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"The Exchange Rate Regime and the Currency Composition of Corporate Debt: The Mexican Experience"

Lorenza Martínez
lmartin@banxico.org.mx

Alejandro Werner[1/, 2/]
awerner@banxico.org.mx

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Abstract

This paper analyses the effect that the change from a fixed to a floating exchange rate regime that took place in Mexico in December 1994, had on the currency composition of corporate debt. In particular, the paper asks whether a fixed exchange rate regime biases corporate borrowing towards foreign currency, due to an implicit exchange rate guarantee given by the government. Therefore, under a predetermined regime firms will not fully internalize their exchange rate risk and, they will be more likely to engage in balance sheet mismatches than under a floating regime. We study the main determinants of foreign currency borrowing of those firms listed in the Mexican Stock Exchange from 1992 to 2000 to test whether balance sheet currency mismatches fell after the adoption of the floating exchange rate regime. The result found, support the view that the floating exchange rate regime has been useful in reducing exchange rate exposure.

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2/ Both authors work at the Research Department at Banco de México. We thank Judith Frías, Eduardo Espinosa and Daniel Acevedo for research assistance. The authors are responsible for the opinions expressed in this paper and they do not represent those of Banco de México. Contact information: Tel. (525) 237.25.73, Address: Av. 5 de Mayo # 18, piso 4, Col. Centro, México, D. F. 06059, México.

I. Introduction

This paper analyses the effect that the change from a fixed to a floating exchange rate regime that took place in Mexico in December 1994, had on the currency composition of corporate debt. In particular, the paper asks whether a fixed exchange rate regime biases corporate borrowing towards foreign currency, due to an implicit exchange rate guarantee given by the government. Therefore, under a predetermined regime firms will not fully internalize their exchange rate risk and they will be more likely to engage in balance sheet mismatches than under a floating regime. We study the main determinants of foreign currency borrowing of those firms listed in the Mexican Stock Exchange from 1992 to 2000 to test whether balance sheet currency mismatches fell after the adoption of the floating exchange rate regime.

One key point in the current discussion on the reform of the international financial architecture is the impact of the exchange rate regime on financial vulnerability. One of the main channels through which the exchange rate regime can affect the vulnerability of an economy is through its impact on foreign currency borrowing. However, there is no clear consensus among economists regarding this last point.

On the one hand, several authors have argued that a pegged exchange rate is another variation of implicit guarantees. This is the case because to maintain this regime, the monetary authority will always claim that the prospects of a change in the parity are nil. Through its constant denial of the possibility of a change in the parity, the authorities will be implicitly assuming part of the cost that the private sector would incur in the case of a devaluation. In these circumstances, private sector agents will have less incentives to hedge their foreign currency exposure.

These arguments have been made recently by many authors. The following quote from Fisher (2001) clearly states the biased incentives towards foreign currency borrowing in a pegged regime*:*

"The belief that the exchange rate will not change removes the need to hedge, and reduces perceptions of the risk of borrowing in foreign currencies".

Along the same lines, Mishkin (1996) highlights the advantages of floating regimes:

"Indeed, the daily fluctuations in the exchange rate in a flexible exchange rate regime have the advantage of making clear to private firms, banks and governments that there is substantial risk involved in issuing liabilities denominated in foreign currencies".

On the other hand, without totally dismissing the implicit guarantees argument, several authors claim that some emerging markets have a natural tendency for liability dollarization that is more ingrained in the system than what can be explained by the presence of a pegged exchange rate regime. This has been termed the original sin hypothesis (see Eichengreen and Hausmann (2000)). According to these authors:

"This is a situation in which the domestic currency cannot be used to borrow abroad or to borrow long term, even domestically. In the presence of this incompleteness, financial fragility is unavoidable because all domestic investments will have either a currency mismatch (projects that generate pesos will be financed with dollars) or a maturity mismatch (long-term projects will be financed with short-term loans).

Critically, these mismatches exist not because banks and firms lack the prudence to hedge their exposures. The problem rather is that a country whose external liabilities are necessarily denominated in foreign exchange is, by definition, unable to hedge. Assuming that there will be someone on the other side of the market for

foreign currency hedges is equivalent to assuming that the country can borrow abroad in its own currency. Similarly, the problem is not that firms simply lack the foresight to match the maturity structure of their assets and liabilities; it is that they find it impossible to do so. The incompleteness of financial markets is, thus, at the root of financial fragility. It follows that both fixed and flexible exchange rates are problematic."

Other authors (for example Calvo and Reinhart (2000 (a) and (b)) have made claims along similar lines arguing that the problem of unhedged foreign currency liabilities has deeper roots than the choice of exchange rate regimes. Therefore, the movement towards floating regimes that is taking place in emerging markets will not alleviate this problem.

Although the debate has been intense, there are no empirical studies that look at this issue. And we should say that at the end of the day this is mainly an empirical question. The recent Mexican experience represents a good case study to tackle this question. Mexico was the first country to suffer a "XXIst Century Crisis" (that started with the devaluation of the peso on December 19, 1994) and to adopt a floating exchange rate regime after that. In addition, the availability of data permits a thorough study of the determinants of corporate foreign currency debt.

We take both of the hypothesis mentioned before seriously to argue that they complement each other. The fact that a country cannot issue debt in its own currency does not mean that those creditors that are lending in foreign currency should not take into consideration the exchange rate risks they are undertaking by lending to Mexican firms. And, although there might not be a deep enough market for hedges, different firms have different exchange rate exposures according to whether they sell in domestic or foreign markets. Because of this, creditors can adjust their currency exposure by selecting different types of firms. Therefore, it is extremely plausible that in an economy suffering from "original sin", a fixed

exchange rate carries with it an implicit exchange rate insurance and, therefore incentivates foreign currency lending to this economy.

To formalize this arguments we extend the simple model developed by Holmstrom and Tirole (1997) to allow for the possibility of currency mismatches. In our version of the model firms can borrow in pesos from local banks who serve a monitoring role and in dollars from the international capital markets where the cost of capital is lower. Therefore, we take Eichengreen and Hausmann seriously and model the implication of their hypothesis. This simple model has clear implications for the determinants of the share of dollar debt in total debt. Those firms that have a higher probability of success in their investment projects, have a smaller informational problem, and are more export oriented will have a higher share of dollar denominated debt and a more leverage. Also, to the extent that a fixed exchange rate regime is associated with an implicit guarantee, the export orientation of a firm will be less important in determining foreign currency debt under this regime, increasing its share in total debt and leading to an increase in leverage.

