

Are Loan Guarantees Effective? The Case of Mexican Government Banks

Guillermo Benavides*

Alberto Huidobro**

Banco de México

Banco de México

First version: December 2004.

This version: March 2008.

Abstract:

Mexican Government's Banks offer loan guarantees to private banks in order to spur credit directed to non-financial small and medium sized firms and this policy is examined here. Application of representative data to the analysis of the guarantee-use decision suggests that these schemes, as currently designed, are justifiable from an economic viewpoint. However, there is some evidence of inefficiency and ineffectiveness about the way these guarantee programs operate. Marginal take-up is plausibly explained only by the benefits perceived by private bankers.

Keywords

Adoption incentives, bank credit, government-loan guarantees, Mexican banks.

JEL classifications: C22, D61, G21, G38.

*/** Dirección General de Investigación Económica y Dirección de Intermediarios Financieros de Fomento, Banco de México. This paper's findings, interpretations, and conclusions are entirely those of the authors and do not necessarily represent the views of Banco de México (Central Bank of Mexico), its Board or its Staff Officials. We thank an anonymous referee for very helpful suggestions and participants at the Banco de México's Estudios Economicos Seminar for useful comments and discussions. Any remaining errors are the responsibility of the authors.

* Mailing address: Av. 5 de Mayo No. 18, piso 5, Col. Centro, México DF., 06059. Mexico. Telephone: 52-55-5237-2000 ext. 3877, and Fax: 52-55-5237-2230. Email: gbenavid@banxico.org.mx.

** Mailing address: Av. 5 de Mayo No. 1, piso 6, Col. Centro, México DF., 06059. Mexico. Telephone: 52-55-5237-2158, Email: ahuidobr@banxico.org.mx.

Introduction

The objective of this paper is to determine a break-even credit increase when a loan guarantee scheme is initiated. Specifically, we study if the Mexican Government-owned banks have succeeded in promoting a break-even increase in the credit offered by private banks to non-financial small and medium sized firms by means of their loan guarantee programs.

Loan guarantees are promises made by a guarantor to pay an amount of money, a percentage of a loan, or a percentage of a loan plus its accrued interests, in case of default by borrowers. Hence, guarantees have value to the guaranteed agent and impose costs on the guarantor. Several authors have proposed methods and models which value or price loan guarantees [Merton (1977), Jones and Mason (1980), Chaney and Thakor (1985), Huidobro (2003) and Chang, Chung and Yu (2003)].

While the use of loan guarantees that cover a stake of the risk of debt repayment became more widely used by Governments [Mody and Patro (1996)], some issues, apart from their value or price, stimulated theoretical and empirical research work. For instance, Jones and Mason (1980) valued loan guarantees under various circumstances (like full vs. partial guarantees; junior vs. senior guaranteed debt; and callable vs. non-callable guaranteed debt); Based on the perverse-incentives they potentially induce¹, Chaney and Thakor (1985) suggested a loan guarantees pricing mechanism according to which premiums paid depended on the risk of the assets and the leverage of the guaranteed firms.

¹ The potential perverse-incentive effects are described as “ ... firms receiving loan guarantees ... might attempt to ... choose riskier projects with higher returns.”
“ ... These perverse incentive effects imply that the actual loan-guarantees-related contingent liability of the Government could be much larger than suspected..” [Chaney and Thakor (1985), p. 169-70].

From the sustainability and cost-benefit points of view, Huidobro (2003) proposed an optimal penalty for the case in which the guarantor finds that a private counterpart includes non-eligible loans in the guaranteed portfolio; and Chang, Chung and Yu (2003) constructed a general framework under which they analyzed the value of loan guarantees when there was one-borrower and multiple guarantors, as well as when there were multiple borrowers and one-guarantor, both with stochastic interest rates. They found that the higher the senior debt of the guarantor, and the higher correlation coefficients in their model, the lower the value of the guarantee and the higher the probability of default, respectively².

Other applied studies have provided the essential elements, scope and problems in the design and operation of loan guarantee schemes. Levitsky and Prasad (1989) as well as Llisterri and Levitsky (1996) studied the experience gained in the operation of schemes around the globe, while Riding and Haines (2001) revised the experience in North America and UK. Others have focused on some consequences arising from their use. The work of Huizinga (1997) examined whether World Bank loan guarantees improved the credit terms (interest rate and maturity) that developing countries faced with private creditors on the nonguaranteed part of the overall financing. Klein (1997) discussed the risks of infrastructure projects, and offered some guidelines for managing government guarantee programs in support of private investment in infrastructure; Gendron, Lai and Soumaré (2002) evaluated portfolios of private loan guarantees and investigated their risk diversification properties.

² They study the correlations between: a) interest rates and the assets values of the guarantor; b) interest rates and the assets values of borrowing firms; c) guarantor's and borrowing firms' values, among others.

Up today, the relatively scarce literature on loan guarantees relies on the assumption that private lenders provide optimal amounts of credit for the economy as a whole. In fact, none of the previous studies has questioned if a situation of optimal amount of credit offered to non-financial small and medium-sized firms has been reached as a consequence of the use of loan guarantees. Moreover, few studies have analysed the extent to which loan guarantees have accomplished their objective of increasing funds to certain key industries [Llisterri and Levitsky (1996)]. Finally, given that Government loan guarantees, as well as direct credit programs and subsidies, are examples of financial assistance programs by means of which employment and economic growth could be fostered, they deserve extensive analyses.

The next section presents an analytical framework, which describes how a private banker decides whether to participate in a Government loan-guarantee scheme or not. We start by mentioning the subsidy implied by a guarantee scheme and the benefits reported to private bankers in case of participating. Due to the fact that private bankers' participation depends critically on the elasticity of their credit supply, a range of magnitudes for this variable is tested on representative data, in order to calculate a break-even quantity that makes the guarantee scheme self-sustainable. We observe a strong real increase on the aggregate supply of credit offered by Mexican private banks, which we ideally calculate by about 39% - 44%, the outstanding stock of guaranteed credit showed about 780% real increase from September 2001 through June 2007, the revised period. In regards to this, it is worth stating that the December 1994 Mexican financial crisis was followed by a collapse in the banking industry and a decrease in real terms of the amount of credit to private firms. However, by 1998 a significant number of financial institutions had restructured their

liabilities and the Mexican economy grew again. The use of loan guarantees was economically justified at that time and appears to be justifiable right now. The Mexican Government objective was to increase loans (in real terms) for certain productive activities. It was expected that credit to those activities would stimulate higher growth and employment. However, the results of this paper show that the currently open-ended (up to ninety per cent) coverage to private loans is likely to prove both, unnecessary high and in some cases inefficient.

The layout of this paper is as follows. The purpose and main features of credit (loan) Guarantee Programs in Mexico are briefly explained in Section I. The Model is presented in detail in Section II. Section III presents the Break-even analysis. Finally, Section IV concludes. The Appendix contains the relevant mathematical derivations, tables and figures.

I. Purpose and Main Features of Credit (loan) Guarantee Programs in Mexico

As Meyer and Nagarajan (1997) state³, in general, credit guarantees are advocated as a means to entice reluctant private lenders into lending to clientele groups of interest to governments, such as small farmers, micro enterprises, medium-sized firms, etc. “It is usually thought that a major impediment to lending is the perceived risk associated with such loans so if the default risk is reduced through a guarantee, it is expected that private lenders will learn that these clientele are not so risky and may lend to them in the future

³ Meyer and Nagarajan (1997).

without the need for guarantees”⁴. Therefore, the explicit objective of credit guarantee programs is usually additionality in bank lending to the target sector⁵. On the other hand, the implicit objective could be thought as fostering the economic growth of the targeted population that could be achieved because of improved access to credit.

In Mexico, the main government suppliers of credit guarantees are Sociedad Hipotecaria Federal (SHF), a government-owned bank which provides housing loans for lower income population; Fideicomisos Instituidos en Relación con la Agricultura (FIRA) - a group of governmental trust funds that provide financial assistance to the rural sector-, and the government-owned bank named Nacional Financiera (NAFIN), which provides loans to businesses in what are known as key industries. Other public sector providers are Banco Nacional de Obras y Servicios Públicos (BANOBRAS), Financiera Rural and Banco Nacional de Comercio Exterior (BANCOMEXT), but all these other are much less important or have little to do with guarantees directed to small and medium sized enterprises (SME’s). The main features of their guarantee Programs are described below.

SHF

SHF -a government-owned bank- provides several credit guarantee types to support individual mortgages for the acquisition of new or used houses. As the main characteristics (coverage and premiums) of each type depend on several variables (initial payment, term

⁴ Idem.

⁵ Riding and Haines (2001) clarify that additionality refers to the extra or additional loans that could be made because of the guarantee. “Extra loans can be thought of as the benefit of the guarantee”. However, they also mention that additionality can take a variety of forms besides higher volumes of lending. “Borrowers may gain additionality by getting loans at better interest rates, for longer terms, or by getting larger loans than they would otherwise have obtained.”.

scheduled for repayment, etc.), let us simply say that coverage ranges from 5 to 100%, and that premiums range from as low as 0.33% to 9.79%, being the median around 2%⁶. According to our own calculations, SHF's weighted average exposure in its guaranteed mortgages has decreased noticeably from around 48%, by the end of 2003 – beginning of 2004, to around 26% by mid 2007 (See **Figure 1**). This might be a reflection of a kind of “success story”, as it might be the case that other guarantors, public and private, are probably assuming increasing shares of the risk involved in these credits, while mortgages have grown rapidly since 2004 (See **Figure 2**).

Notice that SHF's guarantee programs are not related to credits directed to small and medium sized firms, the kind of guarantees we are revising in this paper. However, their relevance at a national level makes it difficult not to mention them.

FIRA

Through the “Fondo Especial de Asistencia Técnica y Garantía para Créditos Agropecuarios (FEGA)”, the FIRA offer credit guarantees which objective is facilitate to rural producers the access to commercial banks' lending. The main purpose is to complement producer's own collaterals in order to help them obtain financing for their investment projects in the agricultural and fishery sectors⁷.

⁶ Visit SHF's WEB Page www.shf.gob.mx. (Available in Spanish only).

