IMF WORKING PAPER

© 1996 International Monetary Fund

This is a Working Paper and the author(s) would welcome any comments on the present text. Citations should refer to a Working Paper of the International Monetary Fund, mentioning the author(s), and the date of issuance. The views expressed are those of the author(s) and do not necessarily represent those of the Fund.

WP/96/41 INTERNATIONAL MONETARY FUND

Research Department

Mexico's Currency Risk Premia in 1992-94: A Closer Look at the Interest Rate Differentials

Prepared by Alejandro M. Werner 1/

Authorized for distribution by Peter Wickham

April 1996

Abstract

This paper studies the behavior of interest rate differentials in Mexico during the 1992-94 period. It shows that the currency risk premia is positively related to the share of peso denominated debt in total debt and that the magnitude of this effect is considerable. For every 1 percentage point increase in the ratio of peso denominated debt in total debt, the interest rate differential increases between 20 and 30 basis points. In light of this result, and to get a better measure of the expectation of a devaluation during the period, the observed interest rate differential is adjusted for the change in the composition of public debt. In contrast to the behavior of the interest rate differential, the adjusted measure remained at extremely high levels throughout 1994, signalling a low level of confidence in the announced currency band.

JEL Classification Numbers:
E43, F31, F40, F41

1/ I would like to thank Gustavo Canonero, Agustin Carstens, Martina Copelman, Charles Engel, Mauricio Naranjo, Julio Santaella, Miguel Savastano, Peter Wickham and Ewart Williams for their comments and suggestions. The views expressed in this paper do not reflect those of the IMF.
Contents

Summary

I. Introduction

II. The Model

III. Estimation

IV. The Interest Rate Differential and the Composition of Debt

V. Conclusions

Text Tables

2. Cete-Tesobono Interest Rate Differential and Relative Asset Supplies 1992:01-1994:02

Figures

1. Interest Rate Differentials
2. Share of Cetes and Tesobonos in Total Debt
3. Adjusted Interest Rate Differentials (Beta=24.2)
4. Adjusted Interest Rate Differentials (Beta=32.5)

References
Summary

This paper tests the relevance of relative asset supplies in explaining the currency risk premia and the reliability of interest rate differentials as a measure of expected changes in exchange rates for Mexico during 1992-94. Second, it examines quantitatively the effect on the interest rate differential of the observed changes in the currency composition of government debt during 1994.

The paper develops and estimates a simple portfolio model of a representative investor who maximizes a utility function that depends on the mean return and portfolio variance. The model leads to a reduced form where the peso-dollar interest rate differential is proportional to the relative supplies of assets in both currencies.

The estimation results show that there exists a significant correlation between the risk premium and the currency composition of government debt. In particular, the cost to the Government of increasing the share of peso-denominated debt (CETES) in total debt by 1 percentage point is about 20-30 basis points. Thus, according to these estimates, the observed drop in the share of CETES in total debt held by private agents from 60 percent to about 20 percent during 1994 seems to have prevented an increase of 8.0-11.3 percentage points in peso-denominated rates.

Finally, to recover a measure of the credibility of the exchange rate regime, two adjustments are made to the interest rate differentials. The effect of changes in relative asset supplies and the expected depreciation of the exchange rate inside the band are subtracted from the interest rate differential to get a measure of the expected realignment. The outcome of these adjustments shows that the expected realignment after March 1994 stayed at one of its highest levels since 1992, although the interest rate differential shows quite a different story.
I. Introduction

The aim of this paper is twofold. First, to test the relevance of relative asset supplies in explaining the currency risk premia and the reliability of interest rate differentials as a measure of expected changes in exchange rates for Mexico during the period of 1992-94. Second, the paper examines quantitatively the effect that a change in the currency composition of government debt has on interest rate differentials when a risk premium is present.

Recent empirical studies that try to explain the currency risk premia have been unable to find any systematic relationship between prediction errors in exchange rate equations and relative asset supplies. The outcome of this line of research has been summarized by Frankel (1993): "changes in assets supplies, such as are the result of foreign exchange rate intervention should on average have small effects." These findings have been made in the context of developed countries. The recent Mexican experience presents an interesting test case for the presence of a currency risk premia in a developing country context. Mexico's experience has two desirable properties. First, during the 1990s the Mexican government issued domestic debt denominated in domestic currency and foreign exchange (U.S. dollars). Second, the exchange-rate risk is higher in the Mexican case, so the risk premia should be more important, in contrast with other studies that focus on developed countries.

