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MEXICO´S CURRENCY BAND BEFORE THE 1994 PESO CRISIS

Introduction

Several hypotheses have been put forward to explain the collapse of Mexico's peso in late 1994 and the dramatic turnaround in the country's outlook from one year to the next. There were two basic lines of argument. One has structural misalignment, that resulted from either a hasty trade or financial liberalization, provoking a real disequilibrium that had to be corrected eventually. The second argument emphasizes that all the conditions were met at the end of 1994 for the economy to jump suddenly to a panic equilibrium, and has this as what happened after the announcement of a realignment of the ceiling of the currency band on December 19 and the crisis that followed. I believe that these are not competing hypotheses but that they aim at two different episodes. The Mexican economy was hit by two crises. A currency crisis that developed throughout 1994 with pressure building on the currency as one after another adverse political shock deteriorated the foreign reserve position at the central bank. And a public finance crisis that developed after a 50% devaluation through mid-January 1995, driven by short-term foreign currency government bonds coming due in a row at the end of the following three months.

The exchange rate rule needed a correction after the market rate reached the upper limit of the band and reserves loss mounted at the start of the second quarter of 1994. The currency crisis was imminent from that moment on. Had there been a correction then I believe it would not have been more than the 50% devaluation of early January 1995. Missing this correction created the new problem of having to refinance short-term foreign debt each time around until expectations take on a favorable turn. This ingredient was not present before the second quarter of 1994. With the benefit of hindsight we can now say that facing a run on the currency in a position where the government does not have enough funds to meet, not some but, all short-term obligations makes a big difference on the kind of adjustment a country must go through after the crisis hits[1].

Since the multiple equilibrium hypotheses have been able to explain Mexico's public finance crisis during[2] 1995, this study concentrates on the currency crisis at the end of 1994. The analysis is based on the currency band regime in place at the time. Mexico's central bank strategy consisted of the maintenance of an intervention band, within the official currency band. The intervention band limits were announced at the start of each trading day, defended constantly, and realigned on several occasions. The central bank did not intervene within the intervention band. There was a significant policy change after the COLOSIO shock, when a serious reserve loss called for a realignment of the upper limit of the band. Instead large amounts of short-term dollar denominated debt were switched for peso-denominated debt coming due. This was a veritable breach with the past that fed on investors perceptions on the viability of the exchange rate strategy, snowballed into

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[1] A simple model around this argument can be found in Calvo (1995).

[2] See Sachs et al (1995), and Calvo (1995).

Abstract

From late 1991 to late 1994 Mexico's exchange rate policy consisted of a currency band. Through most of the life of the regime the central bank maintained an intervention band, the limits of which were announced at the start of each trading day. The central bank intervened to defend this band only when the exchange rate reached either limit, and realigned it on several occasions. This study focuses on the evolution of exchange rate expectations and tries to determine how credibility of the central bank's commitment evolved over time. Under a currency band expected exchange rate depreciation can always be represented as the sum of within the band depreciation and expected realignment. I obtain an estimate of the probability of realignment of the upper limit of the intervention band running a PROBIT of realignments on the evolution of variables such as the level of foreign reserves at the central bank and the position of the exchange rate within the band. I find that most realignments can be predicted quite accurately when the model is estimated up to October 1993, before public holdings of Tesobonos took off. An out of sample forecast has estimated realignment probability approaching 80% right after the Colosio assassination in March 1994. Moreover, this probability never reverts below 50%, and rises steadily towards 100% by the end of the year. I also construct an estimate of expected realignment by filtering estimated within the band depreciation from the interest differential. Estimated expected realignment turns out to be closely linked to the right hand variables of the PROBIT model, with an out of sample forecast mimicking closely the previous result.