⁷ Visit FIRA's WEB Page www.fira.gob.mx. (Available in Spanish only).

In order to be eligible, beneficiaries must comply with “good” records as debtors and present viable projects, which require no more than the equivalent of \$106 millions of pesos⁸ (as of the end of 2004) of guaranteed amount.

FIRA's guarantees are never lower than 40% of the total amount of credit, and could reach up to 90%, depending on the existence of collaterals (the higher the collateral, the lower the guarantee). On the basis of available data, the weighted average of exposure for FIRA in its guarantee programs is slightly below 60% (See **Figure 3**). Annual guarantee fees range from 0.6 to 4% of the total amount of the guaranteed credit and follow a direct relationship with the coverage of the loans. However, the median fee is around 2%.

NAFIN

NAFIN administers several credit guarantee programs, but the availability of information is rather thin⁹. It is known, however, that the maximum coverage range from 70% for loans directed to large firms, to 75% for medium, and 80% to micro and small firms. Annual fees range from 2 to 4% of the total amount of the guaranteed credit. Based on available data, weighted average exposure of NAFIN is one or two percentage points above 52% (See **Figure 4**), and the median premium charged is 2%.

BANOBRAS

This government-owned bank offers credit guarantees in order to back credits granted to subnational (state and local) governments, usually directed to finance

⁸ This is approximately US\$9.79 million considering an exchange rate of \$10.83 per dollar.

⁹ Visit NAFIN's WEB Page www.nafin.gob.mx. (This site is also available in English).

infrastructure projects. As this kind credit guarantees are not related to our study, we limit ourselves to briefly mention them.

FINANCIERA RURAL

Financiera Rural is a relatively new government body which performs operations that replicate those of development banks, but is not a bank itself.¹⁰ It administers several credit guarantee programs, basically in the name of SAGARPA,¹¹ all of which are directed basically to the same agricultural population as FIRA.

Available information establishes that its guarantees provide a coverage that ranges from 10 to 70%, according to the degree of exclusion of the locality¹². However, we found no information regarding the fees charged by Financiera Rural, and we only got some data for the period that goes from December 2006 to July 2007, situation that excluded it from our analysis.

BANCOMEXT

Up to the end of 2006, BANCOMEXT operated a couple of credit guarantee programs which were intended to help small and medium sized firms to enroll in the export-oriented “production chain”, as well as to conduct their businesses in a more certain environment, protecting them from the possibility of default on their clientele side¹³.

¹⁰ Financiera Rural was created in December of 2002, in a closer fashion to a Development Agency than to a development bank. It slowly started operations during 2003.

¹¹ SAGARPA is the shortcut for Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación, which is the Mexican Ministry of Agricultural, Rural, Fishery and related subjects.

¹² For a detailed description of these programs, see SHCP (2007) and SAGARPA (2007).

¹³ Visit BANCOMEXT’s WEB Page www.bancomext.gob.mx. (This site is also available in English). It is worth mentioning that it was difficult to obtain relevant information from BANCOMEXT.

As well as the number and amounts of guaranteed operations, available information, which was few, only stated that coverage and fees were determined on the basis of the risk rating or creditworthiness of the debtor¹⁴. Even though, it was known that average coverage was 70%, and fees went from 0.5 to 4% of the total amount of the guaranteed credit.

Early in 2007, several new programs were under analysis, and were supposed to be in place by mid 2007, right at the end of the period studied in this paper. Therefore, we had no data to revise BANCOMEXT's experience.

II. The Model

II.1 Credit risk and the lending decision

Loan guarantees are valuable not only because they provide certainty to creditors, but also because they allow releasing financial resources and increasing profitability to commercial banks¹⁵. Now, in order to focus on the consequences of a guarantee program in the context of our model, it is important to make several assumptions.

¹⁴ Idem.

¹⁵ According to Huidobro (2003), capital (K) and reserve (R) requirements are released by amounts equal to: $\Delta K = -gkQ_0(\beta_3 - \beta_2)$ and $\Delta R = -g\gamma_0Q_0$, respectively, where g stands for the (percent) coverage of the guarantee, k stands for the minimum percentage of capital required (8%), Q_0 is the pre-guarantee amount of credit, β_3 and β_2 are the risk factors for post and pre guarantee credits, respectively, and γ_0 is the minimum reserve requirement for a non-guaranteed credit. Note that, for any amount of bank stock and outstanding credits, the reduced capital and reserve requirements imply a higher profit rate for private bankers. Moreover, if the banker uses the released resources to finance a new credit (Q_1), it would be of an amount equal

to: $Q_1 = \frac{[k(\beta_3 - \beta_2) + \gamma_0]}{\beta_3k + \gamma_1} gQ_0$, [γ_1 is the minimum reserve requirement for a guaranteed credit], which

is greater than Q_0 as long as Q_1 is rated below "high risk". Therefore, it is expected an increase in the credit offer whenever the banker does not keep to himself the benefits of the subsidy implied by the guarantee scheme.

First, it is assumed that private bankers are risk averse, that is, they are unwilling to take unnecessary risks. Second, they are interest rate-takers; they take the prevailing market interest rate and they could not influence it (a horizontal demand curve is assumed). Third, it is assumed that the bankers have the option to choose whether they join or not the guarantee program. Fourth, we assume that there do not exist information asymmetries, that is, there is neither “moral hazard” nor “adverse selection” on the private banker side¹⁶. Fifth, private bankers do not translate (charge) the guarantee fee to the borrowers. Sixth, development banks “correctly” fix guarantee fees at “fair” levels.

The chosen total amount of credit (Q) will be offered either at the guaranteed interest rate relevant to the guaranteed part of the credit (Q_g), or at the prevailing interest rate at the time of lending for the non-guaranteed part (Q_n). In other words,

$$Q = Q_g + Q_n \quad (\text{where, } Q_g \geq 0, Q_n \geq 0).$$

Starting from a conventional mean-variance framework [Copeland and Weston (1992), Benavides (2003) and Benavides and Snowden (2006)], the net revenue the banker will face will be subject to random disturbances as follows:

$$\pi = r_g Q_g + r (Q - Q_g) - c(Q) - \rho Q_g, \quad (1)$$

where π is the banker’s expected profit (net revenue), r_g represents the nominal interest rate of the guaranteed part of the credit (Q_g). r is the stochastic or random interest rate of the non-guaranteed part of the credit¹⁷.

¹⁶ This implies that private bankers will continue being diligent and cautious in analyzing and managing the credits they grant, as if there were no credit guarantees.

¹⁷ We say that r is random in the sense that if the borrower does not honor his debt, the actual interest rate charged is zero, whereas it could be equal to the prevailing market interest rate when he does.

Lending is subject to a rising cost curve $c(Q)$ and the guarantee is undertaken at a known premium (ρ) that the private bank has to pay to the guarantor over the guaranteed amount. Thus, ρQ_g is the private cost of the guarantee.

Re-arranging (1) with the addition and subtraction of $\bar{r}(Q - Q_g)$ (where the bar denotes the banker's *expected* interest rate, i.e. $\bar{r} = E[r]$), yields the following (the algebraic derivation is presented in Appendix):

$$\pi = (r - \bar{r})(Q - Q_g) + \bar{r}(Q - Q_g) + r_g Q_g - c(Q) - \rho Q_g \quad (2)$$

Following a standard procedure (using Taylor series expansion) to obtain the expected net revenue and its variance within a mean-variance framework,¹⁸ and assuming the banker has perfect foresight¹⁹, it will therefore be:

$$\bar{\pi} = \bar{r}Q + (r_g - \bar{r})Q_g - c(Q) - \rho Q_g, \quad (2a)$$

$$\sigma_\pi^2 = \sigma_r^2 (Q - Q_g)^2. \quad (2b)$$

Assume that the banker has an exponential utility function:

$$E[u(\pi)] = -E[e^{-\lambda\pi}] \quad (3)$$

Where λ stands for a measure of absolute risk aversion. Now consider $\pi \sim N(\bar{\pi}, \sigma_\pi^2)$, which implies:

¹⁸ See Copeland and Weston (1992), pgs. 145-192, for a more detailed explanation of this procedure.

¹⁹ That is, $\bar{r} = r$.

$$E[u(\pi)] = -e^{-\lambda[E(\pi)]}. \quad (3a)$$

The banker's utility is therefore maximised according to the following objective function (see the Appendix):

$$Max_{Q, Q_g} [u(\pi)] = Max_{Q, Q_g} [E(\pi) - \frac{\lambda}{2}(\sigma_\pi^2)]. \quad (4)$$

Substituting for the expectation and variance of returns from above yields:

$$Max_{Q, Q_g} \left(E(\pi) - \frac{\lambda}{2} \sigma_\pi^2 \right) = \bar{r}Q - c(Q) - \rho Q_g + (r_g - \bar{r})Q_g - \frac{1}{2} \lambda (Q - Q_g)^2 \sigma_r^2 \quad (5)$$

This is the objective function for the private banker. For our simplified case the first order conditions are:

$$\frac{\partial u}{\partial Q} = 0 = \bar{r} - \frac{\partial c}{\partial Q} - [\lambda \sigma_r^2 (Q - Q_g)], \quad (6)$$

$$\frac{\partial u}{\partial Q_g} = 0 = r_g - \bar{r} - \rho + [\lambda \sigma_r^2 (Q - Q_g)], \quad (7)$$

Notice that the second order conditions are negative, which is consistent with finding a maximum. Given the banker's own expected interest rate, the guaranteed interest rate may exceed it by enough to 'pay' (prospectively) for the contribution made to the guarantee premium (ρ). From this point all the new credit would be guaranteed, irrespective of the size of the risk aversion coefficient (λ): the critical consideration would be the relationship between the guaranteed interest rate and the banker's personal expectations for the market interest rate at the time of lending. While such expectations are not observable,

some inferences about their calculation can be obtained from the arithmetic average of the market interest rates during recent years. **FIGURE 5** in the Appendix shows a time-series of monthly Mexican nominal interest rates during the period 1998-2007²⁰.

A highest guarantee premium (ρ) of four per cent is charged by NAFIN and FIRA. As the private banker is liable to this payment, it is of his interest that the value $(r_g - \bar{r})Q_g$ will be as high as possible in order to increase his net revenues.