The empirical finding that relative asset supplies are irrelevant in explaining the risk premia in the context of developed countries has raised our confidence in the reliability of interest rate differentials as a measure of expected changes in exchange rates. Therefore, two of the major conclusions that financial analysts have derived from the Mexican crisis are that the devaluation of the peso was a surprise to participants in financial markets, and that Mexican authorities, by intervening heavily in the money market, did not let interest rates rise to fight the speculative attack on the peso. 1/

These conclusions are based on observations of market activity, that followed the March 23, 1994 assassination of Luis Donaldo Colosio, the candidate favored to win Mexico's presidential election in August 1994. A few months after this event, the interest rate differential between peso-denominated and dollar-denominated government bonds partially reversed its increase. Simultaneously, the government implemented a significant change in the composition of its domestic debt. The ratio of dollar-denominated bonds (Tesobonos) to peso-denominated bonds (Cetes) in private hands went from 0.08 in February 1994 to 2.50 in November 1994. This change in the

1/ For example Lustig (1995) says: "In particular it is puzzling that domestic interest rates were allowed to fall even when external rates were still rising and the foreign investors were showing clear signs of nervousness by switching from Cetes to Tesobonos almost in full". Similar statements can be found in several papers on Mexico's crisis.
currency composition of government debt has been singled out by some authors as a principal cause of the financial crisis that ensued following the announcement of the devaluation in December 1994. However, little notice was taken of whether the significant change in the composition of government debt might have had an important impact on the level of interest rates, if these two types of bonds were not perfect substitutes. If this effect was present, it would be important to know its magnitude.

To provide a brief overview of these events, the interest rate differential between Mexican government bonds in domestic currency (Cetes) and the U.S. Treasury Bill rate can be decomposed into political risk, expected devaluation and exchange rate risk premia. To measure the political risk premium for Mexico, the difference between the dollar-denominated bond and the U.S. interest rate can be considered, and to calculate the expected depreciation plus the currency risk premia the difference between the peso-denominated interest rate and the dollar-denominate bond interest rate can be used. Following the Colosio assassination, there was a substantial increase in the Cete-Tesobono interest rate differential, whereas the political risk premia is only slightly affected. After July 1994, these two indicators partially reversed their initial increases. As mentioned before, if it is posited that the currency risk premia is negligible or constant, this implies that there was a significant recovery of confidence after July 1994. On the other hand, if a risk premium which depends on the currency composition of domestic debt is present, the interest differential is not a reliable predictor of the expectations of a devaluation. As depicted in Figure 2, the composition of government debt changed dramatically during 1994. The share of dollar-denominated bonds rose from less than 4 percent of total debt in 1992 to 55 percent in 1994. During 1992 and 1993 there was a tendency in the share of Cetes to gradually increase and issuance of other types of long term bonds ceased.

Motivated by this recent episode, this paper looks at the effect of the change in composition of domestic debt on the interest rate on peso-denominated debt, when a risk premium is present. In other words, an attempt is made to estimate the level that interest rates on domestic debt denominated in domestic currency would have reached if the change in the composition of government debt had not have taken place.

1/ For example Calvo and Mendoza (1995).
2/ We can express this decomposition as:
   \[ i_{cete} - i_{tbill} = i_{cete} - i_{tesobono} + i_{tesobono} - i_{tbill} \]
   where:
   \[ i_{cete} - i_{tesobono} = \text{currency risk premium plus expected devaluation} \]
   \[ i_{tesobono} - i_{tbill} = \text{political risk premium} \]

3/ It is important to highlight the difference between the compensation that an investor requires to equalize returns in a common currency when the expected depreciation is different from zero (what I call expected depreciation) and the exchange rate risk premia that this investor has to be paid to bear the exchange rate risk (This is present as long as there is uncertainty, even if the expected depreciation is zero).
Figure 1: Interest Rate Differentials
Figure 2: Share of Cetes and Tesobonos in Total Debt
To analyze these counterfactual type questions, the paper first develops and then estimates a very simple portfolio model of a representative investor who maximizes a utility function that depends on the mean return and portfolio variance. The model leads to a reduced form where the peso-dollar interest rate differential is proportional to the relative supplies of assets in both currencies.

In estimating the model, the fact that the relative asset supplies are not exogenous variables is taken into account. The reason for this is that the government will be changing relative asset supplies according to the relative cost of its debt, i.e., the interest rate differential. To tackle this problem, the model is estimated with both Ordinary Least Squares and Instrumental Variables.