In the empirical part of the paper we describe the evolution of the share of dollar denominated debt in total debt for Mexican corporates from 1992 to 2000 and perform an econometric study to asses its main determinants. In that section we find that although the share of dollar debt to total increased from 34% in 1994 to 49% in 2000 for the median firm the exposure to a depreciation risk decreased during the same period. The ratio of dollar debt to exports decreased from 3.9 in 1994 to 1.6 in 2000, for the median firm.

The result of estimating the reduced form obtained from the model for the ratio of dollar debt to total, indicate on the one hand that during the predetermined exchange rate regime our endogenous variable was mainly explained by the size of the firm and marginally by the exports. So, in terms of the weight given to the exchange rate risk we conclude that there was little difference between foreign and domestic sales.

On the other hand, during the free floating regime, exports became the only significant variable determining the importance of dollar indebtness. These results are robust even when we control for sales growth. Moreover, as predicted by the model the estimated total indebtness is lower for the second period than for the first one, controlling for firm characteristic.

Finally, the last section presents the main conclusion of the paper and directions for future research.

II. A simple model:

We use the model developed by Holmstrom and Tirole (1997) to analyze the financing alternatives of a firm that has to chose a level of investment (I) and has a limited amount of internal funds (A). When the desired level of investment exceeds the firm's assets, corporates will have to finance the rest either through domestic banks that lend in pesos (at short maturities)[3] or foreign creditors that lend in dollars.

A contract should specify how much each party will invest and the payments to each of them as a function of the outcome of the project. One optimal contract will have the following structure:

(i) The firm invests all its capital A.

(ii) Everybody is paid 0 in case the project fails.

(iii) When the project is successful, the firm gets paid $R_f > 0$, the domestic bank is paid $R_b > 0$ and the foreign creditors get $E_{t+1} R_u > 0$ (where R_u is the return in dollars and E_{t+1} is the exchange rate next period).

Firms face a moral hazard problem, given that in the absence of appropriate monitoring they can deliberately reduce the probability of success and get a private

benefit (B) in return. When they choose to do this, the probability of success falls from P_H to P_L (we call $P = P_H - P_L > 0$). The project has a return per unit invested equal to:

$$R = S_d E_{t+1} + S_p - W_p$$

Where:

S_d: are dollar sales
S_p: are peso sales
W_p: costs (in pesos)
E_{t+1}: the exchange rate at t+1

The role of domestic banks in this model is to monitor firms and reduce the moral hazard problems. Although banks monitor, they are not able to completely eliminate the moral hazard problem, they can only reduce the private benefit from *B* to *b*. To perform their role as monitors, banks will pay an unobservable amount *c* per unit of investment. To recuperate this cost they will have to lend a sufficient amount of funds to the project at a level above the market rate. Due to the fact that their main sources of funds are in pesos, we will assume that all bank lending is in pesos and demand a rate of return *r*. Finally, foreign creditors are assumed to be uninformed and demand a rate of return in foreign currency equal to r^*[4].

Under this set-up, a firm will choose I, R_b, R_u, I_b, I_u given r^*, r and A, to:

$$\textit{Maximize: } U(A) = P_H \ [S_d E_{t+1} + S_p - W_p] \ I - P_H \ R_b - P_H \ R_u E_{t+1}$$

Subject to:

(i) $A + I_b + I_u E_t = I$

(ii) $P_H \ R_b \geq r \ I_b$

3/ Lending at short maturities, although practically irrelevant in the model developed here, could be explained as an instrumental part of the banks' monitoring role.

4/ Since monitoring is costly and banks could in principle invest abroad at rate r*, the domestic interest rate r adjusted by the expected depreciation must be higher than r*. We will assume that bank capital is scarce and, therefore, this condition will always hold (For more details see Holmstrom and Tirole (1997).

$$(iii) \quad P_H \, R_u \geq r^* \, I_u$$

$$(iv) \quad P \, R_b \geq cI$$

$$(v) \quad P \, R_f \geq bI$$

$$(vi) \quad R_f + R_b + E_{t+1} R_u \leq RI$$

The first constraint only states that total investment has to be financed from one of the three sources mentioned before: the firm's capital (A), bank credit (I_b) and foreign currency lending (I_u). Constraints (ii) and (iii) guarantee that the expected rate of return for banks and foreign creditors has to be at least r (in pesos) and r* (in dollars), respectively. Constraints (iv) and (v) are the incentive compatibility constraints for the firm to undertake the high probability project and for the bank to monitor. Finally, equation (vi) indicates that the full return of the project has to be divided among the firm, the bank and foreign creditors.

Due to the constant return nature of the firm's profit function, it is obvious that in equilibrium all constraints will bind. From (iv) and (v) we obtain the returns that the firm and the domestic bank should be guaranteed so the high probability project is undertaken and the bank monitors:

$$(1) \quad R_b = \frac{cI}{\Delta P} \qquad (2) \quad R_f = \frac{bI}{\Delta P}$$

That defines what Holmstrom and Tirole call the pledgeable expected income, this is the expected income that can be promised to foreign investors while maintaining the firms and the bank's incentives. This in pesos will be equal to:

$$(3) \quad P_H \left[S_d E_{t+1} + S_p - W_p - \frac{(c+b)}{\Delta P} \right] I$$

This return translated into dollars should be enough to satisfy constraint (iv). Therefore,

$$(4) \qquad P_H \left[S_d + \frac{S_p - W_p - \frac{(c+b)}{\Delta P}}{E_{t+1}} \right] I = r^* I_u$$

From equation (4) it is clear that the pledgeable expected income in dollar is decreasing in next period exchange rate. And the sensibility to expected exchange rate changes is related to the importance of the peso surplus ($S_p - W_p - \frac{(c+b)}{\ddot{A}P}$) on the firms total return. To the extent that S_d is larger, the pledgeable income will be less sensitive to expected movement in the exchange rate. As the next equation shows, the level of foreign currency lending will be negatively related to the expected exchange rate depreciation (assuming that the firm has a peso surplus). This sensitivity will be smaller the more export oriented the firms is. So the level of investment by foreign creditors will be:

$$(5) \qquad I_u = \frac{P_H}{r^*} \left[S_d + \frac{(S_p - W_p)}{E_{t+1}} - \frac{(c+b)}{\Delta P \, E_{t+1}} \right] I$$