While motivations for private bankers to accept a guarantee program are clear, it is not the case when asking if such programs are achieving their goal of fostering the quantity of real credit available to the Mexican non-financial firms. In order to investigate further this phenomenon, as well as to assess the subsidies implied under the guarantee programs, it is helpful to calculate a ‘break-even’ credit response after their implementation.

II.2 Loan guarantees and ‘break-even’ quantity of credit

The implications for the government of a guarantee program may be clarified with reference to **FIGURE 6**, which provides a diagrammatic representation of the first order conditions specified in equations (6) and (7).

Assuming a linear marginal cost curve [$c'(Q)$], Figure 6 depicts the ‘risk adjusted’ (or technical) supply curve when the risk aversion coefficient and the interest rate variance are both equal to zero. Since the product of the risk aversion coefficient and the variance of

²⁰ Note that the peak observed in the second half of 1998 is related to the Russian exchange rate crisis, which affected emerging economies like the Mexican.

the interest rate is taken as being zero, an alternative marginal cost curve is implied $[c'(Q) + \lambda\sigma_r^2(Q - Q_g)]$. To derive a comparative measure of the benefits and costs of the guarantee program, two ‘polar’ equilibrium positions might be envisaged from the figure. Initially, suppose that guarantee facilities are offered to the banker. That means that any movement would take place along the technical supply curve. Should expectations of the interest rate at the time of lending coincide with, or fall short of, the current guaranteed interest rate ($\bar{r} \leq r_g$), the decision would be to offer more guaranteed credit, and reach point B, the new technical optimum. The move from point C to point B over the marginal cost curve $c'(Q)$ reflects that the guaranteed interest rate r_g is higher than the random interest rate without guarantee (r_0).

In the opposite case, cut off from the guarantee program, the banker’s marginal cost curve would lie to the left and above the ‘technical’ schedule $[c'(Q)]$ by the vertical distance AC [equal to $\lambda\sigma_r^2(Q - Q_g)$]. This vertical distance is the marginal subjective risk perceived by the banker²¹. This represents the marginal interest rate value to the banker of the risk being borne with the initially non-guaranteed part of the credit. Credit at A would be below the technical optimum represented by B, with the implied surplus of interest rate over marginal cost compensating the overall interest rate risk (area ABC). The intuition behind this is that, now, the banker has to face a risk he did not have to take care of when having his credit guaranteed. The equilibrium position at B suggests that if the banker had one hundred percent premium subsidy ($\rho = 0$), the expected interest rate would be equal to

²¹ The diagram shows that this represents the marginal cash value to the banker of the risk being borne with the initially not-guaranteed credit.

the guaranteed interest rate ($\bar{r} = r_g$) and all the credit would be guaranteed²². The surplus of the extra credit encouraged (the area ABC) over resource cost could then be compared with the budgetary cost of the hypothetical one hundred per cent subsidy covering the entire (enhanced) credit²³.

From the government perspective, therefore, the trade-off between the overall subsidy and the net benefit of the extra credit encouraged can be expressed in terms of a “break-even” quantity of credit that would finance the subsidy. Measuring the elasticity of the credit supply, from a pre-guarantee point like C to point B in **Figure 7**, will show that the required proportional increase in the amount of credit is expressed as follows (the algebraic derivation is presented in appendix):

$$Q^0 = \frac{\frac{2\rho}{r'} + \sqrt{\left(\frac{2\rho}{r'}\right)^2 + \frac{8\rho\varepsilon}{r'}}}{2} \quad (8)$$

The break-even percentage quantity increase (Q^0) therefore depends positively on the premium (ρ) expressed as a percentage of the credit granted, the supply elasticity (ε) of the marginal cost schedule and inversely on the interest rate (r')²⁴ (See Figure 7).

Three measures of ε are presented. The first figure was obtained from the estimation of a Vector Autoregressive Model (VAR). This model was estimated in order to find the

²² Then $\lambda\sigma_r^2(Q - Q_g)$ will disappear and the credit quantity would reach the technical optimum at point B.

²³ In principle, with a premium subsidy of ‘only’ about fifty per cent, some of the credit may be left without guarantee (Huidobro: 2003). Evaluation of the remaining risk [$\lambda\sigma_r^2(Q - Q_g)$] would be balanced against the premium cost saving from bearing it [$(\rho)(Q - Q_g)$].

²⁴ See APPENDIX for the definition of r' .

elasticity of supply based on observed data in Mexico. The other two elasticity measures were taken from other studies. Morgan (1998), for example, obtained values within the range of 0.06 and 0.15 for the supply elasticity of the U.S. banks. He used a VAR model, in which he considers several relevant variables like loans, industrial production, log of consumer prices and nominal interest rates and a trend. He argues that his estimates are consistent with the literature. For Argentina, Catao (1997) found an elasticity coefficient of 0.10 using a similar structural model. Following Morgan (1998) and Catao (1997), elasticity coefficients of 0.15 and 0.10, respectively, are considered for our analysis in addition to our VAR model.²⁵

II.3 The VAR model

In view of the difficulties encountered in obtaining an estimated credit supply function for the Mexican banking industry from the literature, a Vector Autoregression (VAR) approach was adopted in order to estimate the supply elasticity of credit. This coefficient is required to measure the cost and benefits of the guarantee on the basis of the profit function (Equation 1) presented before. In general, the VAR can be expressed in matrix notation as:

$$x_t = A_0 + A_1x_{t-1} + \dots + A_px_{t-p} + B_0z_t + B_1z_{t-1} + \dots + B_rz_{t-r} + u_t \quad (9)$$

In this representation x is a vector of variables in the system. A_0 represents a $n \times 1$ vector of intercept terms. A_1, \dots, A_p represent $n \times n$ matrices of coefficients of the lagged

²⁵ Using a Vector Error Correction Model (VECM), Calza, et. al., (2006), found an elasticity coefficient of around 0.23 for the Euro Area countries. However, that coefficient was not statistically significant. Because of this, we decided not to include it for our analysis.

values of the endogenous variables. B_0, \dots, B_r represent $n \times m$ matrices of coefficients of the current and lagged values of the exogenous variables (z 's). Finally, u_t represent a $n \times 1$ vector of error terms. The results of the VAR model are reported in **TABLE 1** in the appendix.

For an aggregate case, that is, for the whole guaranteed credit granted by commercial banks to non-financial firms, the VAR model was estimated from September 2001 through June 2007 using monthly data. This period was chosen because is the one for which there were monthly data available in a CNBV database for loan operations²⁶. The results reflect the expected sign and a statistically significant relationship between the quantity of real credit to medium sized firms and real interest rate.

The estimates on Table 1 indicate that, at lag one, the changes in the natural logarithm of the quantity (dependent variable) responded to changes in interest rates (independent variable) one period later, by a rough factor of 0.0809. Note that the magnitude is smaller compared with those in the literature, circumstance that arise as an interesting question. A possible explanation may be that after the 1994 Mexican financial crash, credit supply became relatively unresponsive to changes in real interest rates (relatively inelastic).

III. Break-even Analysis

Using equation (8), **TABLE 2** presents calculations of the implied increases in credit that would achieve 'break-even' when the guarantee scheme is available. Three

²⁶ CNBV is a shortcut for Comisión Nacional Bancaria y de Valores, the banks' supervisory body in México.

elasticity values were considered (0.08, 0.10 and 0.15). The first elasticity was taken from the estimation of the VAR model and the other two were taken from the literature [Catao (1997) and Morgan (1998), respectively]. The guarantee premium was set at 2 per cent, that is, the median of the premiums charged by Mexican development banks. The break-even values were computed by adding the calculated percentage amount (from Equation 8) to the amount of credit at the first observation of the sample, i.e., September 2001.

III.1 Analysis of the results

The estimates of the required credit increase in Table 2 are measures relating the distance AB in Figure 6. The magnitudes are reported in the final line of Table 2 and expressed as a fraction of the guaranteed credit granted (Q), range from 39.3 to 43.9 per cent²⁷.

A clearer perspective can be obtained in a graphical representation. **FIGURE 8** shows that the outstanding stock of credit is considerably above the break-even quantity (horizontal line) estimated in our model. The break-even quantity was \$50,197.8 million (in real terms). Note that the observed increase in outstanding credits during the last few years has been more than enough to reach the break-even quantity²⁸.

Possible reasons for this significant increase in credits could be related to a reinforced Law that took place in order to make easier the process by which lenders realize

²⁷ Assuming that the whole quantity of credit is guaranteed.

²⁸ The stock of outstanding guaranteed commercial credits increased 780%, in real terms, from September 2001 to June 2007, and reached \$307,307.7 millions of 2002 Mexican Pesos. This figure is well above the 39.3 – 43.9% range estimated in our model. It is worth noting that, during the same term, total commercial credits increased 16%, and reached \$562,826.1 millions of 2002 Mexican Pesos. See Figure 9.

and/or repossess the assets pledged as collaterals.²⁹ Also, financial authorities approved, by the end of 2005, the use of credit scoring³⁰ especially to small amount credits.³¹ Finally, the reduction and stabilization of market interest rates, as a consequence of the reduced macroeconomic volatility achieved, might have increased the number of viable projects. In fact, all these favorable conditions may also have helped to witness a reduction in the average amount of the guaranteed loans, from \$11 million (2002 Pesos), in June 2003, to \$3.4 million in June 2007, as shown in **Figure 10**. But there might be another powerful explanation.

At first glance, credit guarantees are negligible in the Mexican credit market. As **Table 3** shows, the sum of the credits guaranteed by SHF, FIRA and NAFIN represent roughly 10.9% of the total credits granted by private banks to the non-financial private sector. **Table 4** shows the total amount of credits guaranteed by Mexican Government banks in millions of pesos as of June of 2007. However, a closer look reveals that an average of 54.4% of total commercial loans granted by private banks was backed by any form of guarantees during the revised term (see **FIGURE 9**). Moreover, the average coverage of total guarantees offered to these loans was as high as 86.7%. Why is this coverage that high?. The answer lies in the fact that, in addition to the guarantees offered by development banks, these loans are eligible for guarantees coming from, say, the Secretaría de Economía (Ministry of the Economy), subnational governments, international

²⁹ See SHCP (2003), SHCP (2004) and SHCP (2006.a).