The estimation results show that there exists a significant correlation between the risk premium and the currency composition of government debt. In particular, the cost to the government of increasing the share of peso-denominated debt in total debt by 1 percentage point is of the order of 20 to 30 basis points. Thus, according to these estimates, the observed drop in the share of Cetes in total debt held by private agents from 60 percent of total debt to around 20 percent during 1994, seems to have prevented an increase in peso denominated rates of 8.0-11.3 percentage points. 1/

Finally, to recover a measure of the credibility of the exchange rate regime, two adjustments are made to the interest rate differentials. The effect of changes in relative asset supplies and the expected depreciation of the exchange rate inside the band are subtracted from the interest rate differential to get a measure of the expected realignment. 2/ The outcome of these adjustments shows that the expected realignment after March 1994 stayed at one of its highest levels since 1992, although the interest rate differential shows quite a different story.

The rest of the paper is structured as follows. Section II reviews the simple portfolio model and discusses some estimation problems. Section III estimates the model and uses these estimates and the drift adjustment method suggested by Bertola and Svensson (1993) to get a sense of the impact that the change in the composition of domestic debt and movements of the exchange rate inside the band had on the interest rate differential. Section IV concludes.

1/ We exclude from the measure of asset supplies debt instruments held by the central bank and the government’s development banks.

2/ During this period the Mexican authorities maintained a currency band. For a description of exchange rate policies in Mexico during this period, see Leiderman et al., (1994), Werner (1995a) and Dornbusch and Werner (1994).
II. The Model

A model of expected utility maximization for an individual faced with three securities is specified (See Dornbusch 1983). The three securities are: a peso denominated government bond (Cetes), a dollar denominated government bond (Tesobonos), and a bond indexed to the domestic price level (these are other types of long term indexed bonds issued by the government, i.e. Bondes and Ajustabonos). 1/ The portfolio composition can be expressed in terms of the parameters of the model and the structure of returns.

Let $W$, $i_c$, $i_d$, and $i_r$ be the values of total wealth, the interest rates on peso-denominated bonds, on dollar-denominated bonds and on real indexed bonds. If an investor invests a fraction, $\alpha_1$, of his wealth in Cetes and a fraction, $\alpha_2$, in Tesobonos, the expectation for the level of real wealth at the end of the period is: 2/

$$\bar{W} = \alpha_1 W(1+i_c - \tau - \pi) + \alpha_2 W(1+i_d + e - r - \pi) + (1-\alpha_1 - \alpha_2) W(1+i_r - \tau)$$  

The term $\tau$ is the expected capital levy rate that will give rise to a political risk premium, $e$ is the expected rate of depreciation and $\pi$ is the expected inflation rate. The depreciation rate and the inflation rate can be correlated, but the capital levy is assumed to be independent of both of these variables. Under these assumptions, the variance of end-of-period wealth will be given by:

$$\sigma_w^2 = \alpha_1^2 \sigma_e^2 \sigma_\pi^2 + \alpha_2^2 \sigma_\pi^2 (\sigma_e^2 + \sigma_\pi^2) - 2\alpha_1 \alpha_2 \sigma_e^2 \sigma_\pi + \alpha_1 \alpha_2 \sigma_\pi^2$$  

The investor's utility, represented by the function $U(W, \sigma_w^2)$, will be positively related to expected wealth and negatively related to the variance of end of period wealth. After some manipulation of the first order conditions, the following expression is obtained:

$$\frac{U_W}{2\sigma_w^2} (i_c - i_d - e) = (\alpha_2 \sigma_e^2 - \alpha_1 \sigma_\pi^2) - \alpha_1 \sigma_e^2$$  

1/ Including U.S. Treasury Bills as another investment option will not affect the expression derived for the interest rate differential between Cetes and Tesobonos.

2/ Following Dornbusch (1982) and Frankel and Engel (1989) we use the approximation: $(1+x)/(1-z)$ = $1 + x - z$. A very similar expression can be derived assuming log-normal distributions for the stochastic variables (See Engel (1995)).
Where e is the expected rate of depreciation. We will simplify this equation by renaming the risk aversion parameter: 1/

\[ \frac{U_w}{2\kappa U_{\sigma}} \]^{-1} = \theta \] (4)

Finally, we rewrite equation (2) as:

\[ i_c - i_d = e + \theta (\sigma_e^2 \alpha_1 - \alpha_2 (\sigma_e^2 - \sigma_{e\pi}^2)) \] (5)

The currency risk premium on Cetes is proportional to the covariance between the rate of devaluation and the rate of inflation, \( \sigma_{e\pi} \). On the other hand, the risk premium on Tesobonos is proportional to the difference between the variance of the devaluation rate and the covariance between the rate of inflation and the rate of devaluation. The interest rate differential between Cetes and Tesobonos will depend on the expected devaluation, on the share of Cetes and Tesobonos in Total Debt and on the covariances mentioned above. It is important to highlight that it does not depend on the level of Total Debt. The level of total debt will affect the political risk premia, the expected capital levy and in some cases the expected devaluation. Because of this, any sterilization operations by the Central Bank will not affect the interest rate differential between Cetes and Tesobonos, when the expected devaluation is accounted for.