Also (1) and (ii) determine the level of investment by domestic banks (I_b) necessary for this bank to earn a return r and monitor:

$$(6) \qquad I_b = \frac{P_H}{r} \frac{cI}{\Delta P}$$

Using (5) and (6) we can also get the share of dollar debt in total debt:

$$(7) \qquad \frac{I_u E_t}{I_u E_t + I_b} = \frac{\frac{P_H}{r^*}\left[S_d E_t + \left(S_p - W_p - \frac{(c+b)}{\Delta P}\right)\frac{E_t}{E_{t+1}}\right]}{\frac{P_H}{r^*}\left[S_d E_t + \left(S_p - W_p - \frac{c+b}{\Delta P}\right)\frac{E_t}{E_{t+1}}\right] + \frac{P_H}{r}\frac{c}{\Delta P}}$$

From equation (7) it is clear that the share of dollar debt will be negatively related to the expected rate of depreciation, as long as the firm has a peso surplus. This is the case, because when the expected pledgeable income in dollar declines, the amount of dollar financing available falls. This effect will be smaller for those firms that are more export oriented given that their pledgeable income in dollars will be less sensitive to exchange rate fluctuations. Secondly, the model shows that given that dollar debt is the marginal source of funding, its share in total debt will increase when monitoring costs (c) are lower, the private benefits of shirking (b) falls, the probability of success (P_H) increases and interest rates, domestic and foreign, fall. It is also clear from equation (7) that to the extent that agents perceive that there is a clear exchange rate guarantee by the government ($E_{t+1} = E_t$), then foreign creditors will disregard the exchange rate exposure of the firm as a determinant of the share of dollar lending.

Plugging (5) and (6) into (i) we get the equilibrium level of investment:

$$(i') \qquad A + \left[\frac{P_H}{r^*}\left\{S_d E_t + \left(S_p - W_p - \frac{(c+b)}{\Delta P}\right)\frac{E_t}{E_{t+1}}\right\} + \frac{P_H}{r}\frac{c}{\Delta P}\right] I = I$$

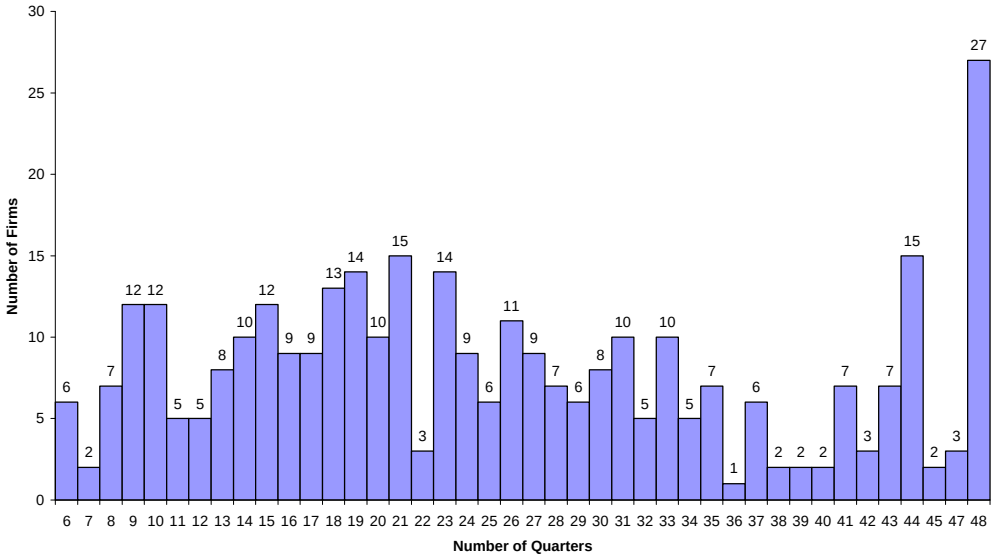
$$(8) \qquad I = \frac{A}{1 - \frac{P_H}{r^*}\left\{S_d E_t + \left(S_p - W_p - \frac{(c+b)}{\Delta P}\right)\frac{E_t}{E_{t+1}}\right\} - \frac{P_H}{r}\frac{c}{\Delta P}}$$

It follows that the main determinants of total investment are the same as those of the share of dollar debt in total debt. This result is obvious due to the fact that dollar debt is the marginal source of funding.

III. Empirical Analysis

In this section we describe the database used in the paper, some basic statistics of the employed variables, the most important stylized facts and the econometric results. The data used comes from the Mexican Stock Market and includes not only public firms, but also those firms that at some point have issued debt. The period covered goes from the first quarter of 1990 to the last quarter of 2000. The total number of firms is 376, but just very few (27) are present for the whole period. Figure 1 shows the distribution of firms by the number of quarters available, where we see that it is a very irregular panel.

Figure 1
Distribution of the Number of Firms by Quarter



We constructed a transition matrix to analyze the distribution of firms according to our two main variables of interest: export status and whether or not they hold dollar debt. Table 1, which shows the matrix, also helps to see how the characteristics of

the firms in the sample changed from 1992 to 2000. We used 1992 as the initial year to leave out the period before the financial liberalization in order to avoid changes on the debt structure that are associated to this process. The matrix includes five categories for each year, resulting on a total of 25 groups describing the status of each firm at the initial and final year. The rows correspond to the number of firms in each category during 1992, while the columns correspond to 2000. As usual the diagonal terms correspond to those observation that did not change their status between the two years and the opposite is true for the off-diagonal terms. The last column and row show the total number of firms in each of the five categories in 1992 and 2000 respectively.