³⁰ Which is “an automated statistical technique used to assess the credit risk of loan applicants. It involves analyzing large samples of past borrowers to identify the characteristics that predict the likelihood of default” [De la Torre, et. al., (2006), P. 10].

³¹ See SHCP (2005) and SHCP (2006.b).

institutions, etc. In that sense, it could be said that 47.2% of the increase observed in commercial loans is explained by the presence of credit guarantees.

These results are not necessarily good news because they might indicate that guarantees could be inefficient and possibly ineffective. Inefficient because their premiums and coverage might be incorrectly fixed, that is, away from their “fair” level, i.e., either premiums do not fully reflect the risk involved, or, given the current premiums, coverage is excessively high, so private bankers try to make the most they can out of that situation. For instance, under Huidobro’s (2003) framework, considering a 50% coverage of NAFIN’s guarantees, the “fair” premium would be 3.4%, instead of the current median of 2%. On the other hand, if the premium is set at 2%, the maximum coverage should be 29.3%³². In the case of FIRA, if its average coverage is set at 60%, the “fair” premium should be 6.2%. Likewise, if the premium is at 2%, the maximum coverage should be 19.2%³³.

An interesting question here is for how long this situation will continue, given the costs that the guarantor bank has to face, in terms of capital and reserves requirements. Ineffectiveness may appear because they might be failing in promoting additionality and, therefore, beneficiaries may not be the targeted population (those who can not access private banks financing by their own means). However, this possibility is to be confirmed through deeper research on the subject. At this point, the conjecture can be stated on the grounds of comparing value added by the smallest firms in the economy, and average

³² This calculation considers a 6% of interest margin adjusted by risk (over earning assets) for private banks, and a rate of 0.4% of non-performing commercial credits, as seen in June 2007.

³³ Calculations for FIRA assume the same 6% of financial margin to private banks, but a 3.8% of non-performing credits (observed in June 2007) and 60% coverage. By the way, for SHF’s guarantees, this model predicts a “fair” premium of 2.5%, if SHF is to back a 26% of mortgages, and the non-performing is 3.2% (observed in June 2007).

commercial loans guaranteed. **Table 5** shows that micro and small firms produce a maximum average of \$2.7 million value added a year. Therefore, as average credit guaranteed is around \$3.4 millions, it is an open question if credit guarantees are being used mainly to back loans directed to smaller firms.

Another potential source of inefficiency is found if we realize that, since 2001, most of guarantees have been directed to back short term loans (less than a year). This might imply a limited contribution for firms to update their processes and methods, so their competitive capacities might not be improving. Moreover, it is known that delivery of credit guarantees usually goes together with credit funding, a situation that may distort prices and risk taking in the market.

As De la Torre, et. al (2006) state, “the lack of a private guarantors market (or a limited private provision of guarantees) makes it difficult to assess if: i) Mexican development banks’ guarantees are not accurately priced, ii) the provision of guarantees by government banks is preventing the development of a private guarantors market, especially because they cover a large share of credit risk, and because they usually go together with second-tier financing, and iii) in that sense, it remains as an open question if credit guarantee systems can be designed in a market-friendly way, minimizing their unintended consequences while at the same time promoting private financial market activity”. These considerations in addition to the ones mentioned previously could explain the possible inefficiencies of these types of guarantee programs in Mexico.

IV. Conclusions

Considering that access to loan guarantees is beneficial to private bankers, credit guarantee schemes, as currently designed, seem like a puzzle. If private bankers are sufficiently risk-sensitive beforehand, profit incentives ensure their growing participation in loan guarantee schemes subsequently. In that sense, the most important factor in assessing the impact of credit guarantees Programs seems to be their high average coverage, in spite of their negligible relevance within the Mexican credit market. As these Programs amount to roughly 10.9% of the total credits granted by commercial banks to the non-financial private sector, but a 50% of total commercial banks, it is not surprising to observe an increase in this kind of loans within the whole bank credit market.

Now, looking at the available data, the significant increase in the level of guaranteed credits exceeded the amount needed for break even. However, there still questions about their overall efficiency and effectiveness. This could be an inefficient program because their premiums and coverage might be incorrectly fixed away from their “fair” level. Ineffectiveness may appear because they might be failing in promoting additionality and therefore, beneficiaries may not be the targeted population. Another potential source of inefficiency might be found looking at the type of credits they have been directed to support (short term credits), which may poorly contribute for more competitive capacities of Mexican firms.

Based on our results, it is recommended that additional research should focus on issues like the additionality achieved with these Programs. Following Chaney and Thakor (1985) it is also important to revise the “perverse incentives” and/or agency problems

which may arise by using loan-guarantees. Additional research could also be done for the case of finding the optimum guarantee premium. According to Huidobro (2003), there could be a source of benefit for commercial banks if loan guarantee-premiums were unfairly priced and/or if percent coverage were too high, given certain level of premiums.

REFERENCES

Benavides, Guillermo. (2003) Commodity Prices, Options and Futures Behaviour: The Cases of Corn and Wheat with an Application to the Mexican (ASERCA) Scheme. Doctoral Thesis. Lancaster University. June 2003.

Benavides, Guillermo and Nicholas Snowden (2006). Futures for Farmers: Hedging Participation and the Mexican Corn Scheme. Journal of Development Studies. Volume 42, number 4. May 2006. pp. 698 – 712.

Calza, A.; Manrique, M. and Sousa, J. (2006). Credit in the Euro Area: An Empirical Investigation using Aggregate Data. The Quarterly Review of Economics and Finance. Vol 46. pp. 211-26.

Catao, Luis (1997). Bank Credit in Argentina in the Aftermath of the Mexican Crisis: Supply or Demand Constrained? International Monetary Fund Working Paper WP/97/32. March 1997.

CONDUSEF (2004), “Comisiones Bancarias”, September. (Available in www.condusef.gob.mx).

Copeland, Thomas and Fred Weston (1992), Financial Theory and Corporate Policy, Third Edition, Addison-Wesley Publishing Company.

Chaney, Paul and Anjan Thakor (1985), “Incentive Effects of Benevolent Intervention. The Case of Government Loan Guarantees”, Journal of Public Economics, 26, pp. 169-189.

Chang, Chuang-Chang, San-Lin Chung and Min-Teh Yu (2003), “Loan Guarantee Portfolios and Joint Loan Guarantees with Stochastic Interest Rates”, The Quarterly Review of Economics and Finance, In Press.

De la Torre, Augusto, Juan Carlos Gozzi and Sergio Schmukler (2006), “Innovative Experiences in Access to Finance: Market Friendly Roles for the Visible Hand?”, World Bank, April.

Gendron, Michel, Van Son Lai and Issouf Soumaré (2002), “An Analysis of Private Loan Guarantee Portfolios”, Research in International Business and Finance, Vol. 16, Financial Risk and Financial Risk Management, pp. 395-415, Book of the Month at Elsevier Science.

Gonzalez-Anaya, José (2003), “Why Have Banks Stopped Lending in Mexico Since the Peso Crisis in 1995”, Center for Research on Economic Development and Policy Reform, Stanford University, April.

Gudger, Michael (1996), “Sustainability of Credit Guarantee Systems”, in Llisterri Juan and Jacob Levitsky (Eds.), Credit Guarantee Systems: International Experiences and Lessons for Latin America and the Caribbean, Inter-American Development Bank, 11/96.

Huidobro, Alberto (2003), “Garantías de Crédito de la Banca de Desarrollo: Una Nota para su Análisis”, Gaceta de Economía, Año 8, Vol. 16, Instituto Tecnológico Autónomo de México, Primavera, pp. 41-61.

Huizinga, Harry (1997), “Are there Synergies Between World Bank Partial Credit Guarantees and Private Lending?”, Working Paper No. 1802, The World Bank, August.

Instituto Nacional de Estadística, Geografía e Informática (INEGI) (2006), Censos Económicos 2004.

Jones, Phillip and Scott Mason (1980), “Valuation of Loan Guarantees”, Journal of Banking and Finance, 4, pp. 89-107.

Klein, Michael (1997), “Managing Guarantee Programs in Support of Infrastructure Investment”, Working Paper No. 1812, The World Bank, August.

Levitsky Jacob and Ranga Prasad (1989), Credit Guarantee Schemes for Small and Medium Enterprises, World Bank Technical Paper, No. 58.

Llisterri Juan and Jacob Levitsky (1996), Credit Guarantee Systems: International Experiences and Lessons for Latin America and the Caribbean, Inter-American Development Bank, 11/96.

Merton, Robert (1977), “An Analytical Derivation of the Cost of Deposit Insurance and Loan Guarantees”, Journal of Banking and Finance, 1, pp. 3-11.

Merton, Robert and Zvi Bodie (1992), “On the Management of Financial Guarantees”, Financial Management, Winter.

Meyer, Richard and Geetha Nagarajan (1997), Comments on Gudger, Michael, “Sustainability of Credit Guarantee Systems”, The Financier, Vol 4, Nos. 1 and 2, Pages. 112-114.

Mody, Ashoka and Dilip Patro (1996), “Valuing and Accounting for Loan Guarantees”, The World Bank Research Observer, Vol. 11, No. 1, February, pp. 119-142.

Morgan, David P. (1998), ‘The Credit Effects on Monetary Policy: Evidence using Loan Commitments’, Journal of Money Credit and Banking, Vol. 30, No. 1, February issue.

Riding, Allan and George Haines (2001), “Loan Guarantees: Costs of Default and Benefits to Small Firms”, Journal of Business Venturing, Vol. 16, No. 6, pp. 595-612.

Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA) (2007), “Modificaciones a las Reglas de Operación del Programa de Apoyo para Facilitar el Acceso al Financiamiento Rural”, Diario Oficial de la Federación, 9 de febrero de 2007.

Secretaría de Hacienda y Crédito Público (SHCP) (2003), “Decreto por el que se Reforman, Adicionan y Derogan Diversas Disposiciones de la Ley General de Títulos y Operaciones de Crédito; del Código de Comercio; de la Ley de Instituciones de Crédito; de la Ley del Mercado de Valores; de la Ley General de Instituciones y Sociedades Mutualistas de Seguros; de la Ley Federal de Instituciones de Fianzas y de la Ley General de Organizaciones y Actividades Auxiliares del Crédito”, Diario Oficial de la Federación, 13 de junio de 2003.

