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ARE LOAN GUARANTEES EFFECTIVE? THE CASE OF MEXICAN GOVERNMENT BANKS

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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 comparative static 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 classification: C22, D61, G21, G38.

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Introduction

The objective of this paper is to determine a break-even credit increase when a loan guarantee scheme is initiated. Specifically, we study, under a comparative static setting, 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 induce,[1] 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. 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, respectively.[2]

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

[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, pages 169-70).

[2] They study the correlations between: i) interest rates and the assets values of the guarantor; ii) interest rates and the assets values of borrowing firms; iii) guarantor's and borrowing firms' values, among others.

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.

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.

Section 1 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.[3] 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.

At first glance, credit guarantees are negligible in the Mexican credit market. As Table 1 shows, the sum of the credits guaranteed by the main guarantors—*Sociedad Hipotecaria Federal* (*SHF*), *Fideicomisos Instituidos en Relación con la Agricultura* (*FIRA*) and *Nacional Financiera* (*NAFIN*)—represent roughly 10.9% of the total credits granted by private banks to the non-financial private sector.[4]

[3] See, among others, Haber (2005) and González-Anaya (2003).
[4] While there are other public sector providers, they are much less important or have little to do with guarantees directed to small and medium sized enterprises (SME's), as we will see below.

Table 1
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 2 shows the total amount of credits guaranteed by Mexican government banks in millions of pesos as of June of 2007.

Table 2
Total Amount of Credits Guaranteed by Mexican Government Banks
(millions of pesos as of June 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

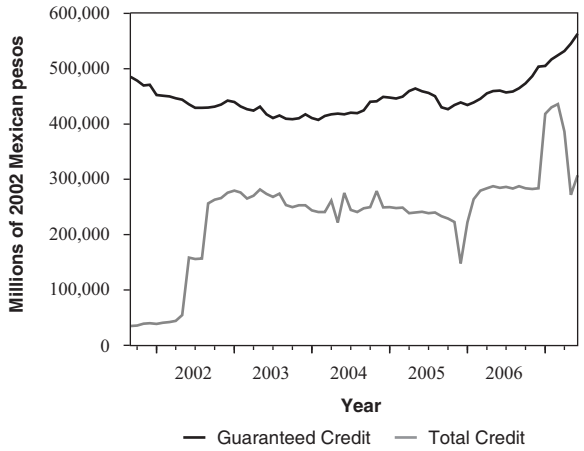
Note: The actual figures are US$6.4 and US$3.25 millions, respectively. The amount in pesos was calculated using the exchange rate of $10.83 per dollar.
Source: Own, based on preliminary information from the Mexican development banks.

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 (for example see Figure 1).[5]

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 institutions, etc.

[5] *Source*: Guaranteed credit data obtained from *CNBV* (*CNBV* is a shortcut for *Comisión Nacional Bancaria y de Valores*, the banks' supervisory body in Mexico). Total credit data obtained from *Banco de México*.

Figure 1
Real Guaranteed and Total Commercial Credits Granted by Mexican Private Banks



Note: Total commercial credits exclude loans to sub-national governments.
Source: Own, based on data from CNBV.

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 1. The Model is presented in detail in Section 2. Section 3 presents the Break-even analysis. Finally, Section 4 concludes.

1. Purpose and Main Features of Credit (Loan) Guarantee Programs in Mexico

As Meyer and Nagarajan (1997) state, 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 without the need for guarantees" (Meyer and Nagarajan 1997). Therefore, the explicit objective of credit guarantee programs is usually additionality in bank lending to the target sector.[6] On the other hand, the implicit objective could be thought as

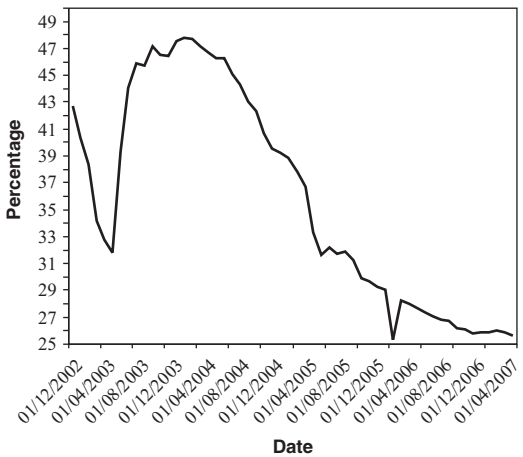
[6] Riding and Haines (2001) clarify that additionality refers to the extra or additional loans that could be made because of the guarantee. "Extra loans can be thought of as the benefit of the guarantee". However, they also mention that additionality can take a variety of forms besides higher volumes 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."

fostering the economic growth of the targeted population that could be achieved because of improved access to credit.