Table 1
Transition Matrix

1992 \ 2000	Nonexistent in 2000	With USD debt and exporter	With USD debt and non-exporter	Without USD debt and exporter	Without USD debt and non-exporter	
Nonexistent in 1992	0	36	13	1	8	58
With USD debt and exporter	97	46	4	1	0	148
With USD debt and non-exporter	46	8	12	0	1	67
Without USD debt and exporter	2	1	0	0	0	3
Without USD debt and non-exporter	34	2	2	0	4	42
	179	93	31	2	13	318

The total number of firms in the period is 318, 58 were not in the sample during 1992 and 179 exited before or in 2000. Thus only 81 were present for the whole period. Table 1 clearly shows that the sample, during both years, is dominated by

firms with dollar debt. For example, 269 firms or 85% of the total had dollar debt in either period, 215 (83%) of the firms in 1992 had dollar debt while this number changed to 124 (89%) for 2000. Therefore, even in 1992 most of the firms had access to dollar debt, and surprisingly this proportion did not increased significantly. Regarding survival rates, 36 firms of the ones without dollar debt in 1992 exited the sample, while only 9 survived to 2000 and of those just 4 stayed without dollar debt. By the same token only 9 (15%) of the firms that entered after 1992 did not have dollar debt in 2000.

Regarding the exporting status we also see that most of the firms export, but in this case we do see an important increase in the share of exporting firms from 58% to 68%. It is also the case that most of the exporting firms have dollar debt. For example, 46 firms or 57% of the total number of firms present in both years correspond to the mentioned category. During both years, only 2% of the exporting firms did not have dollar debt.

III.1. Stylized Facts.

Now we move to the analysis of the behavior of the currency composition of debt. By looking at the trend of this variable for different groups of firms we get six major stylized facts:

1. *The average and median firm experienced an increased on the share of dollar debt after the 1995 crisis*.- The results of the model developed in section 2 imply that after the crisis creditors (and also firms) have given a higher weight to exchange rate risk. That could had happen because before 1995 they expected that either the government would defend the exchange rate to maintain the predetermined rate or that if a crisis developed the government would rescue, at least partially, the affected firms. The most obvious implication of this hypothesis would be a reduction of the share of dollar denominated debt to total debt. However, the first two rows of Table 2 show that the share of dollar denominated

debt on total debt increased sharply from 1992 to 1994, it moved from 25% to 34%. After the crisis, in 1996, the level was roughly at the 1994 level and then it increased again to end in 2000 at a level of almost 50% (see also Figure 2). This trend is very similar if we take only those firms with dollar debt, which implies that this increase can not be explained by a higher proportion of firms with debt denominated in foreign currency.

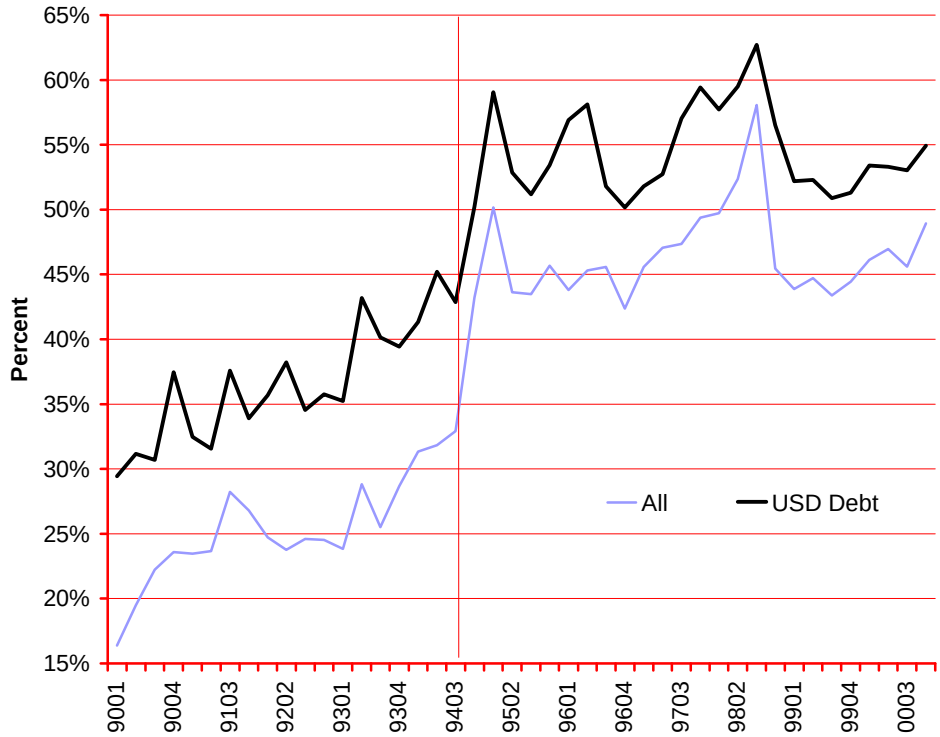
As the facts presented below indicate there were several factors contributing to the increased in dollar debt and, as we show below, are consistent with the results of our model.

Table 2
USD Debt /Total Debt
(medians)

	1992	1994*	1996	2000
All	25%	34%	42%	49%
USD debt	36%	44%	50%	55%
Exporting firm	47%	52%	54%	58%
Non-Exporting firm	3%	8%	10%	9%
Small firm	3%	5%	20%	27%
Medium firm	25%	32%	41%	47%
Large firm	60%	64%	76%	64%

* Medians of the first three quarters.

Figure 2
USD Debt / Total Debt



2. *Dollar debt increased for exporting firms*.- Exports have been very dynamic since 1995, allowing for higher dollar indebtness without increasing the exposure of firms to a sharp devaluation. The exports to sales ratio increased from 1% in 1994 to 8% in 2000 for the whole sample and it increased from 2% to 11% for those firms with dollar debt (Table 3). Also, as we mentioned before, more firms became exporters. In 1992, 58% of the firms exported while 68% did it in 2000.