Secretaría de Hacienda y Crédito Público (SHCP) (2004), “Decreto por el que se Reforman y Adicionan Diversas Disposiciones de la Ley de Instituciones de Crédito; de la Ley de Ahorro y Crédito Popular; de la Ley de los Sistemas de Ahorro y Crédito Popular; de la Ley Federal de Instituciones de Fianzas; de la Ley General de Instituciones y Sociedades Mutualistas de Seguros; de la Ley del Mercado de Valores; de la Ley de Sociedades de Inversión, y de la Ley General de Organizaciones y Actividades Auxiliares del Crédito”, Diario Oficial de la Federación, 28 de enero de 2004.

Secretaría de Hacienda y Crédito Público (SHCP) (2005), “Disposiciones de Carácter General Aplicables a las Instituciones de Crédito”; Diario Oficial de la Federación, 2 de diciembre de 2005.

Secretaría de Hacienda y Crédito Público (SHCP) (2006.a), “Decreto por el que se Reforman, Derogan y Adicionan Diversas Disposiciones de la Ley General de Títulos y Operaciones de Crédito; Ley General de Organizaciones y Actividades Auxiliares de Crédito; Ley de Instituciones de Crédito; Ley General de Instituciones y Sociedades Mutualistas de Seguros; Ley Federal de Instituciones de Fianzas; Ley para Regular las Agrupaciones Financieras; Ley de Ahorro y Crédito Popular; Ley de Inversión Extranjera; Ley de Impuesto sobre la Renta; Ley de Impuesto al Valor Agregado y Código Fiscal de la Federación”, Diario Oficial de la Federación, 18 de julio de 2006.

Secretaría de Hacienda y Crédito Público (SHCP) (2006.b), “Resolución que Modifica las Disposiciones de Carácter General Aplicables a las Instituciones de Crédito”; Diario Oficial de la Federación, 8 de diciembre de 2006.

Secretaría de Hacienda y Crédito Público (SHCP) (2007), “Reglas de Operación del Programa de Apoyo para Facilitar el Acceso al Financiamiento Rural”, Diario Oficial de la Federación, 28 de febrero de 2007.

Vogel, Robert and Dale Adams (1996), “Costs and Benefits of Loan Guarantee Programs”, in Llisterra Juan and Jacob Levitsky (Eds.), Credit Guarantee Systems: International Experiences and Lessons for Latin America and the Caribbean, Inter-American Development Bank, 11/96.

Weller, Christian E. (2001), 'The Supply of Credit by Multinational Banks in Developing and Transition Economies: Determinants and Effects', DESA Discussion Paper No. 18. UN ST/ESA/2001/DP 16, March, 2001.

APPENDIX

CALCULATION OF THE RISK PREMIUM AND RISK AVERSION

From Equation (1) we have:

$$\pi = r_g Q_g + r(Q - Q_g) - c(Q) - \rho Q_g \dots\dots\dots(A.1)$$

Assuming $\bar{r} = E[r]$, and adding and subtracting $\bar{r}(Q - Q_g)$ in (A.1) we get:

$$\pi = (r - \bar{r})(Q - Q_g) + \bar{r}(Q - Q_g) + r_g Q_g - c(Q) - \rho Q_g \dots\dots\dots(A.2)$$

In order to rearrange (A.2) according to the measure of absolute relative risk aversion used by Copeland and Weston (1992)³⁴, assume that “the non random” revenue for the private banker is equal to:

$$a = \bar{r}Q - c(Q) + (r_g - \bar{r} - \rho)Q_g$$

and the “random” revenue is equal to:

$$h = (r - \bar{r})(Q - Q_g)$$

Assume also that:

$$h \sim E(h) - \delta(a, h)$$

so that $\pi = (a + h)$, and the private banker’s utility function can be written as:

$$u(\pi) = u(a + h)$$

Taking expectations:

$$E[u(\pi)] = E[u(a + h)] = u[a + E(h) - \delta(a, h)]$$

but, given that $E(r - \bar{r}) = 0$ (the perfect foresight assumption), $E(h) = 0$ ³⁵, so

³⁴ Pages 920-921.

$$E[u(\pi)] = E[u(a+h)] = u[a - \delta(a,h)] \dots\dots\dots(A.3)$$

Performing a Taylor's expansion on the right hand side of (A.3) we get:

$$u(a) - \delta u'(a) + \dots$$

Note that we stop at the first order expansion based on what Copeland and Weston state, quoting Pratt (1964), who assumes that second and higher order terms are insignificant. Now expanding the left hand side of (A.3):

$$E\{u(a+h)\} = E\{u(a) + hu'(a) + \frac{h^2}{2!} u''(a)\} = E\{u(a)\} + E(h)u'(a) + \frac{E(h^2)}{2!} u''(a) = u(a) + \frac{\sigma_h^2}{2} u''(a)$$

Putting the left and the right hand sides together:

$$u(a) + \frac{\sigma_h^2}{2} u''(a) = u(a) - \delta u'(a)$$

Finally, solving for δ , the risk premium:

$$\delta = -\frac{1}{2} \sigma_h^2 \frac{u''(a)}{u'(a)} = \frac{1}{2} \sigma_h^2 \lambda \dots\dots\dots(A.4)$$

Where $\lambda = -\frac{u''(a)}{u'(a)}$ is a measure of absolute risk aversion, which is always positive.

³⁵ Note also that $E[u(a)] = u(a)$, because $u(a)$ is not a random variable, and that $E\{h^2\} = \sigma_h^2$ since $\sigma_h^2 = hp_i[h_i - E(h_i)]^2 = \sum_i p_i h_i^2 = E(h_i)^2$, where p represents a probability. In this model, $E\{h^2\} = \sigma_h^2 = (r - \bar{r})^2 (Q - Q_g)^2 = \sigma_r^2$.

CALCULATION OF THE FIRST ORDER CONDITIONS FOR UTILITY MAXIMIZATION

Assuming that the private banker's profits behave normally, and that she or he has an exponential utility function:

$$\pi \sim N[E(\pi), \sigma^2_\pi]$$

$$u(\pi) = -e^{-\lambda\pi}$$

Then:

$$E[u(\pi)] = -E[e^{-\lambda\pi}] \dots\dots\dots(B.1)$$

$$E[u(\pi)] = -e^{-\lambda E(\pi)} \dots\dots\dots(B.2)$$

From Part A of the Appendix we know that:

$$E(\pi) = E(a + h)$$

That is

$$E(\pi) = E(a) + E(h) = a - \delta$$

So,

$$E[u(\pi)] = -e^{-\lambda[a - \frac{\lambda}{2}\sigma_h^2]}$$

$$E[u(\pi)] = -e^{-\lambda a + \frac{\lambda^2}{2}\sigma_h^2}$$

Therefore, the maximization problem is:

$$Max_{Q, Q_g} E[u(\pi)] = Max_{Q, Q_g} [\lambda a - \frac{1}{2} \lambda^2 \sigma_h^2] = Max_{Q, Q_g} [a - \frac{1}{2} \lambda \sigma_h^2]$$

Note that,

$$a - \frac{1}{2} \lambda \sigma_h^2 = \bar{r}Q - c(Q) + (r_g - \bar{r} - \rho)Q_g - \frac{1}{2} \lambda (r - \bar{r})^2 (Q - Q_g)^2 \dots\dots\dots(B.3)$$

So, maximising with respect to Q and Q_g and realizing that $\sigma_r^2 = (r - \bar{r})^2$, we get:

$$\frac{\partial u}{\partial Q} = \bar{r} - \frac{\partial c}{\partial Q} - \lambda (r - \bar{r})^2 (Q - Q_g) = \bar{r} - \frac{\partial c}{\partial Q} - [\lambda \sigma_r^2 (Q - Q_g)] = 0 \dots\dots\dots(B.4)$$

and

$$\frac{\partial u}{\partial Q_g} = r_g - \bar{r} - \rho + \lambda (r - \bar{r})^2 (Q - Q_g) = r_g - \bar{r} - \rho + [\lambda \sigma_r^2 (Q - Q_g)] = 0 \dots\dots\dots(B.5)$$

ALGEBRAIC PROCEDURE TO OBTAIN THE BREAK-EVEN QUANTITY

Let:

$$\Delta Q = Q_1 - Q_0 \Rightarrow Q_0 = Q_1 - \Delta Q$$

and

$$\Delta r = r_1 - r_0 \Rightarrow r_0 = r_1 - \Delta r, \text{ but } r_1 = r - \rho$$

then,

$$r_0 = r - \rho - \Delta r$$

Now, defining the supply elasticity with the reference to the pre-guarantee position at C in Figure 6:

$$\varepsilon = \frac{\Delta Q}{\Delta r} \times \frac{(r - \rho) - \Delta r}{Q_1 - \Delta Q}$$

To simplify let r' equal the observed post-guarantee interest rate ($r' = r_g - \rho$).