In Mexico, the direct beneficiaries of these schemes[7] receive automatic payments of the guarantees, once the default appears, and the covered loans are subject to ex-post verification. Guarantors usually make sure that the guarantees went to eligible loans, that is, those directed to the above-mentioned groups or sectors. The particular features of these guarantee Programs are described below.

Sociedad Hipotecaria Federal (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 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%.[8] 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 2).

Figure 2
SHF's Average Coverage of Loans



Source: Own, based on data from SHF through INFOMEX.

[7] Under our framework, lenders refer only to private banks.
[8] Visit SHF's web page www.shf.gob.mx. (Available in Spanish only).

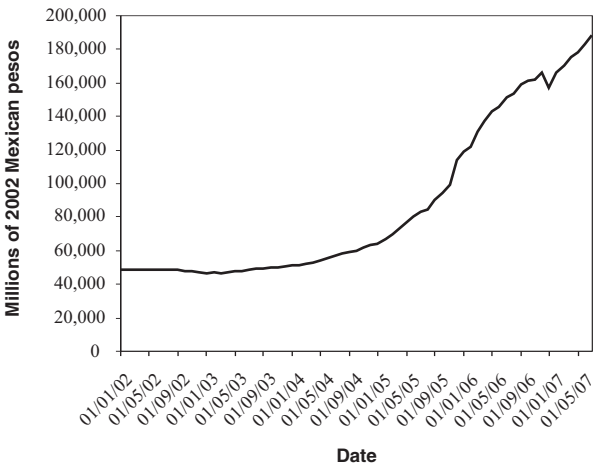
This might be a reflection of a kind of "success story", as it might be the case that other guarantors, public and private, are probably assuming increasing shares of the risk involved in these credits, while mortgages have grown rapidly since 2004 (see Figure 3).

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.

Fideicomisos Instituidos en Relación con la Agricultura (*FIRA*)—a group of governmental trust funds that provide financial assistance to the rural sector—through the *Fondo Especial de Asistencia Técnica y Garantía para Créditos Agropecuarios* (*FEGA*), 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 sectors.[9]

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 pesos[10] (as of the end of 2004) of guaranteed amount.

Figure 3
Real Amount of Mortgages Granted by Mexican Private Banks



Source: Own, based on data from CNBV.

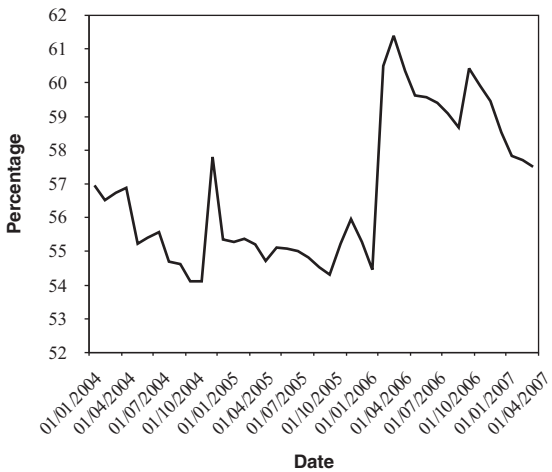
[9] Visit FIRA's web page www.fira.gob.mx. (Available in Spanish only).
[10] This is approximately US$9.79 million considering an exchange rate of $10.83 per dollar.

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 4).

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%.

Nacional Financiera (*NAFIN*), a government-owned bank, administers several credit guarantee programs, but the availability of information is rather thin[11]. 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 5), and the median premium charged is 2%.

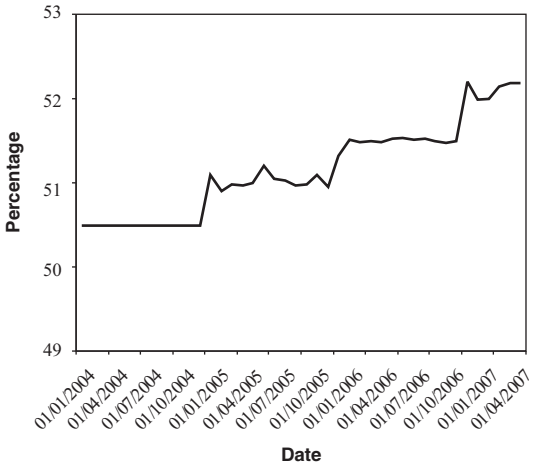
Figure 4
FIRA's Average Coverage of Loans



Source: Own, based on data from FIRA through INFOMEX.