If purchasing power parity holds continuously, this covariance will be equal to the variance of the rate of devaluation; thus equation (5) is reduced to:

\[ i_c - i_d = e + \theta \sigma_e^2 \alpha_1 \] (6)

The empirical analysis focuses on the estimation of equations (5) and (6) with monthly time series for the 1992-94 period. Before reporting the results, however, some of the problems encountered in estimating these equations and the proposed solutions to them will be discussed briefly. The first problem faced was the need to find a proxy for the expected devaluation; this problem is tackled in three ways:

(i) It can simply be assumed that the expected devaluation follows a mean reverting AR(1) process: 2/

1/ Under a CRRA utility function this parameter will be constant.
2/ From now on all the variables will have the subscript t or t-1, depending the time period to which we are referring.
where $\mu$ is the mean of the expected realignment. Now, equation (5) can be rewritten as:

$$e_t = \mu \rho (e_{t-1} - \mu) + \epsilon_t$$  \hspace{1cm} (7)$$

where $x_t$ is an AR(1) error process. Equation (7) can be estimated by OLS correcting the standard errors to take into consideration the AR(1) nature of the error process. To allow for the fact that the mean of the expected devaluation might have changed after the Colosio assassination, a dummy variable is included that takes the value of 0 before the assassination and 1 after this incident. This procedure is not reliable or accurate, given that it only places some statistical restrictions on the level of ignorance, but it does not provide any additional information on the movements of the variable of interest. Hence, the next two proposed solutions try to directly measure depreciation expectations.

(ii) The second solution consists of exploiting the fact that Mexico used an exchange rate band during the 1992-94 period. If the assumption is made that the expectation of a discrete realignment was the driving force of the exchange rate inside the band, a function can be derived that relates the position of the exchange rate inside the band to the expected realignment. This can also be done for the expected depreciation of the exchange rate inside the band. Inverting these functions, another function is obtained that relates the expected devaluation to the position of the exchange rate inside the band. This function can be approximated by a polynomial of order $n$ and a measure of the expected devaluation obtained that depends on the position of the exchange rate inside the band. For the case of $n=3$:

$$e_t = a_0 + a_1 \delta_t + a_2 \delta_t^2 + a_3 \delta_t^3 + \nu_t$$  \hspace{1cm} (9)$$

Where $\delta_t$ is the deviation of the exchange rate from the central parity. Substituting this equation in equation (5) we get:

$$(i_c - i_d) = a_0 + a_1 \delta_t + a_2 \delta_t^2 + a_3 \delta_t^3 + \delta \sigma_e^2 a_1 \sigma_e^2 - \theta \sigma_e^2 + \nu_t$$  \hspace{1cm} (10)$$

---


2/ This is a plausible assumption in the Mexican case. Since the aim of monetary policy in 93-94 appears to have been to keep the exchange rate close to the floor of the band and allow temporary depreciations during periods of high uncertainty.

©International Monetary Fund. Not for Redistribution
which is one of the equations that we estimate.

(iii) The third solution proposed for the problem of measuring the expected exchange rate depreciation is to use survey data for the expected devaluation of the exchange rate. The forecasts presented in the Financial Times Currency Forecaster (FTCF) are used. This source reports monthly forecasts of future exchange rates collected from multinational companies and forecasting services. As the measure of devaluation expectations the consensus forecast is used, which FTCF calculates as the harmonic mean of the survey responses. Equation (5) is estimated with the survey data measuring depreciation expectations.

The second problem encountered in trying to estimate equations (5) and (6) is that the government is also optimizing when it decides what type of bond to issue (it does so after observing the private sector's demands for bonds), thus affecting relative asset's supplies. If this is the case, the interest rate differential between peso-denominated bonds and dollar-indexed bonds will be an important consideration in deciding which bond to issue. Therefore, the relative asset supplies will be correlated with the error term and the OLS estimates will be biased and inconsistent. In particular the share of Cetes will be negatively correlated with the error term, inducing a negative bias in its coefficient. To deal with this problem the equation will be estimated using instrumental variables. The total amount of debt is used as a suitable instrument that might affect the political risk premium but not the exchange rate risk premium. To the extent that the simultaneity problem is arguably less important before the crisis of 1994, the results are also presented for a sample that stops in February of 1994.