Then:

$$\varepsilon = \frac{(r' - \Delta r)}{Q_1 - \Delta Q} \times \frac{\Delta Q}{\Delta r},$$

$$\varepsilon \Delta r = \frac{(r' - \Delta r)}{(Q_1 - \Delta Q)} \times \Delta Q,$$

Defining,

$${}^0\bar{Q} = \frac{\Delta Q}{(Q_1 - \Delta Q)},$$

It follows that,

$$\varepsilon \Delta r = (r' - \Delta r) \overset{0}{Q},$$

Solving for Δr :

$$\Delta r = \frac{r' \overset{0}{Q}}{\left(\varepsilon + \overset{0}{Q} \right)},$$

Similarly,

$$\Delta Q = \overset{0}{Q} (Q_1 - \Delta Q),$$

$$\Delta Q \left(1 + \overset{0}{Q} \right) = \overset{0}{Q} Q_1,$$

$$\Delta Q = \frac{\overset{0}{Q} Q_1}{\left(1 + \overset{0}{Q} \right)}.$$

Defining area of triangle = A (triangle ABC shown in Figure 6),

$$A = \frac{\Delta r \Delta Q}{2}.$$

Substituting,

$$A = \frac{r' \overset{0}{Q}}{\left(\varepsilon + \overset{0}{Q} \right)} \times \frac{\overset{0}{Q} Q_1}{\left(1 + \overset{0}{Q} \right)} \times \frac{1}{2},$$

$$\frac{A}{r'Q_1} = \frac{Q^0{}^2}{2(\varepsilon + Q^0)(1 + Q^0)}.$$

Recalling that the premium ρ is paid on the entire quantity of the guaranteed credit,

at time t_0 (Q_0), the break-even value of Q is defined as:

$$\frac{Q^0{}^2}{2(\varepsilon + Q^0)(1 + Q^0)} \geq \frac{\rho(Q_1 - \Delta Q)}{r'Q_1},$$

$$\frac{Q^0{}^2}{2(\varepsilon + Q^0)(1 + Q^0)} \geq \frac{\rho}{r'} \left[\frac{1}{1 + Q^0} \right]$$

$$Q^0{}^2 \geq \frac{\rho}{r'} \left[\frac{2(\varepsilon + Q^0)(1 + Q^0)}{1 + Q^0} \right],$$

$$Q^0{}^2 \geq \frac{\rho}{r'} \left[2(\varepsilon + Q^0) \right],$$

$$\dot{Q}^2 - 2\frac{\rho}{r'}\varepsilon - 2\frac{\rho}{r'}\dot{Q} \geq 0,$$

$$\dot{Q}^2 - 2\left(\frac{\rho}{r'}\right)\dot{Q} - 2\left[\frac{\rho\varepsilon}{r'}\right] \geq 0. \quad (\text{D.1})$$

Using the quadratic formula,

$$\dot{Q} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a},$$

finally, the break-even quantity is obtained as:

$$\dot{Q} = \frac{\frac{2\rho}{r'} + \sqrt{\left(\frac{2\rho}{r'}\right)^2 + \frac{8\rho\varepsilon}{r'}}}{2}. \quad (\text{D.2})$$

TABLE 1. VAR ESTIMATES

		An aggregate case
Independent variable	Coefficients and <i>t</i> -statistics	$\Delta \ln Q_t$ (Dependent variable)
Δr_{t-1}	Coefficient	0.0809
	Standard error	(0.0407)**
	<i>t</i> -statistic	<i>1.9868</i>
$\Delta \ln Q_{t-1}$	Coefficient	0.0114
	Standard error	(0.1263)
	<i>t</i> -statistic	<i>0.0900</i>
INTERCEPT	Coefficient	0.0270
	Standard error	(0.0241)
	<i>t</i> -statistic	<i>1.1186</i>
R^2		0.0639

This table presents estimates of the VAR model. The variable in the first row (dependent variable) was regressed against the variables in the first column (independent variables). The specification of the model is shown in Equation 9. Standard errors are shown in brackets. *ln* represents natural logarithm and Δ represents first differences. Italics = *t*-statistic. (***) Indicates the coefficient is statistically significant in a two-tailed test at the 1% confidence level; (**) indicates the coefficient is statistically significant in a two-tailed test at the 5% confidence level; (*) indicates the coefficient is statistically significant in a two-tailed test at the 10% confidence level. R^2 = Coefficient of determination. The number of lags in the model was chosen using Schwarz Bayesian Information Criterion. *r* stands for an indicator of the interest rate charged by private banks. This indicator is built for internal purposes at Banco de México. For an aggregate case, the dependent variable was the whole commercial guaranteed credits granted by private banks. The adjusted sample size was 67 observations from September 2001 to June 2007.

TABLE 2. ‘BREAK-EVEN’ QUANTITY OF REAL GUARANTEED CREDIT UNDER THE VAR ESTIMATE AND ALTERNATIVE SUPPLY ELASTICITY ASSUMPTIONS

%	$\varepsilon = 0.08$ (Assumption) VAR estimate	$\varepsilon = 0.10$ (Literature)	$\varepsilon = 0.15$ (Literature)
<u>Aggregate</u>			
$\rho = 2\%$	0.3932	0.4071	0.4386
$r' = 12.24\%$			
Percentage increase in order to break-even	39.32%	40.71%	43.86%

This table presents some estimates for the percentage increase in real guaranteed commercial credits in order to break-even. Using equation (8), the table presents calculations of the implied increases in credit that would achieve ‘break-even’ when the guarantee scheme is available. Three elasticity values were considered (0.08, 0.10 and 0.15) for an aggregate case. The first elasticity was taken from the estimation of the VAR model and the other two were taken from the literature. In this case the guarantee premium was set at 2 per cent, that is, the median of the premiums charged by Mexican development banks.

**TABLE 3. GUARANTEED LOANS AS A PERCENTAGE OF COMMERCIAL,
HOUSING AND TOTAL LOANS**

	Dec. 2004	Jun. 2007
Commercial	8.3	8.3
Housing	89.4	39.5
Total Private Sector	15.2	10.9

Source: Own, based on data from Banco de Mexico and Mexican Government Banks.

TABLE 4. TOTAL AMOUNT OF CREDITS GUARANTEED BY MEXICAN GOVERNMENT BANKS (Millions of Pesos as of June of 2007)

	BANCOMEXT	BANOBRAS	FINANCIERA RURAL	FIRA	NAFIN	SHF	TOTAL
LOANS	69.3	4,901.5	808.5	25,472.6	19,356.6	88,051.1	138,659.6
AMOUNT GUARANTEED	35.2	2,744.5	62.7	14,649.0	10,102.0	22,838.1	50,431.5
AVERAGE % GUARANTEED	50.8	56.0	7.8	57.5	52.2	25.9	36.4

*/ The actual figures are US\$6.4 and US\$3.25 millions, respectively. The amount in pesos was calculated using the exchange rate of \$10.83 per dollar.

Source: Own, based on preliminary information from the Mexican Development Banks.

TABLE 5. NUMBER OF FIRMS AND VALUE ADDED (2002 THOUSANDS OF MEXICAN PESOS) BY SECTOR.

		MICRO	SMALL	MEDIUM	AVERAGE BY SECTOR
MANUFACTURING	NUMBER OF FIRMS	298,678	19,754	7,235	108,556
	VALUE ADDED *	34,500	48,479	147,798	76,926
	AVERAGE VALUE ADDED*	116	2,454	20,428	7,666
TRADE	NUMBER OF FIRMS	1,533,865	33,031	9,976	525,624
	VALUE ADDED *	197,660	102,770	103,840	134,757
	AVERAGE VALUE ADDED*	129	3,111	10,409	4,550
SERVICES	NUMBER OF FIRMS	960,135	43,835	5,179	336,383
	VALUE ADDED *	190,925	94,460	48,591	111,325
	AVERAGE VALUE ADDED*	199	2,155	9,382	3,912
AVERAGE BY SIZE	NUMBER OF FIRMS	930,893	32,207	7,463	323,521
	VALUE ADDED *	141,028	81,903	100,077	107,669
	GENERAL AVERAGE VALUE ADDED	148	2,573	13,407	5,376

Source: Own, based on data from INEGI (2006).

FIGURE 1. SHF'S AVERAGE COVERAGE OF LOANS

FIGURE 2. REAL AMOUNT OF MORTGAGES (MILLIONS OF 2002 MEXICAN PESOS) GRANTED BY MEXICAN PRIVATE BANKS.