[11] Visit NAFIN's web page www.nafin.gob.mx. (This site is also available in English).

Figure 5
NAFIN's Average Coverage of Loans



Source: Own, based on data from NAFIN through INFOMEX.

Banco Nacional de Obras y Servicios Públicos (*BANOBRAS*), another government-owned bank, offers credit guarantees in order to back credits granted to subnational (state and local) governments, usually directed to finance infrastructure projects. As this kind of credit guarantees are not related to our study, we limit ourselves to briefly mention them.

Up to the end of 2006, *Banco Nacional de Comercio Exterior* (*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 side.[12]

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 debtor.[13] 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.

[12] 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*.
[13] *Idem*.

Finally, *Financiera Rural* is a relatively new government body which performs operations that replicate those of development banks, but is not a bank itself.[14] It administers several credit guarantee programs, basically in the name of *SAGARPA,*[15] 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 locality.[16] 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.

2. The Model

2.1 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 banks.[17] 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.

First, it is assumed that private bankers are risk averse, that is, they are unwilling to take unnecessary risks.[18] Second, they are interest rate-takers; they take the prevailing market interest

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[14] *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.

[15] *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.

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

[17] 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 $\Delta R = -g\gamma_0 Q_0$, 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: $Q_1 = \frac{[k(\beta_3 - \beta_2) + \gamma_0]}{\beta_3 k + \gamma_1} gQ_0$, [$\gamma_1$ 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.

[18] Haber (2005) asserts that bankers in Mexico became increasingly risk-averse since 1997 due to the difficulty to enforce property rights. Besides that, our assumption comes from applying a derivation based on Copeland and Weston (1992) and Pratt (1964) methodologies. As it can be seen the coefficient of risk aversion (λ) will always be positive. This concept is intuitive in investment theory specifically for an investor utility function. We assume we could extend it for the case of a banker.

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 side.[19] 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,

$$Q = Qg + Qn \qquad \text{(where, } Qg \geq 0,\ Qn \geq 0\text{)}.$$

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:

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

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 credit.[20]

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:

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

Following a standard procedure (using Taylor series expansion) to obtain the expected net revenue and its variance within a mean-variance framework,[21] and assuming the banker has perfect foresight,[22] it will therefore be:

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

[19] Even though this assumption might seem too strong, it is very necessary under our analytical framework (see Copeland and Weston 1992). An assumption of no information asymmetries is in line with bankers being interest rate-takers. This is analogous for the case of perfect competition (market structure) where there exists many agents, which all have available information about a product and they are price-takers. This assumption also 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.

[20] 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.

[21] See Copeland and Weston (1992), pages 145-192, for a more detailed explanation of this procedure.

[22] That is, $\bar{r} = r$.

$$\sigma_{\pi}^{2} = \sigma_{r}^{2}\left(Q - Q_{g}\right)^{2}. \tag{2b}$$

Assume that the banker has an exponential utility function:

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

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

$$E\left[u(\pi)\right] = -e^{-\lambda[E(\pi)]} \tag{3a}$$

The banker's utility is therefore maximised according to the following objective function:

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

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

$$Max_{Q,Q_g}\left(E(\overline{\pi}) - \frac{\lambda}{2}\sigma_{\pi}^{2}\right) = \overline{r}Q - c(Q) - \rho Q_{g} + (r_{g} - \overline{r})Q_{g} - \frac{1}{2}\lambda\left(Q - Q_{g}\right)^{2}\sigma_{r}^{2} \tag{5}$$

This is the objective function for the private banker. For our simplified case the first order conditions are:[23]

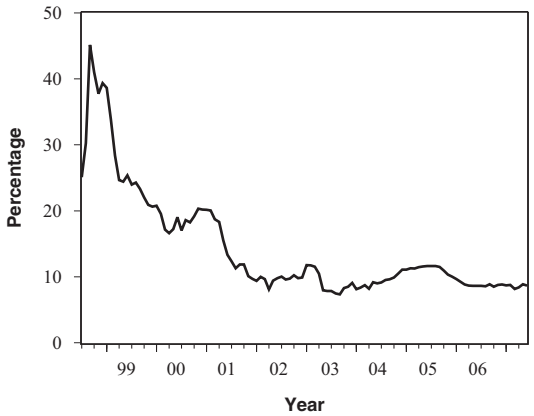
$$\frac{\partial u}{\partial Q} = 0 = \overline{r} - \frac{\partial c}{\partial Q} - \left[\lambda\sigma_{r}^{2}\left(Q - Q_{g}\right)\right] \tag{6}$$

$$\frac{\partial u}{\partial Q_{g}} = 0 = r_{g} - \overline{r} - \rho + \left[\lambda\sigma_{r}^{2}\left(Q - Q_{g}\right)\right] \tag{7}$$

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

[23] A detailed mathematical derivation is available to the interested reader upon request to the authors.