III. Estimation

A series for the real value of Cetes and Tesobonos held by private entities from 1992:01 to 1994:11 was constructed. From these data a measure was constructed of the ratio of Cetes and Tesobonos in total debt holdings. The interest rate differential is the difference between the 1-month Cete and the 1-month Tesobono interest rate. As a result of the three options proposed to deal with the exchange rate expectation problem, there are four different cases. In Case 1 the assumption is made that the expected depreciation follows a mean-reverting process. In Case 2 the deviations of the exchange rate from central parity is used to control for the expected depreciation of the currency, Case 3 uses the FTCF survey data,

1/ This effect is stronger in the Mexican case than in previous studies.
2/ To the extent that this is not a suitable instrument, it will bias the results against our hypothesis.
3/ Banco de Mexico reports the interest rate on one-month Tesobonos from 1992 to 1993 and for three-month Tesobonos from then on, so we use the difference between the one month Cete and the one month Tesobono for 1992-93 and the three month Tesobono for 1994.
and Case 4 combines Cases 2 and 3. For Case 1, equation (8) was obtained as the equation that relates the interest rate differential to relative asset supplies, and ran the following regression:

\[(i_c - i_d)_t = \text{const} + \text{Dum} \times \text{dummy} + B \times \alpha_1 + B_2 \times \alpha_2 + \nu_t\]  \hspace{1cm} (11)

where the dummy (and Dum is the coefficient associated with this variable) takes the value of 0 from 1992:01 to 1994:03, and 1 after that date. When estimating this equation, the standard errors are adjusted to take into consideration the autorregresive nature of the error term.

For Case 2, the equation that relates the interest rate differential and the relative asset supplies was equation (10), so the following equation was estimated: \(^1\)/

\[(i_c - i_d)_t = \text{const} + \alpha_0 \times S_t + \alpha_1 \times S_t^2 + \alpha_2 \times S_t^3 + B \times \alpha_1 + B_2 \times \alpha_2 + \epsilon_t\]  \hspace{1cm} (12)

In Case 3, the expectations presented in the survey are assumed to be the true ones plus an error, so the following equation can be estimated:

\[(i_c - i_d)_t = \text{const} + c_0 \times \text{edev}_t + B \times \alpha_1 + B_2 \times \alpha_2 + \eta_t\]  \hspace{1cm} (13)

Where \(\text{edev}_t\) is the expected devaluation from the survey data. Finally, in Case 4 equations (12) and (13) are combined to give:

\[(i_c - i_d)_t = \text{const} + c_0 \times \text{edev}_t + \alpha_0 \times S_t + \alpha_1 \times S_t^2 + \alpha_2 \times S_t^3 + B \times \alpha_1 + B_2 \times \alpha_2 + \omega_t\]  \hspace{1cm} (14)

It is expected that there will be a positive effect running from the share of Cetes in total debt on the interest rate differential for the instrumental variables regression in both samples, and for the OLS regression in the short sample. In the complete sample the coefficient of the share of Cetes will have a downward bias, so it can be positive or negative. The results from the OLS and the IV regressions will be presented, as will the results from two different samples, one for the complete period (1992:01 to 1994:11), and the other which stops right before the turbulence that started in March 1994 (1992:01 to 1994:02). When these equations are estimated a significant correlation between the share of Cetes and the share of Tesobonos was found. This was likely due to the presence of a severe multicolinearity problem, so the share of Tesobonos was dropped.

\(^1\)/ The theory of target zones does not suggests a clear sign pattern for the coefficients of the deviations of the exchange rate from central parity.
from the regression. 1/ For each case and sample a linear regression was estimated as was another functional form that uses the logarithm of the share of Cetes in Total debt (the rest of the variables in the regression were the same). Only the results from the linear regressions are presented in Tables 1 and 2. Thus, the coefficient B measures the effect on the interest rate differential of an increase of 1 percent of the share of Cetes in total debt. Similar results are obtained with both of these functional forms. 2/ The results from these regressions are reported in Tables 1 and 2. For the instrumental variables regression the level of total real government debt was used as an instrument. Using the U.S. Treasury Bill rate as and instrument yields similar, but weaker results.

The results suggest that there is evidence in support of the existence of an exchange rate risk premium that depends on relative asset supplies. 3/ The OLS parameters exhibit a significant negative bias, as was expected. This is because when the interest rate differential unexpectedly increases, the government substitutes Cetes by issuing Tesobonos, so there is a negative correlation between the error term and the share of Cetes in total debt.

In Case 1, the fit of the regression is rather poor and none of the coefficients are statistically significant and the hypothesis that all of the coefficients other than the constant are zero can not be rejected. The sign pattern is the expected one in the instrumental variables regression. There is a positive correlation between the interest rate differential and the share of Cetes in total debt. As argued before, this case is the least reliable, given that it does not use any additional information to control for the expected devaluation.

