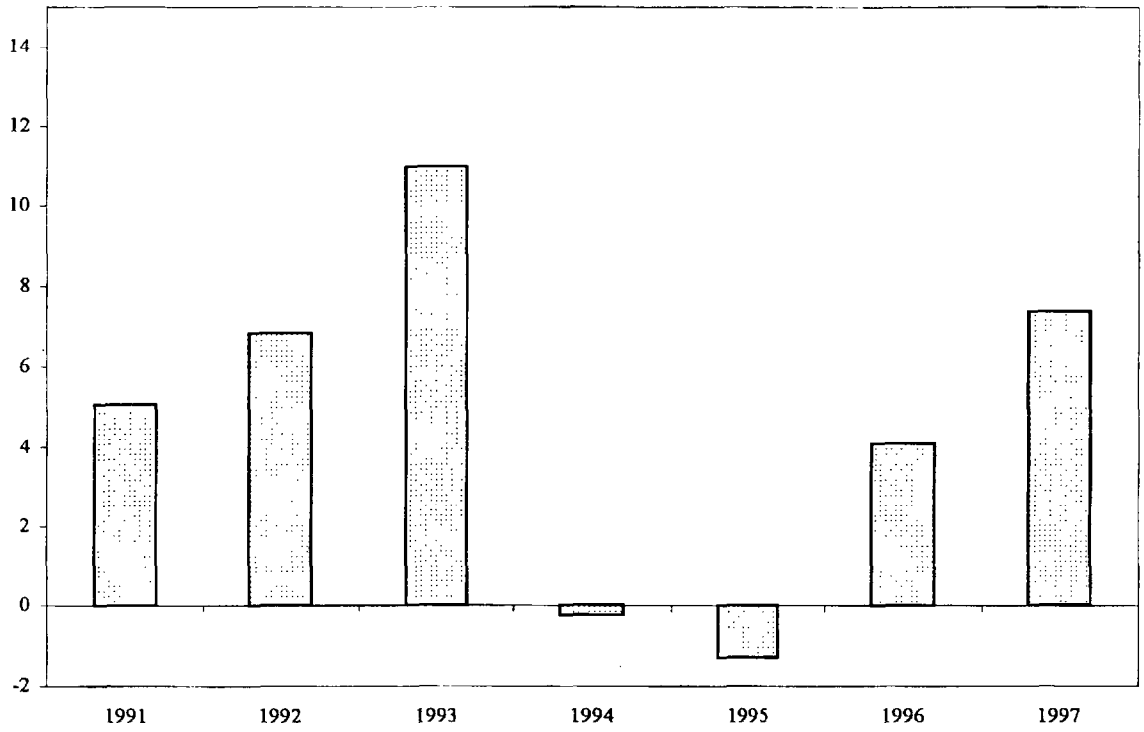
Source: Central Bank of Argentina; and Fund Staff estimates.

Figure 7. Argentina: Share of U.S. Dollar-denominated Loans
(in percent of total loans)