FIGURE 3. FIRA'S AVERAGE COVERAGE OF LOANS

FIGURE 4. NAFIN'S AVERAGE COVERAGE OF LOANS

Figure 1

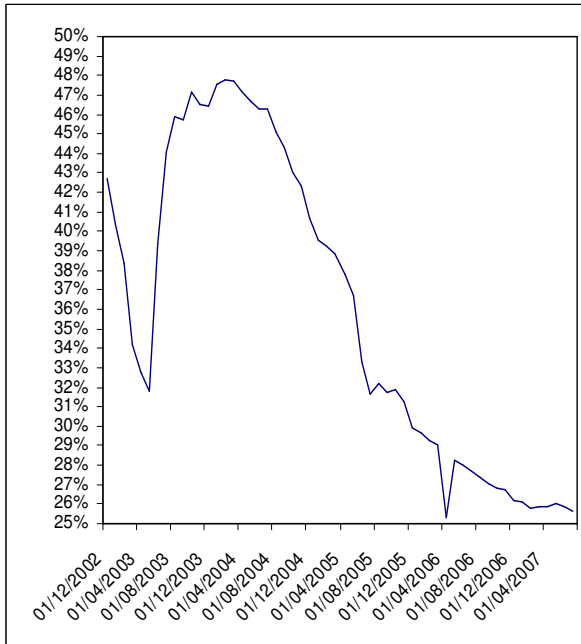


Figure 2

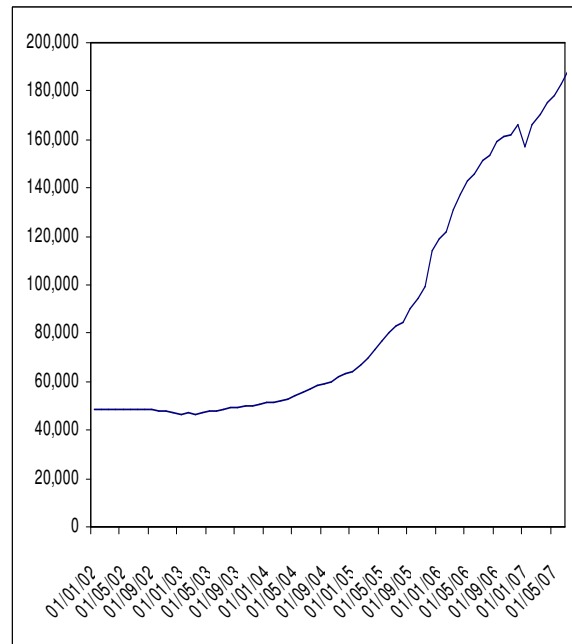


Figure 3

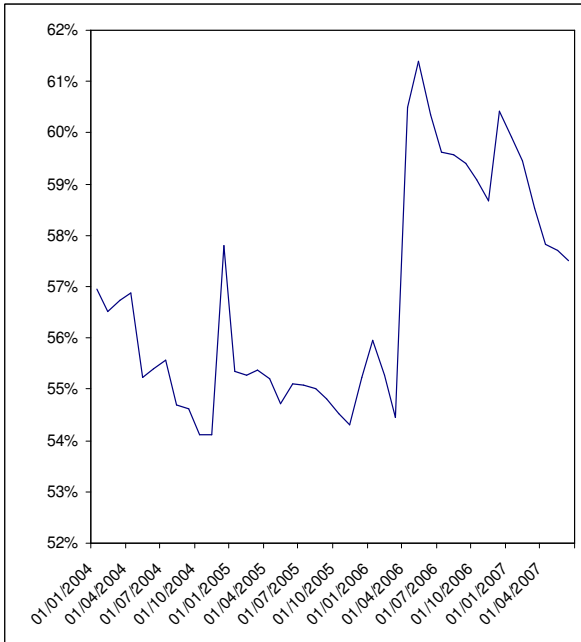


Figure 4

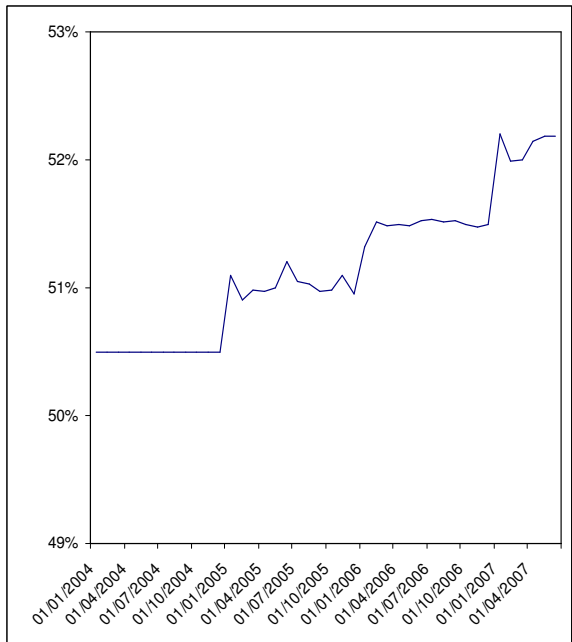
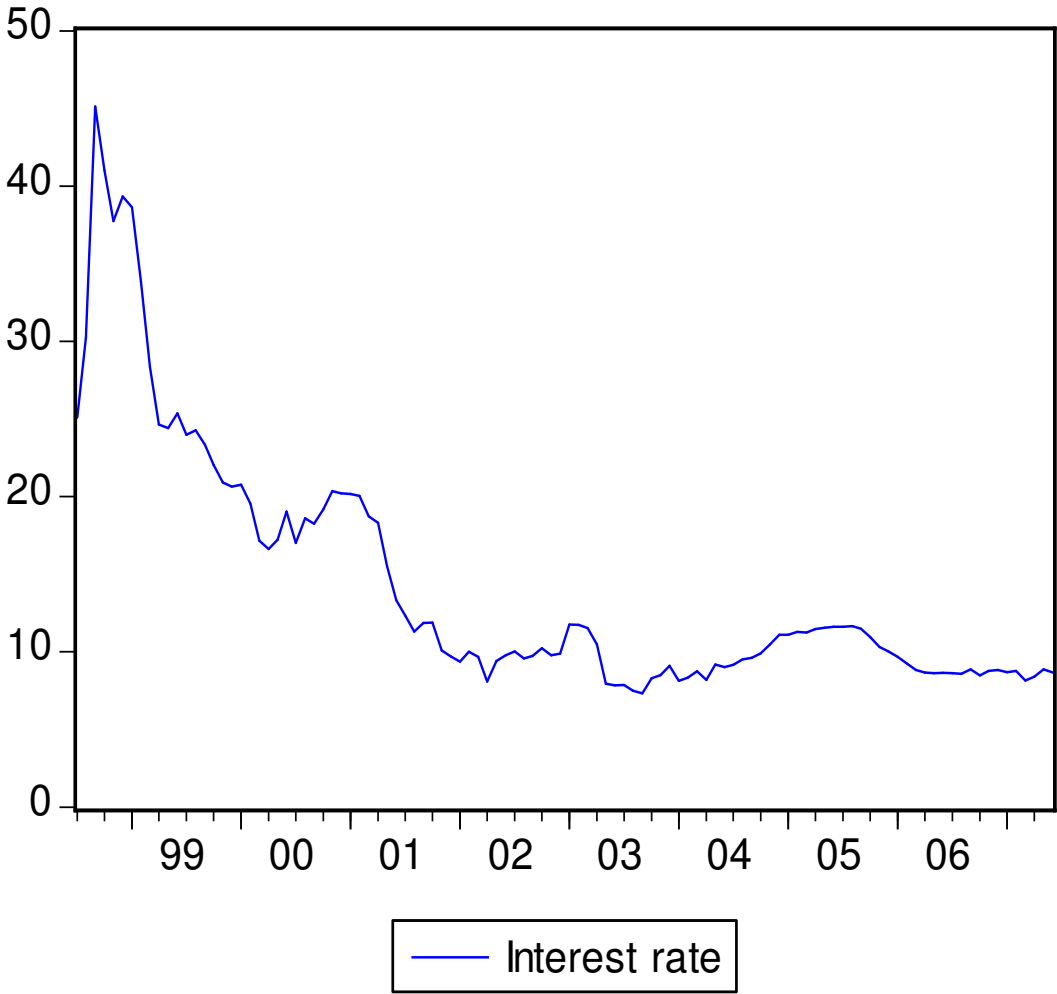


FIGURE 5 MEXICAN NOMINAL INTEREST RATE MONTHLY AVERAGES
(LEFT AXIS REPRESENTS PER CENT).



SOURCE: Own, based on preliminary data from Banco de México.