In Case 2, two regressions were run, the first (line 1) uses a second-order approximation for the expected devaluation, while the second (line 2) uses a third-order approximation. The OLS estimates show no significant effect of the share of Cetes on the nominal interest rate differentials for the complete sample period (1992:01 to 1994:11), but the share has a significant positive effect in the shorter sample period (1992:01-1994:02). As discussed in the previous section, this coefficient is a reduced form coefficient and incorporates the demand side effect coming from investors

1/ As the model in Section II highlights, to the extent that purchasing power parity holds, this coefficient should go to zero.
2/ If capital markets were completely integrated, the currency risk premia should depend on the share of Cetes on total dollar assets in the world. Because of this, an equation was also run that used the ratio of Cetes to U.S Federal Debt to account for this problem and the results were similar, but not as significant as those presented in the paper.
3/ Estimating a different model Agenor and Mason (1995) did not find a significant correlation between the share of Cetes in total debt and the interest rate differential.
Table 1. Cete-Tesobono Interest Rate Differential and Relative Asset Supplies

Sample 1992:01-1994:11

<table>
<thead>
<tr>
<th>Case 1:</th>
<th>Const</th>
<th>DUM</th>
<th>B</th>
<th>Q(T)</th>
<th>Q(T-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS</td>
<td>18.46 (6.5)</td>
<td>-0.4</td>
<td>-9.5 (-1.4)</td>
<td>825*</td>
<td>2.2</td>
</tr>
<tr>
<td>IV</td>
<td>0.82 (0.1)</td>
<td>3.52</td>
<td>34.8 (0.9)</td>
<td>694*</td>
<td>0.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case 2:</th>
<th>Const</th>
<th>a₀</th>
<th>a₁</th>
<th>a₂</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS</td>
<td></td>
<td>17.27 (5.4)</td>
<td>146.6 (1.3)</td>
<td>-10013 (-1.9)</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>15.04 (4.4)</td>
<td>66.68 (0.5)</td>
<td>-25217 (-2.9)</td>
<td>917574 (2.3)</td>
</tr>
</tbody>
</table>

| IV     |       | 8.90 (3.8)  | 830.3 (3.3)  | -42939 (-3.2) | --    | 23.70 (3.5) | 678*  | 16*    |
|        | 2     | 9.96 (3.6)  | 102.2 (0.60) | -62042 (-3.2) | 2644987 (2.2) | 19.32 | 2484* | 15*    |

<table>
<thead>
<tr>
<th>Case 3:</th>
<th>Const</th>
<th>c₀</th>
<th>B</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS</td>
<td>17.75 (7.5)</td>
<td>0.04</td>
<td>-8.27 (-1.4)</td>
<td>753*</td>
</tr>
<tr>
<td>IV</td>
<td>-17.51 (-0.2)</td>
<td>0.36</td>
<td>82.00 (0.4)</td>
<td>69*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case 4:</th>
<th>Const</th>
<th>c₀</th>
<th>a₀</th>
<th>a₁</th>
<th>a₂</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS</td>
<td>13.58 (4.8)</td>
<td>0.11</td>
<td>3.39 (0.2)</td>
<td>-31563 (-4.6)</td>
<td>1330520 (3.2)</td>
<td>5.8</td>
</tr>
<tr>
<td>IV</td>
<td>8.68 (3.5)</td>
<td>0.12</td>
<td>233.0 (1.8)</td>
<td>-76133 (-3.3)</td>
<td>2824852 (2.6)</td>
<td>24.2</td>
</tr>
</tbody>
</table>

Note: t-statistic in parenthesis, Q(T) and Q(T-1) are chi-squared tests for the exclusion of all the independent variables and all the independent variables except the constant respectively. (*) indicates that Q(T) is significant at 99 percent.
Table 2. Cete-Tesobono Interest Rate Differential and Relative Asset Supplies