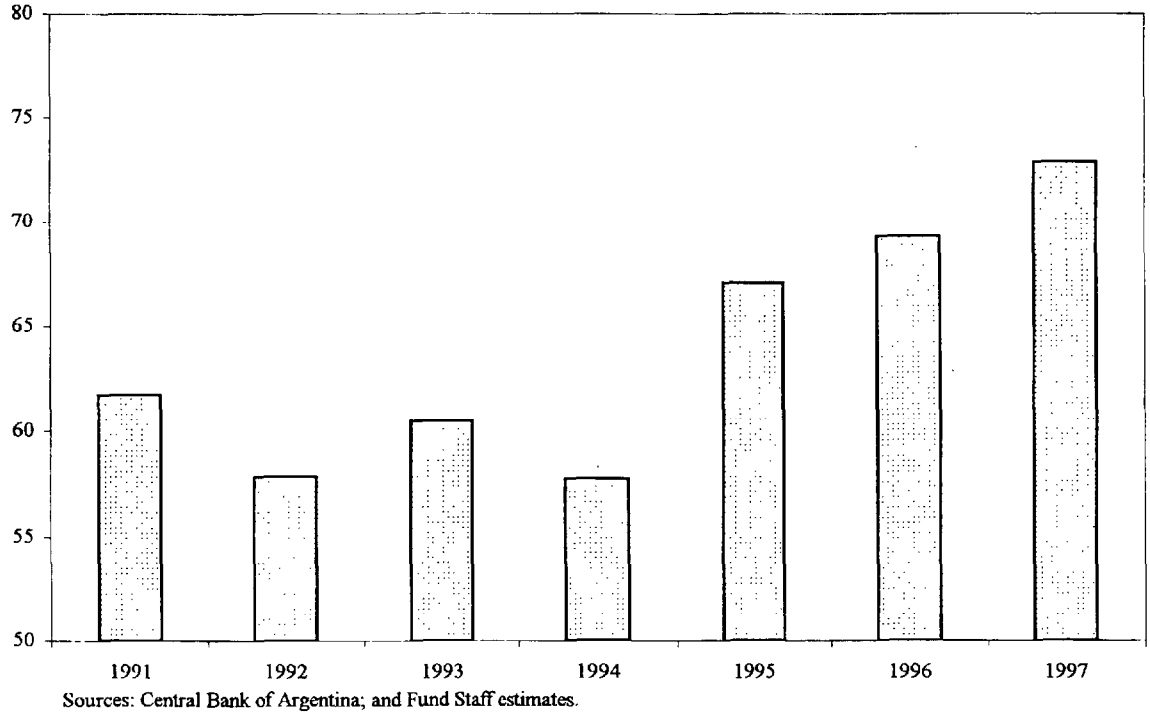
Source: Central Bank of Argentina; and Fund Staff estimates.

Figure 8. Argentina: Rate of Return on Equity of the Banking Sector
(in percent)



Sources: Central Bank of Argentina; and Fund Staff estimates.

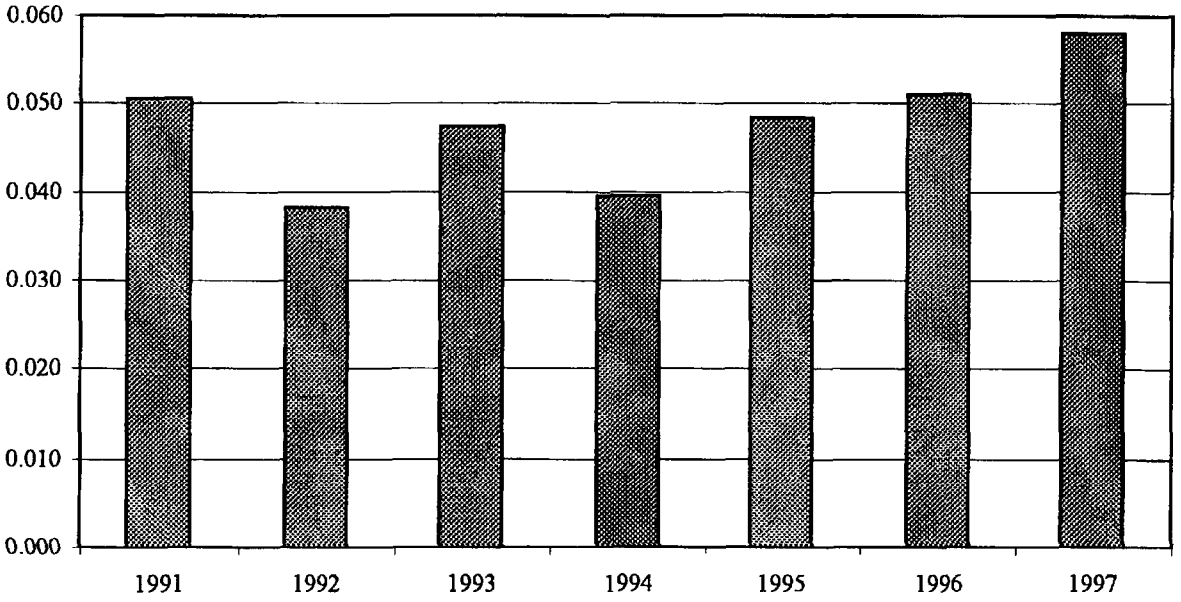
Figure 9. Argentina: Concentration Ratios [1]
(in percent)



Sources: Central Bank of Argentina; and Fund Staff estimates.