FIGURE 6. REPRESENTATION OF EQUILIBRIUM

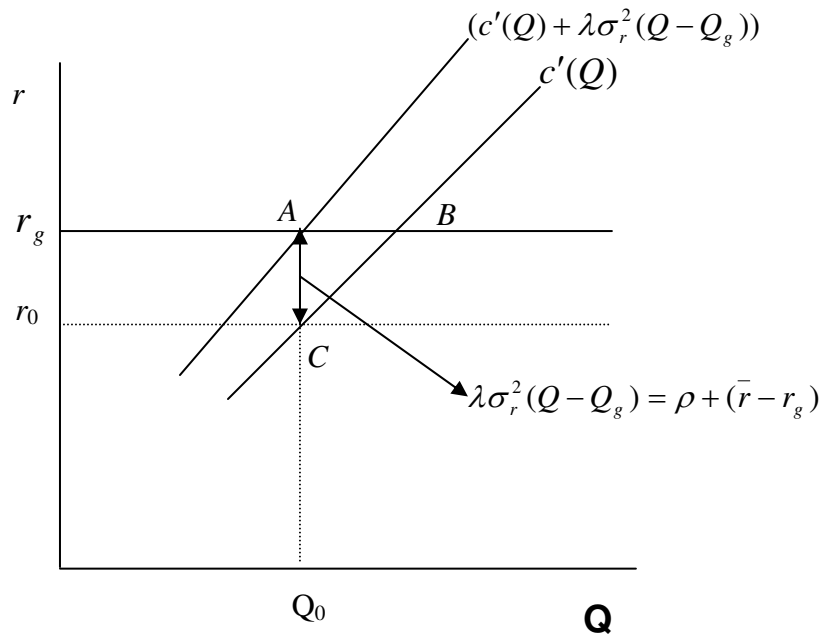


FIGURE 7. CREDIT-SUPPLY ELASTICITY MEASURE

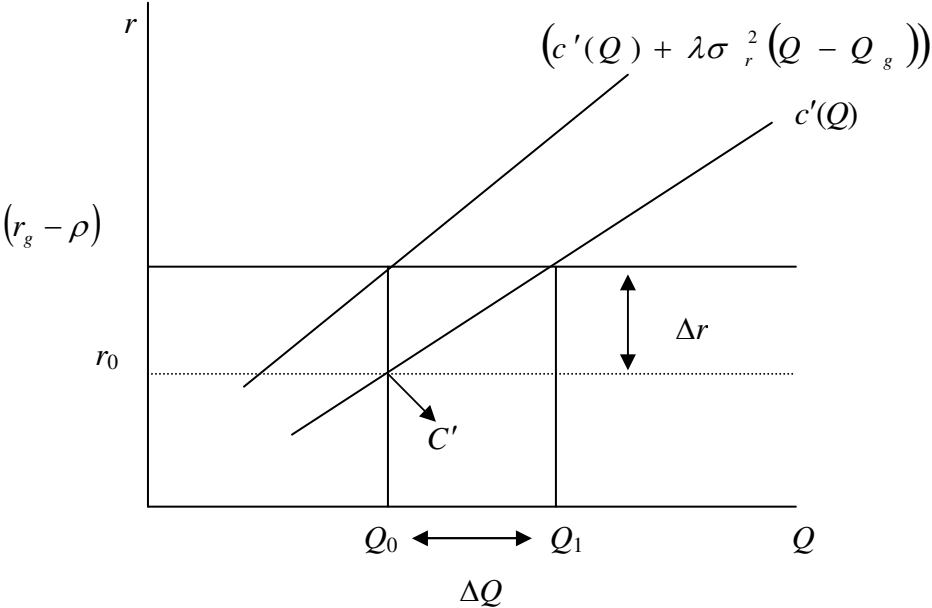
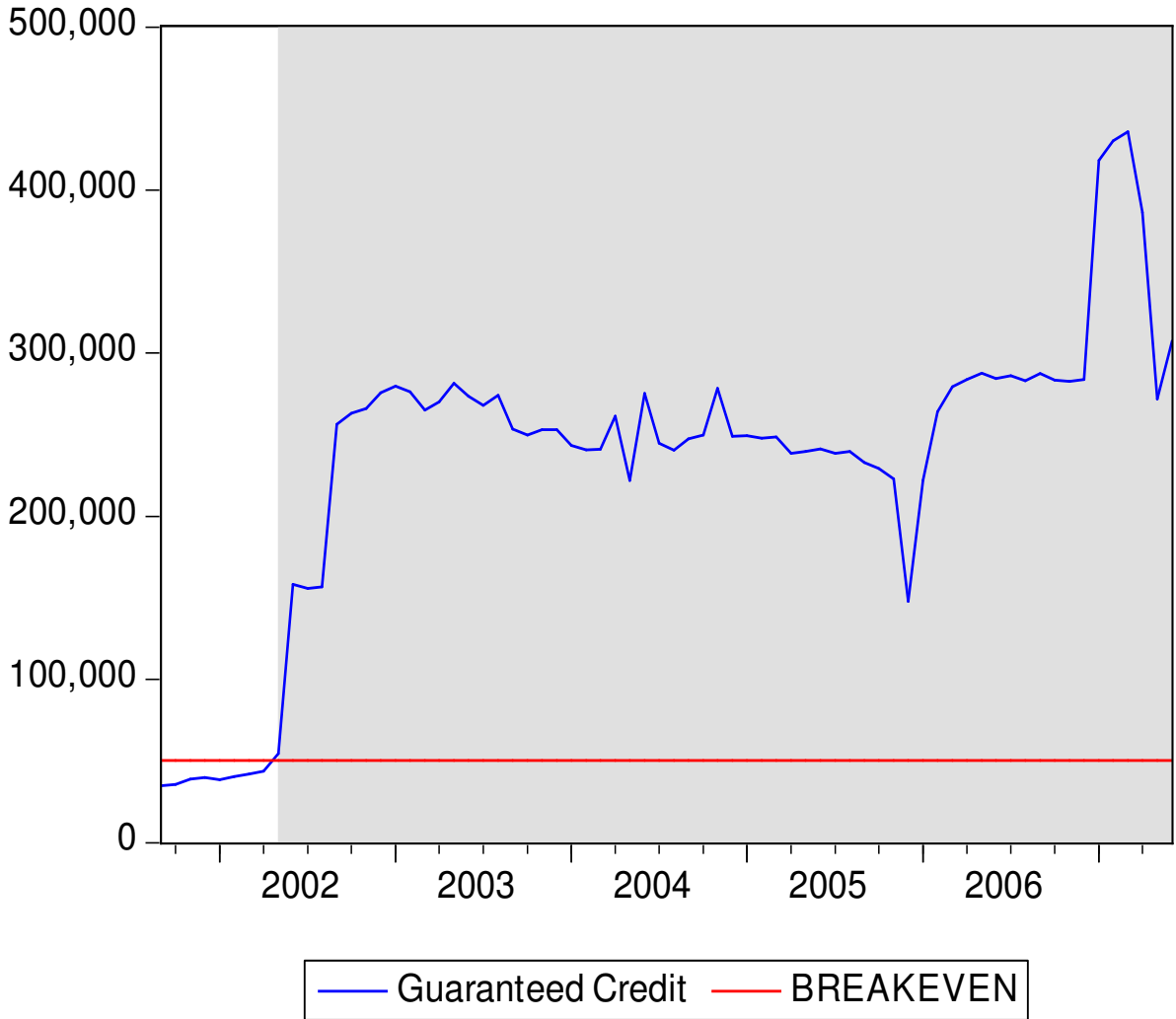
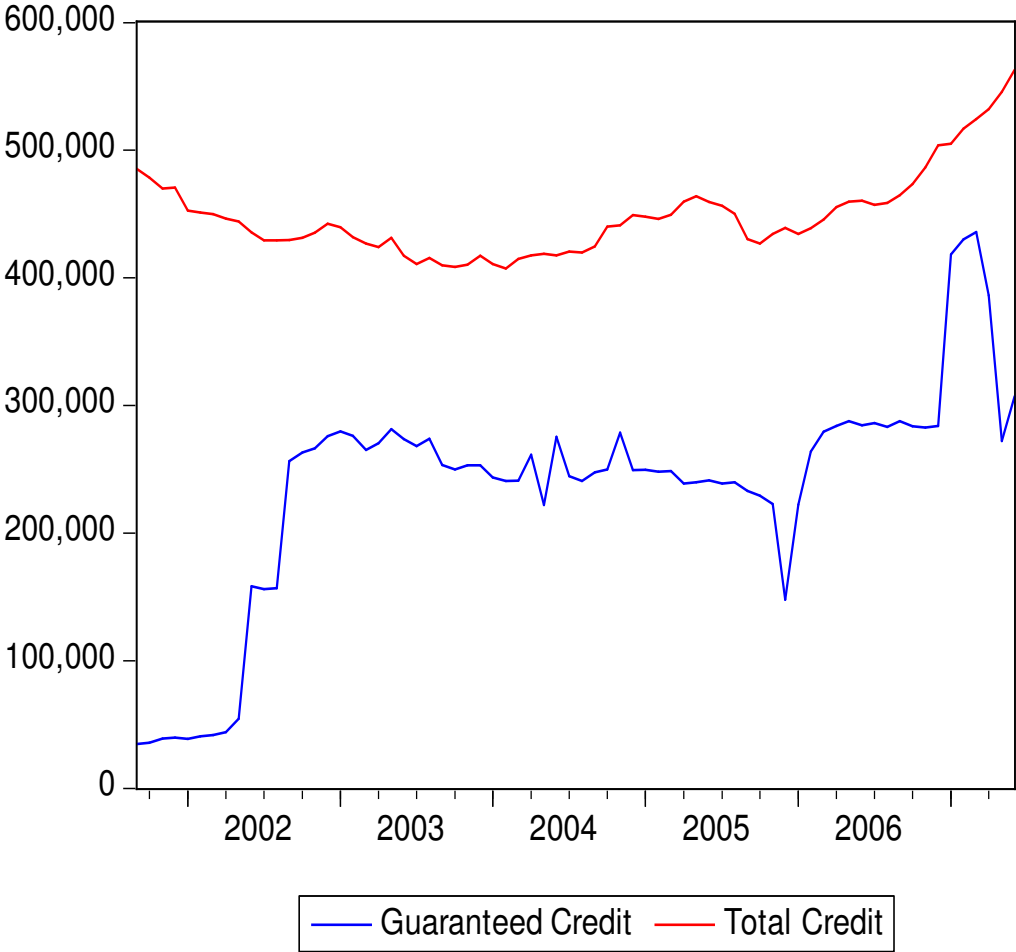


FIGURE 8. REAL GUARANTEED COMMERCIAL CREDITS (MILLIONS OF 2002 MEXICAN PESOS) GRANTED BY MEXICAN PRIVATE BANKS AND THE BREAK-EVEN AMOUNT.



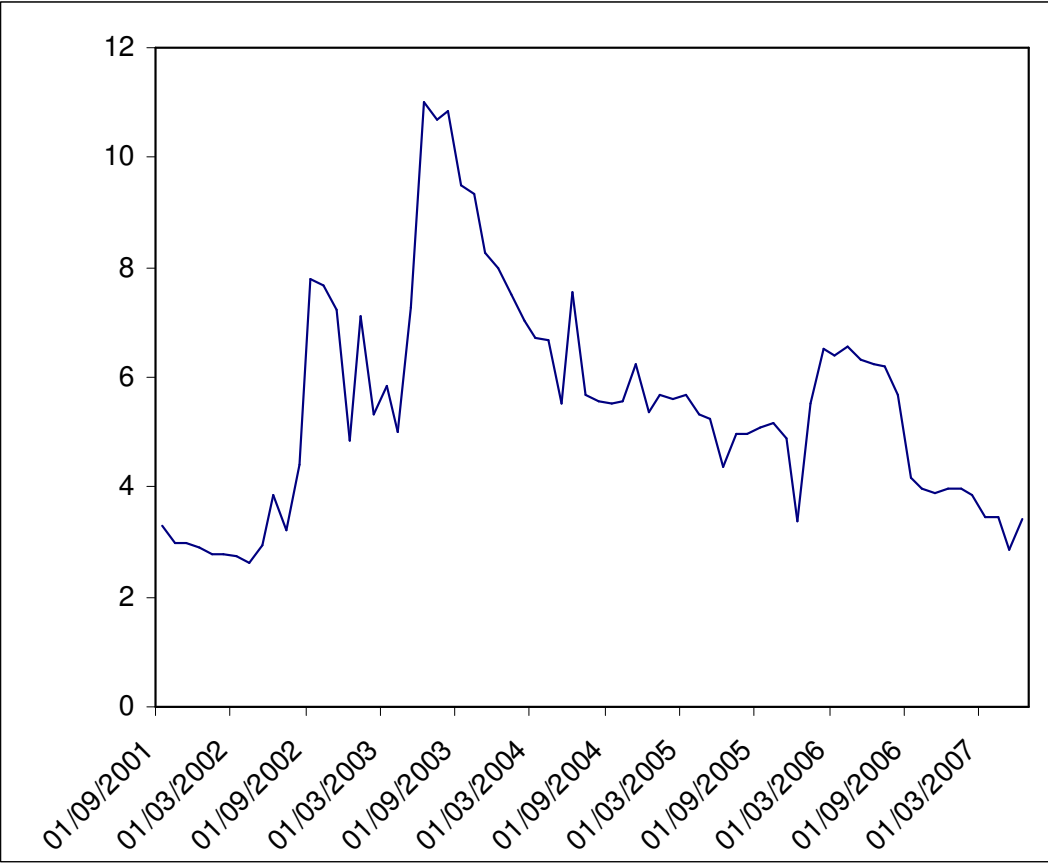
SOURCE: Own, based on data from CNBV. Figures are expressed in millions of 2002 Mexican pesos.

FIGURE 9. REAL GUARANTEED AND TOTAL COMMERCIAL CREDITS (MILLIONS OF 2002 MEXICAN PESOS) GRANTED BY MEXICAN PRIVATE BANKS.



SOURCE: Own, based on data from CNBV. Figures are expressed in millions of 2002 Mexican pesos. Total commercial credits exclude loans to sub-national governments.

FIGURE 10. REAL AVERAGE AMOUNT OF COMMERCIAL CREDITS GUARANTEED BY DEVELOPMENT BANKS (MILLIONS OF 2002 PESOS)



SOURCE: Own, based on data from CNBV. Figures are expressed in millions of 2002 Mexican pesos.