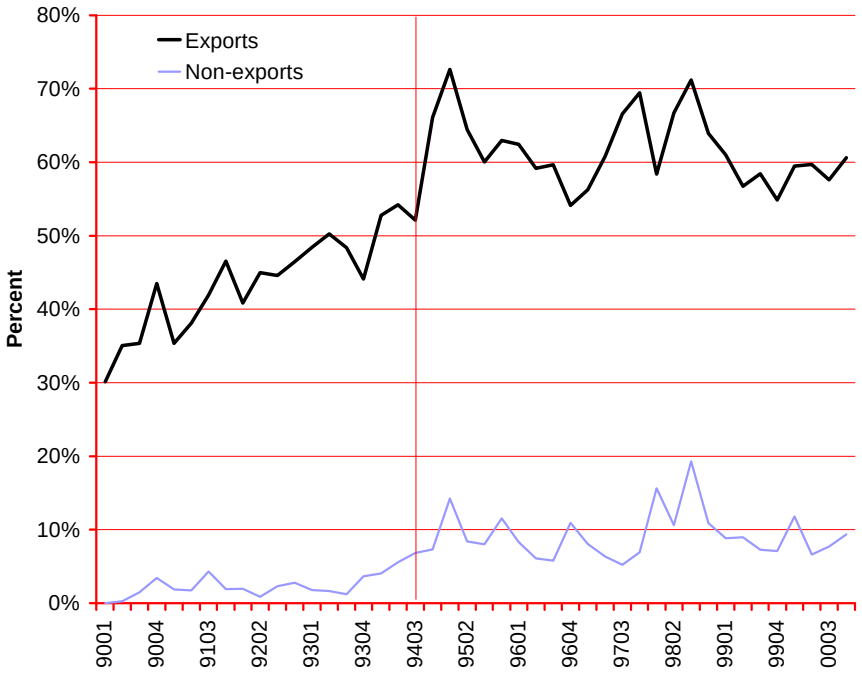
   By looking at the dollar debt of exporting versus non-exporting firms, this explanation is partially confirmed. Figure 3 shows that the share of dollar debt for exporting firms changed from 52% to 58% during the period 1994-2000, while that figure for the non-exporting ones remained almost constant at a level of 9%.

Table 3
Exports / Total Sales
(medians)

	1992	1994*	1996	2000
All	1%	1%	5%	8%
USD debt	3%	2%	7%	11%
Without USD debt	0%	0%	0%	0%
Exporting firm	7%	7%	14%	18%
Small firm	0%	0%	2%	6%
Medium firm	2%	1%	3%	5%
Large firm	3%	3%	21%	23%

* Medians of the first three quarters.

Figure 3
USD Debt / Total Debt



Even when we do not see a decrease in the dollar debt of non-exporting firms from the 1992-1994 period to 2000, that was because its total debt decreased sharply. Total debt over assets decrease from 41% to 31% for non-exporting firms, while for exporters increased marginally from 43% to 45% during the same period (Table 4). We will return to this point later.

Table 4
Total Debt / Assets
(medians)

	1992	1994*	1996	2000
All	41%	42%	44%	43%
USD debt	42%	43%	45%	44%
Without USD debt	39%	36%	32%	26%
Exporting firm	42%	43%	45%	46%
Non-Exporting firm	40%	41%	39%	28%
Small firm	47%	47%	46%	35%
Medium firm	40%	40%	43%	41%
Large firm	38%	43%	45%	45%

* Medians of the first three quarters.

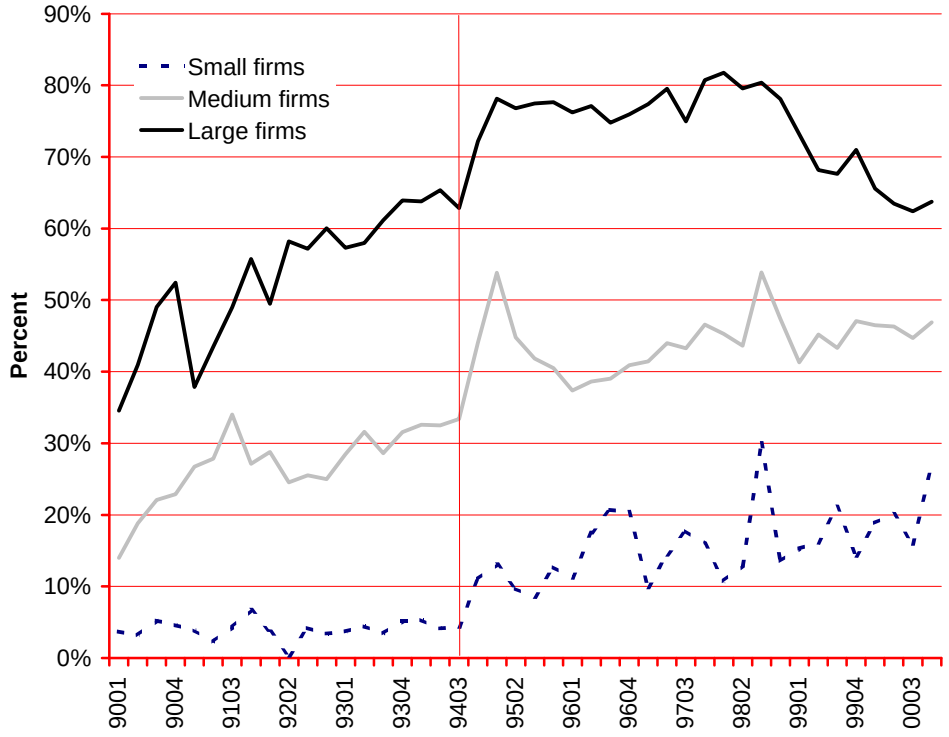
3. *Small and Medium size firms increased their dollar indebtness*.- From 1992 to 1994 these firms, but specially small firms kept a very low ratio of dollar debt to total. As we see in Table 2, this ratio stayed during that period at around 4% for small size firms and around 30% for medium size firms. From Figure 4 it is clear that the ratio stayed relatively stable for small firms. For medium size firms it experienced a significant increase before 1992, probably because of the financial liberalization, and after that it remained stable. However, after the change in the exchange rate regime, the ratio follows an increasing trend reaching levels of 27% and 47% in 2000 for small and large firms, respectively.

4. *Larger firms maintained a higher proportion of dollar debt, but this share decreased after the crisis*.- It has been argued, and shown empirically in the literature, that in Mexico larger firms may access more credit because, among other things, they have higher value of assets that could be used as collateral (Babatz, 1997 and Gelos and Werner, 1999). However, there has also been found for other countries and with data of quoted firms, that the investment of large firms has been more sensible to cash flows, indicating that those firms are more credit constraint (Devereux and Schiantarelli, 1990). In addition, Olin and Rudebusch (1992) find that there are no significant differences between size groups for firms listed on the NYSE.