[1] Participation of the fifteen largest banks in total deposits; end-of-period through October 1997.

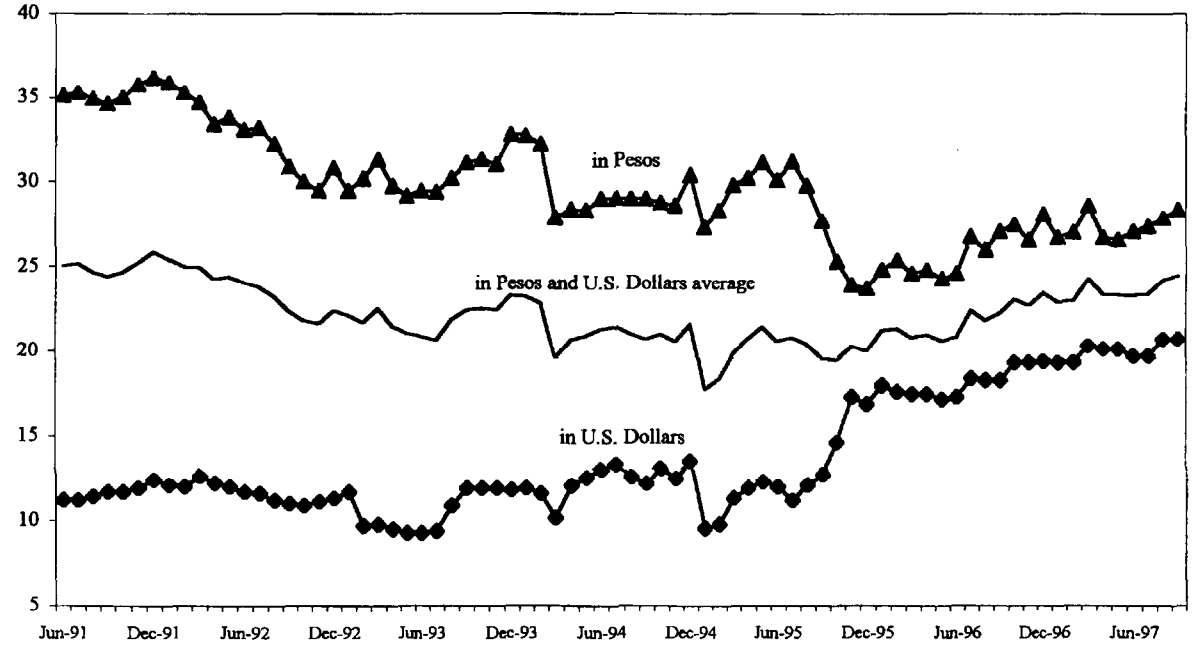
Figure 10. Argentina: Herfindahl Index for the Banking System[1]



Sources: Central Bank of Argentina; and Fund Staff estimates.

[1] Based on end-of-period deposits through October 1997.

Figure 11. Argentina: Reserve Requirements of the Banking System[1]
(in percent of total deposits)



Sources: Central Bank of Argentina; and Fund Staff estimates.

[1] Legal reserve or liquidity requirements held at the Central Bank or at an international custodian, e.g., Deutsche Bank, plus banks' cash in vault.