<table>
<thead>
<tr>
<th>Sample 1992:01-1994:02</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case 1:</strong></td>
</tr>
<tr>
<td>OLS</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>IV</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Case 2:</strong></th>
<th>Const</th>
<th>a₀</th>
<th>a₁</th>
<th>a₂</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS 1</td>
<td>10.34</td>
<td>241.7</td>
<td>-51486</td>
<td>-</td>
<td>17.7</td>
</tr>
<tr>
<td></td>
<td>(3.9)</td>
<td>(1.7)</td>
<td>(-3.3)</td>
<td></td>
<td>(2.2)</td>
</tr>
<tr>
<td>2</td>
<td>10.19</td>
<td>257.0</td>
<td>-21751</td>
<td>2364509</td>
<td>17.48</td>
</tr>
<tr>
<td></td>
<td>(3.8)</td>
<td>(-0.2)</td>
<td>(-1.9)</td>
<td>(1.2)</td>
<td>(2.2)</td>
</tr>
<tr>
<td>IV 1</td>
<td>7.90</td>
<td>193.7</td>
<td>-80190</td>
<td>-</td>
<td>25.84</td>
</tr>
<tr>
<td></td>
<td>(3.1)</td>
<td>(1.3)</td>
<td>(-3.7)</td>
<td></td>
<td>(3.2)</td>
</tr>
<tr>
<td>2</td>
<td>7.21</td>
<td>-40.32</td>
<td>-249353</td>
<td>-11599712</td>
<td>30.65</td>
</tr>
<tr>
<td></td>
<td>(2.1)</td>
<td>(-0.1)</td>
<td>(-1.8)</td>
<td>(1.4)</td>
<td>(2.6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Case 3:</strong></th>
<th>Const</th>
<th>c₀</th>
<th>B</th>
<th>Q(T)</th>
<th>Q(T-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS</td>
<td>16.81</td>
<td>0.53</td>
<td>-8.05</td>
<td>653*</td>
<td>16*</td>
</tr>
<tr>
<td></td>
<td>(4.8)</td>
<td>(1.0)</td>
<td>(1.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>0.11</td>
<td>1.16</td>
<td>30.9</td>
<td>186*</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>(0.1)</td>
<td>(1.9)</td>
<td>(1.2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Case 4:</strong></th>
<th>Const</th>
<th>c₀</th>
<th>a₀</th>
<th>a₁</th>
<th>a₂</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLS</td>
<td>8.74</td>
<td>0.46</td>
<td>247</td>
<td>-12277</td>
<td>303228</td>
<td>18.1</td>
</tr>
<tr>
<td></td>
<td>(4.1)</td>
<td>(2.8)</td>
<td>(1.9)</td>
<td>(-0.4)</td>
<td>(1.4)</td>
<td>(2.9)</td>
</tr>
<tr>
<td>IV</td>
<td>6.35</td>
<td>0.29</td>
<td>-86.6</td>
<td>-298025</td>
<td>-14590118</td>
<td>32.5</td>
</tr>
<tr>
<td></td>
<td>(2.1)</td>
<td>(1.3)</td>
<td>(-0.3)</td>
<td>(-1.3)</td>
<td>(2.9)</td>
<td>(2.9)</td>
</tr>
</tbody>
</table>

Note: t-statistic in parenthesis, Q(T) and Q(T-1) are chi-squared tests for the exclusion of all the independent variables and all the independent variables except the constant respectively. (*) indicates that Q(T) is significant at 99 percent.
preferences and the supply side effect coming from the government’s reaction function. If prior to February 1994 this supply effect was negligible, then the results obtained for the shorter sample period provide strong evidence that the share of Cetes in total debt has a positive and significant effect on the interest rate differential. The second set of regressions corrects for the bias in the coefficient of the share of Cetes in total debt by instrumenting this variable with a the real total value of government debt. 1/ In this case the parameter of the share of Cetes in total debt is highly significant and of significant magnitude. The robustness of the result with respect to the choice of sample, is confirmed given that the regressions ran for the sample which stops in February of 1994 give similar results.

On the other hand, almost all of the coefficients on the exchange rate deviations from the central parity are significant. Regarding their sign, there is no clear theoretical relation that we should expect. 2/

The results from Case 3 present the correct sign pattern, but the coefficients are not statistically significant. The instrumental variables regression for the short sample, however are more encouraging. The coefficient on the expectation of a devaluation is close to one, the coefficient of the share of Cetes on total debt is positive and significant at 22 percent, and the constant is not significant. This is exactly what was expected from equation (13). If the survey data does not capture completely the movements in the expectations of a devaluation, then this effect will be absorbed by the change in the share of Cetes, generating a negative bias for its coefficient. Finally, when all the variables from Cases 2 and 3 are included in Case 4, a strong positive correlation between the share of Cetes in total debt and the interest rate differential is obtained, for all the regressions except the OLS case for the complete sample.

The more reliable estimates are those that use the position of the exchange rate inside the band and the survey data as proxies for the expected devaluation (Case 4), given that they incorporate all the available information on the expected devaluation. In this case the coefficient of the share of Cetes is always significant in the IV regressions. Using the estimates from Case 4, the impact of increasing the share of Cetes on total debt by 1 percentage point will be to increase the interest rate differential by 24.2 to 32.5 basis points. In the next section, the interest rate differential is adjusted for the observed change in the composition of domestic debt.

1/ The exchange rate deviations from the central parities were instrumented with their lagged values.