Under the assumption that the asymmetric information problem would be more severe for foreign creditors than for domestic ones, and for smaller than for larger firms, the latter would hold more dollar debt than the former ones. On Figure 4 we see that large firms had the highest share of dollar debt, followed first by medium size firms and then by small ones. Moreover, those firms experienced the highest growth from 1990 to 1994.

Even more interesting is the inverted U-shaped pattern that the share of dollar debt of large firms followed during the 90s. That is, after the crisis and especially since 1998 that figure decreased for those firms while it increased for middle and small size firms. The ratio was 64% for larger firms in 1994 and then increased to 76% in 1996 and dropped again to 64% in 2000. On the next section we will return to this issue, as we analyze if the estimated model can explain this pattern.

Figure 4
USD Debt / Total Debt



5. *Dollar exposure decreased after the crisis*.- The facts just described, indicate that after 1996 exporting firms have increased their relative dollar indebtness while non-exporting firms have kept fairly constant levels. Since exports increased significantly in this period it is important to analyze what happened with the firms' exposure, measured as the ratio between dollar debt and exports. This ratio also controls for the effect of the devaluation that contributed to the increased of the dollar indebtness in terms of total debt, even when there were no new credits. Before we move to the more formal estimation just by looking at the ratio of dollar debt to exports we see (Table 5) that it decreased from a level of 246% in 1992 to a level of 156% in 2000. Therefore the increase in exports more than offseted the increase in dollar indebtness and, moreover, firms are less exposed to a depreciation than before, even if we take 1992 as the base year. As we divide the sample by firm size, the result is the same for the three categories. Even when larger firms are still the more exposed ones, the ratio of dollar debt to total exports decreased from 385% for 1992 to almost 200% in 2000. The exposure reached in 2000 is lower than the one experienced by the smaller firms in 1994 and even lower than the observed by middle size firms during 1992. It is not surprising that in 1994 firms in all categories reached the highest exposure.

Table 5
USD Debt/Exports
(medians)

	1992	1994	1996	2000
All	246%	389%	192%	156%
USD debt	279%	399%	200%	156%
Small firm	131%	300%	132%	116%
Medium firm	223%	442%	209%	158%
Large firm	385%	377%	209%	199%

6. *From 1994*[5] *to 2000 total debt as a ratio of assets decreased for firms without or few dollar debt*.- Since 1995 and almost until 2000 Mexican banks gave no credit,

[5/] Considering the median level of the year up to the third quarter.

implying that the increase on the importance of dollar debt is partially explained by the reduction of peso debt.

As we can see on Table 4 the ratio of total debt to assets decrease dramatically for those firms without or with few dollar debt. The median of this ratio dropped from 36% in 1994 to 26% in 2000 for firms without dollar debt, from 41% to 28% for non-exporting firms and from 47% to 35% for small size firms.

For the rets of the firms the ratio increased only marginally and definitely less than the amount that could be explained by the depreciation of the peso that took place from the third quarter of 1994 to 2000.

All these results indicate not only that smaller firms could access more dollar credit (even when total debt decreased as a proportion of total assets for these firms) after the crisis, but that given the dynamic growth of exports they became less vulnerable. On the other hand, larger firms that are also the ones that export the most and achieved the highest export growth, have reduced their dollar debt since they were highly exposed before 1994.

III.2. Econometric Analysis

Once we leave the perfect world of Miller and Modigliani, where the capital structure is randomly determined and where the cost of different sources of financing is the same, it is hard to get a simple story for the determinants of capital and debt structure. This follows true because asymmetric information arises in very different ways and several contracts could solve the incentive problems that come with it. Moreover, on top of the specific information problem described in the model developed in section 2, there are transaction costs that differ between the different sources of financing and between firms. However, the model developed in section 2 is rich enough to allow a good mapping from the variables used in our empirical implementation to the parameters of the model.

Considering the setup presented in section 2, our main variable of interest is the exchange rate exposure, thus for a given level of total debt foreign banks will only take into account the share of dollar revenues to limit their exposure. However, they may also consider other variables that are related either to the probability of success of the investment project or to the monitoring technology or the benefits of shirking. We estimate a model of credit rationing inspired by the results presented in section 2 to estimate the importance of the determinants of dollar indebtness. Foreign creditors take certain characteristics of the firm in addition to the share of dollar sales to mitigate the asymmetric information problem. These variables could be interpreted as proxies for P_H, b and c in the model of section 2:

Size.- As mentioned before, as long as the size of the firm is related with the collateralisable wealth it will be positively related to its dollar debt. The variables used to measure size were: the logarithm of total sales, of total assets, and dummy variables for the 25% largest firms either in terms of sales or assets.

Exports.- By including some transformation of exports we test for the importance given to a risk of depreciation. As long as this is important it would make a difference if the revenues or assets are denominated in dollar instead as in pesos. The variables used are: total exports over sales, over total debt and a dummy variable for the firms exporting more than 25% of their sales.

Issued ADR's or bonds in the USA.- We include a dummy variable for those firms that had issued ADR's or commercial paper in the USA up to the base year. This variable may be important if the stricter requirements impose by the SEC help to solve asymmetric information and as long as it does not provide additional information to Mexican banks.

Holding.- We include a dummy variable for the firms that are considered a holding. Being a holding might increase the share of dollar debt if this status implies that

these firms satisfy higher accounting standards and have better corporate governance practices.

Since the results were similar under all the specifications, we just present the ones with the highest *pseudo* R^2*s*. Our endogenous variable is the dollar debt as a ratio of total debt at the end of each period. The exogenous variables are the initial level of the endogenous variable, and one variable to measure each of the characteristics taken into account by the creditor. All of the exogenous variables are taken for an initial year. In order to test for a change in the determinants of dollar credit after the adoption of the floating exchange rate regime we divide the sample in two periods. For the first (second) period we take our exogenous variables for 1992 (1996) and the endogenous for 1994 (2000). We exclude 1995 to avoid all effects associated to the volatility suffered during the crisis. To take into account that our endogenous variable is restricted to the interval (0,1) we employed a Tobit model for the estimation of:

$$USDD_i^T = \alpha_0 + \alpha_1 USDD_i^t + \alpha_2 Size_i^t + \alpha_3 Exports_i^t + \alpha_4 ADR_i^t + \alpha_5 Holding_i + \varepsilon_i^t$$

Table 6 shows the results. In all four specifications the size variable is the log of total assets. For exports we took total exports over total debt in the first two specifications, the export dummy in the third and exports over sales in the fourth. The results are very similar for the three specifications. The size variable is always significant for the first period, but never for the second one and the export variable is always significant for the second period but just in two of the regressions of the first period and only with a confidence of 90%. The rest of the variables (conglomerate or ADR´s) are never significant.