Figure 12a

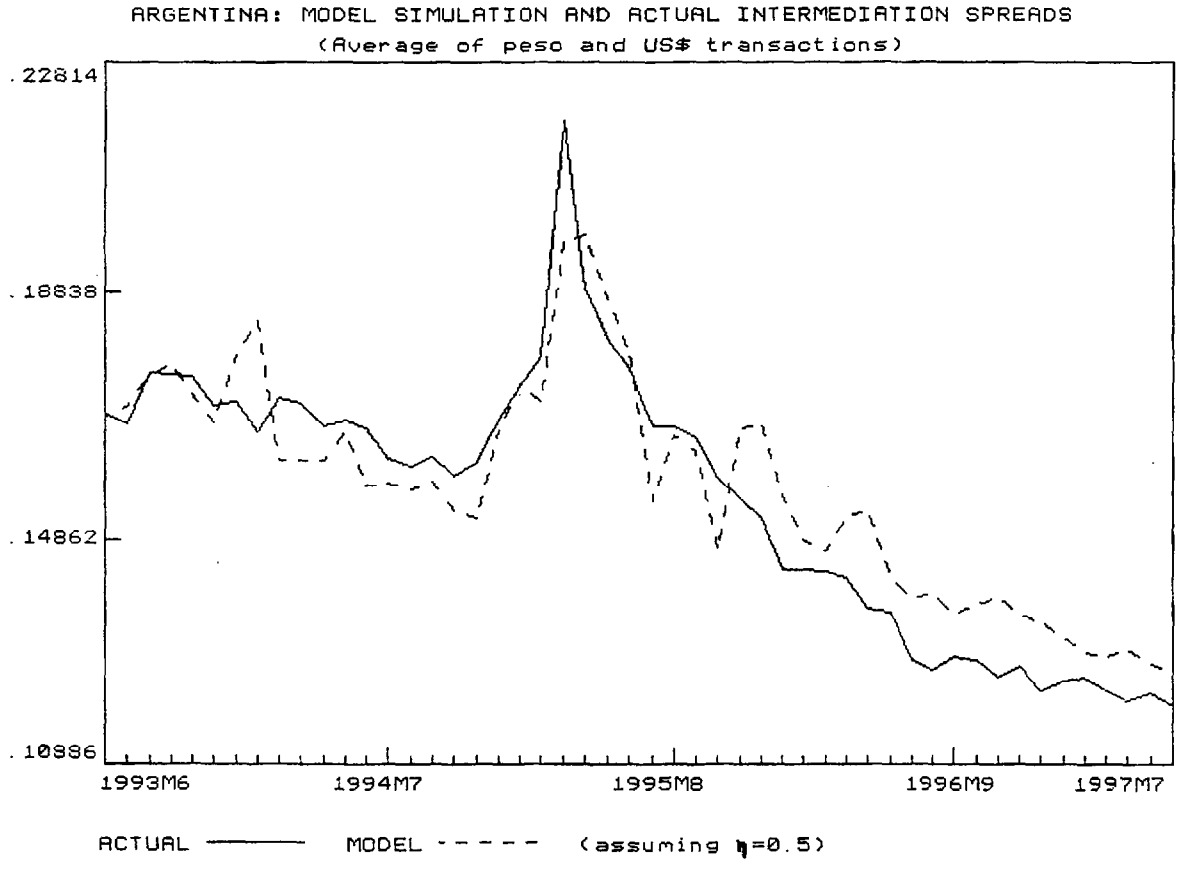

ARGENTINA: MODEL SIMULATION AND ACTUAL INTERMEDIATION SPREADS
(Average of peso and US$ transactions)
.22814
.18838
.14862
.10886
1993M6
1994M7
1995M8
1996M9
1997M7
ACTUAL
MODEL
(assuming η=0.5)