Figure 6
Mexican Nominal Interest Rate
(monthly averages)



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

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 6 shows a time-series of monthly Mexican nominal interest rates during the period 1998-2007.[24]

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.

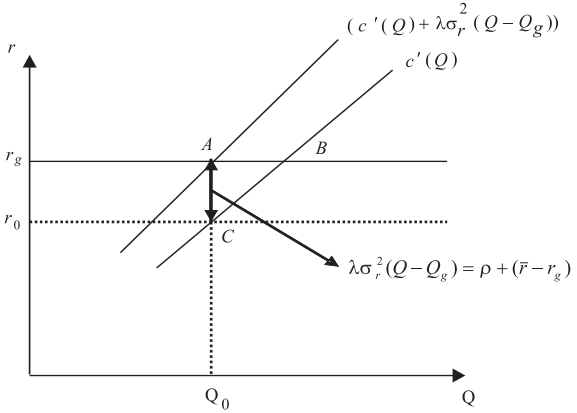
While motivations for private bankers to accept a guarantee program are clear, it is not the case when asking if such programs are achieving their goal of fostering the quantity of real credit available to the Mexican non-financial firms. In order to investigate further this phenomenon, as well as to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

[24] 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.

2.2 Loan guarantees and 'break-even' quantity of credit

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

Figure 7
Representation of Equilibrium



Assuming a linear marginal cost curve [$c'(Q)$], Figure 7 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 the interest rate is taken as being zero, an alternative marginal cost curve is implied $\left[c'(Q)+\lambda\sigma_r^2(Q-Q_g)\right]$. To derive a comparative static 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 banker.[25]

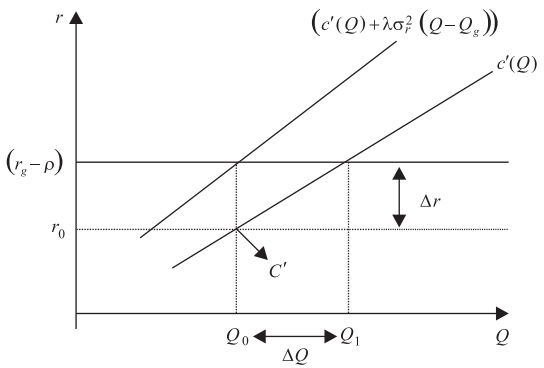
[25] The diagram shows that this represents the marginal cash value to the banker of the risk being borne with the initially not-guaranteed credit.

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 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 the guaranteed interest rate ($\bar{r} = r_g$) and all the credit would be guaranteed.[26] 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) credit.[27]

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 8, will show that the required proportional increase in the amount of credit is expressed as follows:[28]

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

Figure 8
Credit-Supply Elasticity Measure



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

[27] 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 $[(\rho)(Q-Q_g)]$.

[28] It is important to point out that the break-even quantity is for the whole system, i.e. an aggregate case. Because of data limitations we were not able to carry out the estimation for each individual Mexican Government Banks. A detailed mathematical derivation of Equation 8 is available to the interested reader upon request.

The break-even percentage quantity increase ($\overset{0}{Q}$) therefore depends positively on the supply elasticity (ε) reflecting the marginal cost schedule, the premium (ρ) expressed here as a percentage of the credit granted, and inversely on the interest rate (r') (See Figure 8). It depends positively on ε given that a relatively elastic cost schedule will imply a flatter curve. If there is an upward movement in ε *ceteris paribus* a higher quantity will be needed in order to reach the break even (see Figure 8). On the other hand, a relatively inelastic or steeper cost curve implies a lesser amount of Q needed in order to reach the break-even (see Figure 8). In terms of the positive relationship between the quantity increase needed to break-even and the amount of the premium ρ the intuition is that the larger ρ the greater the amount of credit is needed to break-even. That is, a larger Q will be needed to compensate for a more expensive guarantee. In regards to the inverse relationship between the quantity increase needed to break-even and r, a possible explanation may be related to the risk implied in a high value of r. Was r to signal for higher risk, given risk-aversion and a guarantee scheme available, the motivation for a banker to lend more money may decrease in order to reach break-even. Moreover, higher interest rates may leave some projects out of financing. So, basically few variables are needed to calculate the break-even percentage quantity increase in this comparative static analysis framework. Whereas Mexican data did not easily permit direct estimation of the elasticity coefficient, a proxy for the former parameter may be derived for the case of credit.