Table 6
Determinants of USD Debt

	(1)		(2)		(3)		(4)	
	I	II	I	II	I	II	I	II
Constant	-0.36***	0.03	-0.37***	-0.10	-0.40***	-0.02	-0.40***	-0.61
	(0.12)	(0.04)	(0.13)	(0.18)	(0.13)	(0.17)	(0.13)	(0.17)
USD Debt/Total Debt lagged	0.81***	0.77***	0.81***	0.74***	0.78***	0.71***	0.76***	0.68***
	(0.05)	(0.06)	(0.06)	(0.07)	(0.06)	(0.07)	(0.06)	(0.08)
Log of Total Assets	0.04***		0.04***	0.01	0.04***	0.01	0.04***	0.01
	(0.01)		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Exports/Total Debt		0.35***	0.08	0.35***				
		(0.12)	(0.18)	(0.13)				
Exports dummy					0.08*	0.16***		
					(0.05)	(0.05)		
Exports/Total Sales							0.21*	0.33***
							(0.11)	(0.09)
ADR's dummy			-0.05	-0.01	-0.06	-0.01	-0.06	-0.003
			(0.09)	(0.05)	(0.09)	(0.05)	(0.09)	(0.05)
Holding dummy			-0.001	0.05	-0.01	0.02	-0.02	0.02
			(0.04)	(0.06)	(0.04)	(0.06)	(0.04)	(0.06)
Sample Size	209	129	209	129	209	129	209	129
Pseudo R^2	1.31	1.08	1.31	1.10	1.33	1.13	1.33	1.14

The dependent variable is the USD Debt/Total Debt.
Standard devation in parenthesis.
I: 1994-endogenous variable and 1992-exogenous vars. II: 2000-endogenous variable and 1996-exogenous vars.
Exports dummy=1 if exports/total sales > 0.25%. ADR's dummy=1 since the first filing date of ADR's or bonds in the USA.
* Significant at 10%
** Significant al 5%
*** Significant at 1%

These results may imply a very interesting conclusion. Before the crisis the main determinant of the share of dollar debt was the size of the firm, which may indicate that firms were more constraint in dollar terms and that total assets or total sales were a good proxy of the available collateral, while exports were considered only marginally. In terms of the weight given to the exchange rate risk we might conclude that there was very little difference between foreign and domestic sales. However, for the second period the only significant variable is exports, revealing that for creditors (and probably also for debtors) the exchange rate exposure is so important that they only care about the dollar revenues and not about the total.

It is important to recall that, as we employed the ratio of dollar debt to total we solved at least partially the potential criticism of spurious correlation. Since we are not controlling for investment opportunities, one could argue that the results might imply that during the first period these opportunities were positively related with the size of the firm while for the second period this potential was more related to the export status. But since higher dollar share does not imply higher total debt this criticism is no longer valid. This is clearer from Table 4, where it can be seen that total debt as a share of total assets did not follow the same pattern of the dollar debt. Having said that we will analyze further this potential criticism.

This issue becomes even more relevant if we consider that the signing of the North American Free Trade Agreement (NAFTA) in 1994 might had changed the financing opportunities for exporting firms as it was perceived that they had a higher growth potential. Harris et al (1994) found that after the financial liberalization in Indonesia, the credit conditions for exporting firms improved significantly. Therefore even though the trade and financial liberalization in Mexico took place earlier, in 1987 and 1991 respectively, NAFTA brought new opportunities to some firms, especially the exporting ones. Under these circumstances, exporting firms might get higher financing in the post-crisis period not because it implied a lower exchange rate risk, but because the growth potential they had. In addition, if dollar debt is the only source of marginal funding (as it is the case in the model of section 2), its share should be correlate with profitability. To abound on this issue we estimate an additional set of regressions.

We include to the regressions of the share of dollar debt over total debt, the average annual growth of sales from 1992 to 1994 for the first period and from 1996 to 2000, to control for investment opportunities. Table 7 shows the results, where we see that in none of the regressions the added variable is significant and the rest of the coefficients remain very similar to the previous estimations.

Table 7
Determinants of USD Debt

	(1)		(2)		(3)	
	I	II	I	II	I	II
Constant	-0.38***	-0.11	-0.40***	-0.03	-0.40***	-0.07
	(0.13)	(0.18)	(0.13)	(0.17)	(0.13)	(0.17)
USD Debt/Total Debt lagged	0.81***	0.74***	0.78***	0.71***	0.76***	0.68***
	(0.06)	(0.07)	(0.06)	(0.07)	(0.06)	(0.08)
Log of Total Assets	0.04***	0.01	0.04***	0.01	0.04***	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Average Growth Rate of Sales	0.01	0.001	0.01	-0.001	0.01	-0.001
	(0.04)	(0.002)	(0.04)	(0.002)	(0.04)	(0.00)
Exports/Total Debt	0.09	0.34***				
	(0.18)	(0.13)				
Exports dummy			0.09*	0.16***		
			(0.05)	(0.05)		
Exports/Total Sales					0.21*	0.33***
					(0.11)	(0.09)
ADR´s dummy	-0.06	-0.01	-0.06	-0.003	-0.06	-0.001
	(0.09)	(0.05)	(0.09)	(0.05)	(0.09)	(0.05)
Holding dummy	-0.002	0.05	-0.01	0.02	-0.02	0.02
	(0.04)	(0.06)	(0.04)	(0.06)	(0.04)	(0.06)
Sample Size	209	129	209	129	209	129
Pseudo R^2	1.31	1.10	1.33	1.13	1.33	1.14

The dependent variable is USD Debt/Total Debt
Standard deviation in parenthesis
I: 1994-endogenous variable and 1992-exogenous vars. II: 2000-endogenous variable and 1996-exogenous vars.
Exports dummy=1 if exports/total sales > 0.25%. ADR's dummy=1 since the first filing date of ADR's or bonds in the USA.
* Significant at 10%
** Significant al 5%
*** Significant at 1%

Therefore, we did not find evidence in favor of an additional hypothesis, besides the shift in the perception of the exchange rate risk, that might explain the mentioned change in the currency composition of debt of firms with different characteristics.