Figure 12b

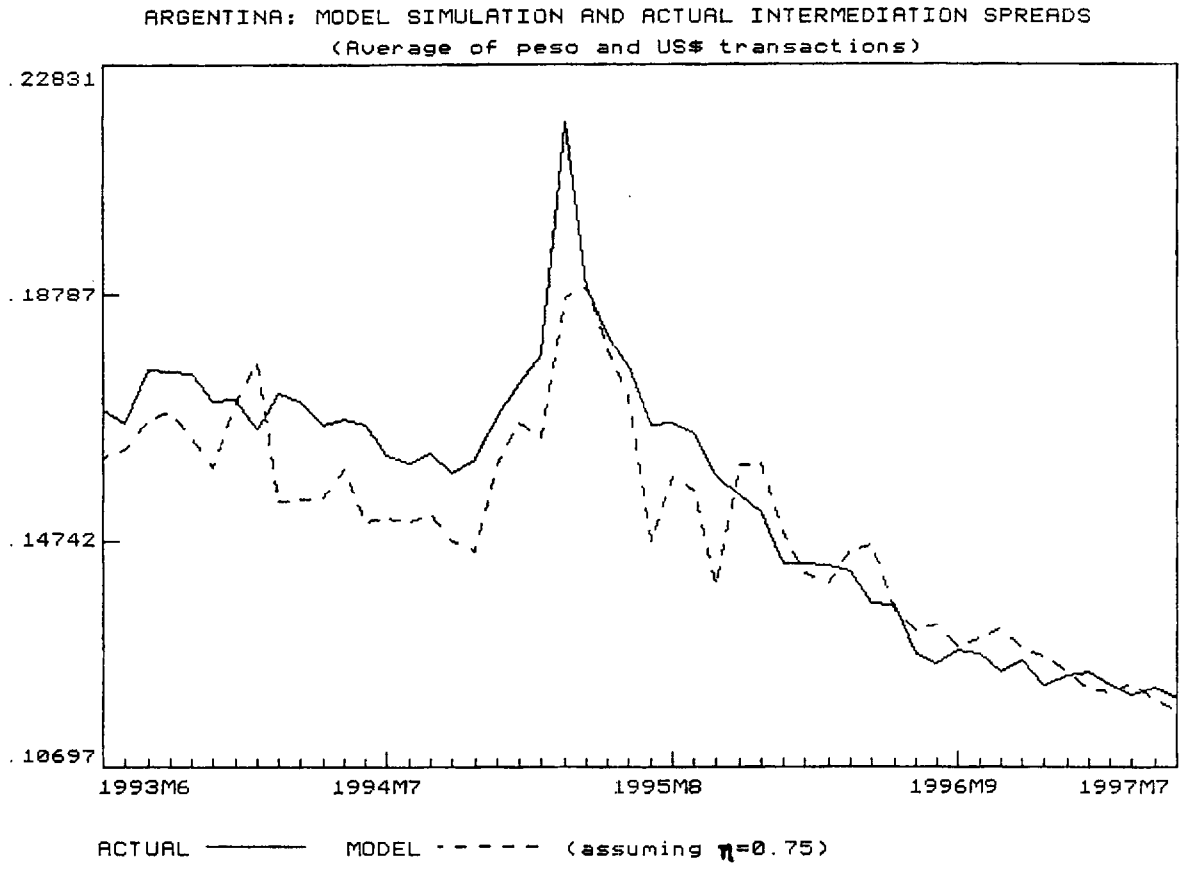

ARGENTINA: MODEL SIMULATION AND ACTUAL INTERMEDIATION SPREADS
(Average of peso and US$ transactions)
.22831
.18787
.14742
.10697
1993M6
1994M7
1995M8
1996M9
1997M7
ACTUAL
MODEL
(assuming π=0.75)

Table 1. Consolidated Income Statement of Commercial Banks in Selected Countries

(End-1994)

	Argentina		France		Germany		Italy		Japan	
	(Billion pesos)	% of loans	(Billion Francs)	% of loans	(DM billion)	% of loans	(Trillion Lira)	% of loans	(Billion Yens)	% of loans
Net interest earnings	5.2	10.0	227.2	3.5	121.4	3.9	62.2	6.0	9,166.0	2.0
Interest receipts	8.9	17.0	1,206.3	18.8	382.1	12.4	166.9	16.1	28,158.0	6.2
Interest receipts	3.8	7.3	979.1	15.3	260.7	8.4	104.7	10.1	18,992.0	4.2
Noninterest income	3.8	7.3	126.3	2.0	29.3	0.9	19.3	1.9	-295.0	-0.1
Gross income	9.0	17.2	353.5	5.5	150.7	4.9	81.5	7.9	8,872.0	2.0
Operating expenses	6.5	12.5	259.8	4.0	91.4	3.0	53.0	5.1	6,773.0	1.5
Provisions	1.9	3.6	89.9	1.4	30.0	1.0	18.9	1.8	1,305.0	0.3
Pre-tax profit	0.5	1.0	3.8	0.1	29.3	0.9	9.6	0.9	793.0	0.2
Taxes	0.5	1.0	13.8	0.2	14.3	0.5	8.9	0.9	585.0	0.1
After tax profit	0.0	0.0	-10.0	-0.2	15.0	0.5	0.7	0.1	208.0	0.0
Memorandum										
		(US$ billions)		(US$ billions)		(US$ billions)		(US$ billions)		(US$ billions)
Average stock of loans	52.2	52.2	6,416.6	1,155.7	3,093.4	1,906.2	1,034.2	641.6	452,057.5	4,422.8
Average deposits	44.4	44.4	4,252.0	765.9	2,817.1	1,736.0	921.3	571.5	537,880.6	5,262.5
No. of Employees ('000)	120.0	120.0	407.5	73.4	...	...	340.0	210.9	414.0	4.1
Deposits ($)/Employee	370.0	370.0	10,434.4	1,879.4	...	...	2,709.7	1,681.0	1,299,228.5	12,711.4
Exchange rate to US$ (av	1.000		5.552		1.623		1.612		102.210	