Considering that an elasticity coefficient is needed some elasticity values are estimated and other are taken from the literature. Therefore 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 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.[29]

2.3 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:

$$x_t = A_0 + A_1 x_{t-1} + \ldots + A_p x_{t-p} + B_0 z_t + B_1 z_{t-1} + \ldots + B_r z_{t-r} + u_t \qquad (9)$$

[29] 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.

In this representation x is a vector of variables in the system. A_0 represents a n x 1 vector of intercept terms. $A_1,\ldots,A_p$ represent n x n matrices of coefficients of the lagged values of the endogenous variables. $B_0,\ldots,B_r$ represent n x m matrices of coefficients of the current and lagged values of the exogenous variables (z's). Finally, u_t represent a n x 1 vector of error terms. The results of the VAR model are reported in Table 3.

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 operations. 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 3 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

Table 3
VAR Estimates

An aggregate case		$\Delta ln\ Q_t$	$\Delta ln\ r_t$
Independent variable	**Coefficients and *t*-statistics**	**(dependent variable)**	**(dependent variable)**
$\Delta\ r_{t-1}$	Coefficient	0.0809**	0.1655
	Standard error	(0.0407)	(0.1231)
	t-statistic	*1.9868*	*1.3448*
$\Delta ln\ Q_{t-1}$	Coefficient	0.0114	0.3047
	Standard error	(0.1263)	(0.3820)
	t-statistic	*0.0900*	*0.7976*
Intercept	Coefficient	0.0270	-0.0236
	Standard error	(0.0241)	(0.0730)
	t-statistic	*1.1186*	*-0.3232*
R^2		0.0639	0.0409

Note: 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. *ln* represents natural logarithm and Δ represents first differences. (**) indicates the coefficient is statistically significant in a two-tailed test at the 95% confidence level. R^2 = Coefficient of determination. The number of lags in the model was chosen using Schwarz Bayesian Information Criterion. Q represents the whole commercial guaranteed credits granted by private banks. r stands for an indicator of the interest rate charged by private banks. This indicator is built for internal purposes at *Banco de México*. The adjusted sample size was 67 observations from September 2001 to June 2007.

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).

3. Break-Even Analysis

Using equation (8), Table 4 presents calculations of the implied increases in credit that would achieve 'break-even' when the guarantee scheme is available.[30]

Table 4
'Break-Even' Quantity of Real Guaranteed Credit under the VAR Estimate and Alternative Supply Elasticity Assumptions

Elasticity ε (%)	ε = 0.08 (assumption) VAR estimate	ε = 0.10 (literature)	ε = 0.15 (literature)
Aggregate ρ=2%; r' =12.24%	0.393	0.407	0.439
Percentage increase in order to break-even	39.32	40.71	43.86

Note: 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.

Three 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.

[30] We are aware about data limitations. However, the database we use is the only one available in the country that has the record of all guaranteed credits from 2001 on. This database is updated by the *CNBV* and is not easily available for the public.

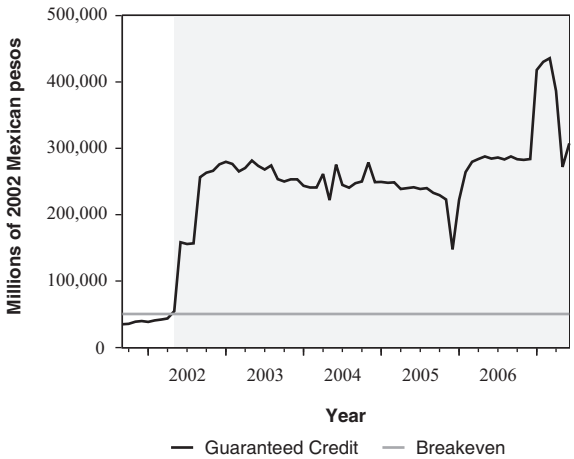
3.1 Analysis of the results

The estimates of the required credit increase in Table 4 are measures relating the distance AB in Figure 7. The magnitudes are reported in the final line of Table 4 and expressed as a fraction of the guaranteed credit granted (Q), range from 39.3 to 43.9 per cent.[31]