2/ For theoretical models that imply different signs for the correlation between the position of the exchange rate inside the band and the expected devaluation see Bertola and Caballero (1992), Bertola and Svensson (1994) and Werner (1995b).
IV. The Interest Rate Differential and the Composition of Debt

As noted in Section I, starting in March 1994, the Mexican government began to change the composition of its domestic debt in a significant way. The share of Cetes in private hands, as a percentage of total debt, fell from 60 percent in February 1994 to 20 percent by November of the same year. According to the estimates obtained in the preceding section, this change contributed significantly to keeping peso interest rates down. In this section, the level that the interest rate differential would have reached if the composition of domestic debt had remained constant at the level observed in March 1994 is calculated (55 percent of total debt in peso denominated bonds), for the two values of the instrumental variables coefficient estimated in Case 4 of the previous section. This will give a better measure of the movements in the expected devaluation than using only the interest rate differential. (This measure is the one labeled Adjusted I in Figures 3 and 4).

One last adjustment is made to this measure to extract a series for the expected realignment. The expected depreciation of the exchange rate inside the band has to be taken into account. (Variable Adjusted 2 in Figures 3 and 4). This is done by the drift adjustment method proposed by Svensson (1992). Following this methodology, an AR(1) model for the deviation of the exchange rate from the central parity is estimated and this coefficient is used to form the expected depreciation of the deviation of the exchange rate from the central parity. Next, these adjustments for two different values of the risk premium parameters are presented.

During 1993 all the measures of expected depreciation show a significant decline. Given that during this time the share of Cetes in total debt was increasing, the decline in the adjusted interest rate differential is even greater. This signals a significant decrease in the expectations of a devaluation. During 1994, however, the picture is very different.

First, it is clear that the large substitution of Cetes by Tesobonos and the depreciation of the exchange rate inside the band, exerted downward pressure on the level of peso-denominated interest rates. The most striking fact is that by the end of 1994, the interest rate differential is below the average level for the entire 1992-94 period, while the adjusted measures reach one of the highest levels in the sample.

From Figures 3 and 4, it is possible to infer that the change in the currency composition of public debt, during March and April of 1994, held interest rate differentials from 3.7 to 5 percentage points below the level they would have reached in the absence of this change. Because the move from Cetes to Tesobonos continued throughout the year, this differential kept climbing and reached a level of between 8 to 11.3 percentage points. By the end of the year, the adjusted measure was at the same level it had reached right after the assassination of L.D. Colosio, whereas the interest rate differential fell 4 percentage points below the level attained after the incident.
Second, it is interesting to note that in contrast to the simple interest rate differential, the adjusted measures experienced a notable jump the month before interest rates differentials reacted, the month when the U.S. Federal Reserve started to increase its interest rates (in March 1994). This change was accommodated by a depreciation of the exchange rate inside the band of 6 percent and by an increase in the share of Tesobonos in total debt of 5 percentage points. Finally, the adjusted measures experienced a significant jump in November, which is not reflected in the interest rate differential. This signals the start of the speculative attack that culminated in the December 20, 1994 devaluation of the peso.

When adjusting the interest rate differential by the currency risk premium, the actions taken by the Mexican authorities are equivalent to an increase in interest rates of around 8 to 11 percentage points. Obviously, this was not enough to contain the speculative attack. The measures that adjust the interest rate differential, indicate that throughout the second half of 1994, the expected realignment remained at one of its highest levels for the full 1992-94 period. This shows a significant contrast with the assessment that can be made by observing interest rate differentials.

V. Conclusions

This paper tests for the presence of a currency risk premium, using data from Mexico, in a simple portfolio model to show the relationship between the currency risk premium and the relative asset supplies. It presents empirical evidence which supports the hypothesis that the currency risk premium is positively related to the share of peso-denominated debt (Cetes). The magnitude of this effect is considerable: for every percentage point increase in the share of Cetes in total debt, the interest rate differential increases between 20 and 30 basis points.

The paper shows that the important change that took place in the currency composition of government debt during 1994 had a significant impact on the interest rate differential, helping to avoid an increase in this variable of between 8 to 11 percentage points. To have a better assessment of the expectations of a devaluation the interest rate differential was adjusted by the observed change in the composition of domestic debt. This measure remained at very high levels during 1994, in contrast with the behavior of the interest rate differential. Finally, when these series were adjusted for the expected movements of the exchange rate inside the band, both adjusted measures of the expected realignment remained at extremely high levels throughout 1994, signaling very low confidence in the exchange rate band.
Figure 3: Adjusted Interest Rate Differentials
(Beta=24.2)
Figure 4: Adjusted Interest Rate Differentials
(Beta = 32.5)
References


Banco de Mexico (1995), "Indicadores Economicos"