Table 1. Consolidated Income Statement of Commercial Banks in Selected Countries (Concluded)

(End-1994)

	Mexico		Peru		Spain		United Kingdom		United States	
	(Billion pesos)	% of loans	(Billion soles)	% of loans	(Billion pesetas)	% of loans	£ billion	% of loans	US$ billion	% of loans
Net interest earnings	31.4	8.2	0.9955	9.7	3,274.0	7.1	16.5	4.4	146.5	6.3
Interest receipts	104.3	27.2	2.0	19.7	9,251.0	20.2	43.0	11.4	257.4	11.0
Interest receipts	72.9	19.0	1.0	10.0	5,977.0	13.0	26.5	7.1	111.0	4.7
Noninterest income	8.7	2.3	1.5	14.6	902.0	2.0	12.5	3.3	76.6	3.3
Gross income	40.1	10.5	2.5	24.3	4,176.0	9.1	29.1	7.7	223.1	9.5
Operating expenses	25.7	6.7	1.8	17.4	2,493.0	5.4	18.6	5.0	145.1	6.2
Provisions	9.6	2.5	0.3	3.0	845.0	1.8	2.3	0.6	11.0	0.5
Pre-tax profit	4.7	1.2	0.4	3.9	838.0	1.8	8.1	2.2	67.0	2.9
Taxes	1.0	0.3	0.2	1.6	197.0	0.4	2.7	0.7	22.4	1.0
After tax profit	3.7	1.0	0.2	2.4	641.0	1.4	5.4	1.4	44.6	1.9
Memorandum										
		(US$ billions)		(US$ billions)		(US$ billions)		(US$ billions)		(US$ billions)
Average stock of loans	383.1	113.5	10.2	4.7	45,857.0	342.3	375.7	245.2	2,342.3	2,342.3
Average deposits	433.0	128.3	14.7	6.7	58,567.0	437.2	498.4	325.3	2,640.0	2,640.0
No. of Employees ('000)	129.0	129.0	17.3	3.1	246.5	151.9	365.6	226.8	1,486.0	1,486.0
Deposits ($)/Employee	3,355.3	994.2	846.3	385.6	237,642.5	1,774.0	1,363.5	890.0	1,776.6	1,776.6
Exchange rate to US$ (av	3.375		2.195		133.96		1.532		1	

Sources: OECD (1996); and Fund staff estimates.

Table 2. Argentina: OLS Estimates of Model on Intermediation Spreads
(Sample: 1993m6 to 1997m7)

		Explanatory Variables 1/						R^2	DW	DF 2/	ADF 3/
		Tax/Loans	ε (r_d-r_e)	dc\dl	Problem Loans	Dev. Risk	H index				
1. Average Spread		1.20	0.02	0.82	0.29	0.21	-0.08	0.92	1.72	-5.77	-4.83
		(1.73)	(7.37)	(5.15)	(4.01)	(4.51)	(-0.32)				
2. Peso Spread		0.60	0.02	0.58	0.54	0.22	1.19	0.92	1.62	-5.59	-5.92
		(0.79)	(10.55)	(3.37)	(5.52)	(4.60)	(3.23)				
3. US$ Sprea	a.	0.82	0.03	0.78	0.32	0.27	-0.04	0.85	1.79	-6.19	-4.79
		(1.12)	(5.32)	(4.24)	(1.25)	(6.71)	(-0.10)				
	b.	0.79	0.03	0.77	0.3	0.28	...	0.85	1.80	-6.2	-4.81
		(1.18)	(5.38)	(5.33)	(2.87)	(7.25)	...				

Source: Fund staff estimates.

1/ t-ratios in brackets. The variables tax/loans and the Herfindahl index entered the regressions with a one-period lag.

2/ Dickey-Fuller test for unit root of regression residuals.

3/ Augmented Dickey-Fuller test including first and second lags of the dependent variable.

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