Resúmen

Entre finales de 1991 y 1994, la política cambiaria en México se caracterizó por las fluctuaciones del tipo de cambio de una banda cambiaria. Durante éste período el Banco de México mantuvo una banda de intervención cuyos límites eran anunciados diariamente al inicio de las operaciones. El banco central intervino para defender los límites de la banda de intervención además de realinearlos en diferentes ocasiones. En éste documento se intenta estimar la evolución de la credibilidad del compromiso del banco central con la banda de intervención. Bajo un régimen como el descrito la expectativa de depreciación siempre puede descomponerse en la suma de la depreciación esperada dentro de la banda y la expectativa de realineamiento del límite superior. En el trabajo se obtiene una estimación de la expectativa de realineamiento del límite superior, a través de estimar un modelo PROBIT que toma en cuenta tanto a la posición del tipo de cambio dentro de la banda de intervención como al nivel de las reserves internacionales del banco central. Se encuentra que la mayor parte de los realineamientos se pueden predecir siempre que el modelo se estima hasta Octubre de 1993, antes de que las colocaciones de Tesobonos por parte del gobierno fueran significativas. Un pronóstico fuera de muestra sitúa a la probabilidad de realineamiento en un 80% inmediatamente después de abril de 1994, después del asesinato de Colosio. Esta probabilidad nunca se revierte a niveles inferiores al 50%, y se acerca a 100% hacia el final del año. Se construye además una estimación de la expectativa de realineamiento filtrando la expectativa de depreciación dentro de la banda del diferencial de tasas de interés. Se observa que ésta medición indirecta de la expectativa de realineamiento está altamente correlacionada con las variables del lado derecho del modelo PROBIT. Un pronóstico fuera de muestra con base en ésta última estimación asemeja a la probabilidad de realineamiento estimada con el modelo PROBIT.

a currency substitution of most government debt, and signaled the imminent collapse of the currency band.

Other hypotheses that suggest that the exchange rate rule needed a correction in early1994 include a secular real exchange rate appreciation deteriorating the current account balance so much that in the face of a fall in foreign capital inflows would crash the balance of payments[3]. Although there seems to be some evidence of this causing realignments in other countries, I find no evidence in support of the hypothesis that real exchange rate misalignment prompted realignments[4].

The paper is organized as follows: in section 2 we review the literature on exchange rate bands. In section 3 we present a brief description of Mexico's foreign exchange policy during the period the currency band was in place. Sections 4,5, and 6 present applications of the different versions of credibility tests to the Mexican case. Section 7 contains some conclusions.

1. A Brief Review of the Literature on Exchange Rate Bands

Most first generation models of the exchange rate in a currency band imply a deterministic non-linear relationship between the exchange rate, the expected rate of depreciation and fundamentals. In terms of Krugman's (1991) model this relationship is characterized by the exchange rate being insensitive to the fundamental near the edges of the band, and by being inversely related to expected depreciation. Under the standard assumptions of perfect credibility and uncovered interest rate parity (UIRP) these results imply an inverse relationship between the exchange rate and the interest rate differential across the band. Studies for countries and episodes where exchange rate bands have been in place find the data to be strikingly inconsistent with models of fully credible exchange rate bands[5].

A second generation of models considered that frequent realignments may play a primary role in determining the behavior of the exchange rate within the band. Svensson (1991) incorporates the probability of realignment into Krugman's model. He considered realignments occurring with constant probability, and devised a credibility test based on the information content of interest rate differentials.

Observing that in practice realignments do not revert the exchange rate to a free float but that a new band is defined, Bertola and Caballero (1992) propose a model that allows for stochastic realignment[6]. In their model, when the exchange rate reaches the upper limit of the band authorities may bring the exchange rate back to central parity, or may double the distance from it. This assumption implies that in the neighborhood of the band's upper limit expected depreciation pulls the exchange rate away from the band instead of reverting it towards the central parity. Under UIRP this implies that the interest differential widens as the exchange rate

[3] See Dornbusch and Werner (1995).
[4] See Edin et al's (1996) evidence on the Italian lira.
[5] For a survey of the findings of most empirical target zone models see Garber and Svensson (1995).
[6] The FF/DM currency band was realigned six times through its existence.

approaches the top of the band. Although simple and based on ad hoc assumptions the implication of a direct relationship between the exchange rate's distance from the central parity and the interest differential seems to be consistent with the data[7].