A clearer perspective can be obtained in a graphical representation. Figure 9 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-

Figure 9
Real Guaranteed Commercial Credits Granted by Mexican Private Banks and the Break-Even Amount



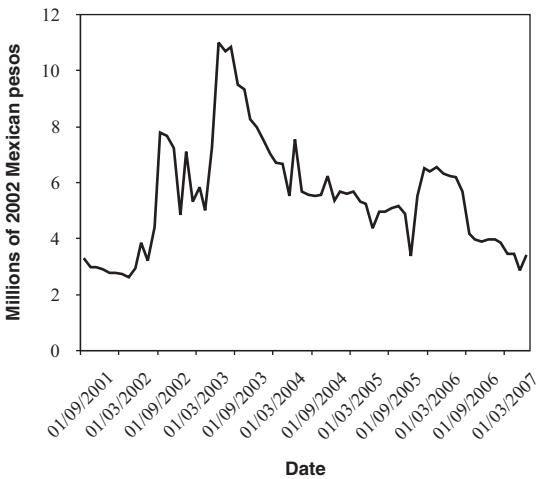
Source: Own, based on data from CNBV.

[31] Assuming that the whole quantity of credit is guaranteed.

even quantity.[32] For comparison purposes we also illustrate in Figure 10 real average amount of commercial credits (millions of 2002 Mexican pesos) granted by Mexican private banks.

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 and/or repossess the assets pledged as collaterals.[33] Also, financial authorities approved, by the end of 2005, the use of credit scoring[34] especially to small amount credits.[35] 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.[36] But there might be another powerful explanation.

Figure 10
Real Average Amount of Commercial Credits Guaranteed by Development Banks



Source: Own, based on data from CNBV.

[32] 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. The source of this information is *CNBV* for the real guaranteed commercial credits. The break-even quantity was obtained from own calculations using Equation 8 above.

[33] See SHCP (2003), SHCP (2004) and SHCP (2006a).

[34] 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).

[35] See SHCP (2005) and SHCP (2006b).

[36] *Source*: Data obtained from *CNBV*.

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%.[37] 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%.[38]

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). Even though the reduction in the average amount of guaranteed credits might be thought as a signal in the additionality direction, this possibility is to be confirmed through deeper research on the subject. At this stage the conjecture can be stated on the grounds of comparing value added by the smallest firms in the economy, and average commercial loans guaranteed. Table 5 shows that micro and small firms produce a maximum average of $2.7 million value added a year.

[37] 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.
[38] 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).

Table 5
Number of Firms and Value Added by Sector
(2002 thousands of Mexican pesos)

	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).

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, and might also discourage potential private guarantors form entering this market.

It is worth noting that, besides credit guarantees, there might be other financial instruments by which governments could possibly promote the risk sharing of loans directed to small and medium sized firms and stimulate the provision of credit to certain groups or industries, such as co-financing or co-funding schemes, securitization, etc. However, in the Mexican experience it has taken long to develop new instruments of the like, and the most promising progress has been reached on mortgage loan securitization, while small and medium sized firms' loans securitization remains as a future goal.

4. Conclusions

Considering that access to loan guarantees is beneficial to private bankers, Mexican credit guarantee schemes, as currently designed, seem like a puzzle. Under our theoretical setting, which relies on standard portfolio assumptions, we find that when 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 54.4% 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 are 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 particularly recommended that further research focus on proper measures of the additionality achieved with these Programs, if any. 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 extra benefits for commercial banks if loan guarantee-premiums were unfairly priced and/or if percent coverage were too high, given certain level of premiums.

On the other hand, it is worth noting several limitations in our analysis. Firstly, we based our study on the very limited data availability, a limitation that restricted the scope of our paper and which ideally could be overcome in the future. Second, our analytical framework made use of several assumptions that could eventually be relaxed, such as information symmetry on the lender's side. Were we to abandon it, a new analytical framework needs to be developed. Thirdly, while our model helps to understand how a lender determines a break-even amount of guaranteed loans, from a portfolio perspective, it does not deal with other relevant aspects of credit guarantees, such as their fiscal consequences, their impact on social welfare or their intended benefits in terms of additionality. We acknowledge, however, that this sort of issues should be addressed in future research work.

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