Creditors might have been rational during both periods given the expected behavior of the government. Unfortunately with our data it is not possible to distinguish the reason that caused this change in expectations. On one hand, the fixed exchange rate regime gave an implicit insurance to firms and ultimately to banks from the government that either they would defend the exchange rate or that in case of a crisis the government would rescue them while with the floating regime both subsidies were eliminated. On the other hand, before 1994 it was very hard to imagine a crisis of that magnitude so nobody considered such a scenario. That is, more than the change in regime it is the likelihood assigned to a big crisis what has changed. To be able to test for these alternative hypotheses one may want compare these results for Mexico with those of other countries, such as Argentina or Brazil (before 1999) in those years. Since, even though these countries didn't experience such a big crisis they did also suffer speculative pressure in their currencies, interest rates increased sharply and ended up with an important recession while they kept their exchange rate regimes.

The results just described give the same picture we found before, that exporting firms increased their debt but larger firms decreased it. Using the estimated coefficients we also decompose the predicted change of the share of dollar debt into three components ($\widehat{USDD}_{00} - \widehat{USDD}_{94}$):

1. The effect attributed to the change on the determinants of credit, or in the coefficients of the regression.

2. The effect attributed to changes on the characteristic of the average firm.

3. The effect attributed to the disparities between the short run level given an initial level of dollar debt and the long run level towards which this ratio was converging in either period.

$$\widehat{USDD}_{00} - \widehat{USDD}_{94} = \widehat{USDD}^{2}{}_{LR} - \widehat{USDD}^{1}{}_{LR} + \underbrace{(\widehat{USDD}_{00} - \widehat{USDD}^{2}{}_{LR}) - (\widehat{USDD}_{94} - \widehat{USDD}^{1}{}_{LR})}_{\text{Disparity between short run and long run levels}}$$

$$\Delta \widehat{USDD}_{LR} = \underbrace{\left[\Delta \hat{a}_0 + \Delta \hat{a}_1 \overline{Size} + \Delta \hat{a}_2 \overline{Exports}\right]}_{\text{Change on the determinants}} + \underbrace{\left[\hat{a}_1 \Delta \overline{Size} + \hat{a}_2 \Delta \overline{Exports}\right]}_{\text{Change on firm characteristics}}$$

Table 8 shows this decomposition of the change using the first specification. The first column considers the change taking the short run coefficients, that is taking into account the initial condition of the dollar debt and before it reached the stationary level implied by the regression. The second column shows the same decomposition, but using the long run coefficients. The top panel shows the dollar debt share predicted for the short and long run. The first row presents the predicted level for 1994. So, eventhough the model predicted a long run level of 66%, since the initial level of dollar debt in 1992 was so low, the level predicted for 1994 was only 37%. Something similar happens for the second period, while now the model predicts a stationary level of 26% the short run level is equal to 44% given the huge level at which it started in 1996. Therefore the disparities between the short and long run level during both years implied an increase on the dollar debt of 47 p.p., more than offsetting the negative effect implied by the long run coefficients of 40 p.p..

Table 8
Factors Determining the Change in the USD Indebtness

	SR	LR	SR-LR
Predicted			
USD debt/Tot 94	0.369	0.665	-0.295
USD debt/Tot 00	0.441	0.262	0.179
Total Change	0.072	-0.403	
Coefficients	-0.095	-0.403	
Constant	0.386	2.008	
Size	-0.483	-2.545	
Exports	0.013	0.059	
Lag of Endog.	-0.011		
Firm Characteristics	0.167	0.075	
Size	0.000	0.000	
Exports	0.017	0.075	
Lag of Endog.	0.150		

The change attributed to differences on the weight given to the long run determinants of dollar debt is -48 p.p. and is mainly explained by the large decrease in the coefficient assign to the size, since both the constant and the coefficient of exports increased. Finally, changes on the characteristics of the average firm implied an increase in the dollar indebtness of 7.5 p.p., determined by fully the increase in exports.

The model also implies that during the first period exports should not affect total debt, once we control for total sales or assets. While for the second period exporting firms should be able to get higher debt than non-exporting ones, once we control for total sales or assets. The results shown on Table 9, support the hypothesis in two out of three of the specifications, so although there is some support for the model's results they are not as clear as in the case of dollar debt.

Table 9
Determinants of Total Debt

	(1)		(2)		(3)	
	I	II	I	II	I	II
Constant	0.15*	0.12	0.15*	0.17	0.17**	0.16
	(0.08)	(0.11)	(0.08)	(0.11)	(0.08)	(0.11)
Total Debt/Total Assets lagged	0.87***	0.78***	0.85***	0.75***	0.84***	0.74***
	(0.05)	(0.07)	(0.05)	(0.07)	(0.05)	(0.07)
Log of Total Assets	-0.005	-0.003	-0.005	-0.006	-0.007	-0.006
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Average Growth Rate of Sales	-0.06**	0.003**	-0.06**	0.003**	-0.06**	0.003**
	(0.03)	(0.00)	(0.03)	(0.00)	(0.03)	(0.00)
Exports/Total Debt	0.17	0.19**				
	(0.12)	(0.09)				
Exports dummy			0.05*	0.06**		
			(0.03)	(0.03)		
Exports/Total Sales					0.16***	0.13**
					(0.1)	(0.1)
Sample Size	209	129	209	129	209	129
Pseudo R^2	-1.88	-161.39	-1.89	-160.03	-1.93	-161.61

The dependent variable is Total Debt/Total Assets.
Standard deviation in parenthesis.
I: 1994-endogenous variable and 1992-exogenous vars. II: 2000-endogenous variable and 1996-exogenous vars.
Exports dummy=1 if exports/total sales > 0.25%. ADR's dummy=1 since the first filing date of ADR's or bonds in the USA.
* Significant at 10%
** Significant al 5%
*** Significant at 1%

IV Final Remarks

(To be completed)

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