Also from a practical observation on realignments occurring both when the exchange rate is near as well as far from the edges of the band, Bertola and Svensson (1993) propose a model that allows expected depreciation to fluctuate independently of the exchange rate's position within the band. They note that under UIRP, and given an independent estimate of within the band depreciation, the standard model can be used to estimate the expected rate of realignment[8]. The implications of their model are similar to Bertola and Caballero's in the sense that they also produce an interest rate differential that widens as the exchange rate approaches the upper limit of the band.

A handful of papers explore the implications of models with devaluation risk, Lindberg, Svensson, and Soderling (1993) do it for the Swedish krona. Rose and Svensson (1995) for the French Franc. The first authors do a comparison of the *drift adjustment* method and the "Simplest test". They find that, although confidence intervals are more precise with the former method, both measures of expected realignment rise sharply during realignments. They also look for relationships between estimated expected realignment and relevant macro variables, finding that the unemployment rate, the real exchange rate, and election dummies share explanatory power. In the second study findings are corroborated since French Franc realignments come out also somewhat predictable.

There are in the literature studies that estimate the likelihood of a devaluation looking for systematic relations between actual realignments and fundamental macroeconomic conditions. Edin and Vredin (1993) allow for the money stock, real output, the real exchange rate, and the level of foreign exchange reserves influence both the probability and the rate of devaluation. Their estimated devaluation probabilities seem to track actual realignments reasonably well for the Nordic countries[9].

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[7] Bartolini and Bodnar (1992) show that Bertola and Caballero's simple extension can generate a realistic correlation between exchange rates and interest differentials.

[8] They call this the *drift adjustment* method, since the interest rate differential is being adjusted by the exchange rate's drift within the band.

[9] Mizrach (1995) also incorporates macro fundamentals into an estimate of realignment probabilities for the French franc and the Italian lira. Macro variables do not include reserves at the central bank. He finds the position of the exchange rate within the band and the slope of the yield curve to be quite important for the estimate of the probability of realignment. He does find the money supply for France and the real exchange rate for Italy to be statistically significant. His model is just as accurate in predicting realignments, with probabilities doubling or even tripling the day before a realignment occurs. Finally, Beckaert and Gray (1996) take on a similar path. They condition the distribution of exchange rate changes on a jump variable. At each point in time a jump may or may not occur. Conditional on no jump occurring they model exchange rate changes as being drawn from a normal distribution that is truncated both above and below so that there is zero probability of observing exchange rate changes that would take the exchange rate out of the band. The mean and size of a jump vary over time as a function of variables such as the position of the exchange rate within the

Lindberg et al (1993) compare results from the standard methodology (the "Simplest Test" and the *drift adjustment method*) with Edin and Vredin's. They argue that since in the latter study expected realignment is derived from macro variables, this study does not take into account what the market's subjective devaluation expectations actually are. However, they do find that estimates from the two methodologies match for some periods and countries.

In the present study we compare credibility measures out of these methodologies applying them to the evolution of credibility of Mexico's central bank commitment to maintain the peso within a pre-specified currency band.

2. *Mexico's Intervention Band*

The Mexican peso/dollar currency band was introduced on November 12, 1991. The official band's upper and lower limits were then established at 3096.6 and 3051.2 old pesos per dollar respectively, and the upper limit was left to crawl initially at 0.2 old pesos per day. The official band was defended every time it came under attack. The official band's rate of crawl was increased to 0.4 pesos per day from October 19, 1992 on, in what can be considered as the only realignment[10]. On December 19, 1994 an announcement of a realignment of the upper limit of the band was followed by a run on the currency, and unfruitful intervention led to the withdrawal of the central bank from foreign exchange markets leaving the peso freely floating.

Throughout most of the life of Mexico's band an intervention band was also maintained. It was introduced on Jan 2, 1992 with its limits at 3.067 and 3.082 pesos for dollar. These limits were announced at the start of each trading day, defended constantly, and realigned on several occasions. For all practical matters, the intervention band was abandoned during the week of the NAFTA voting in the US congress, when its upper limit was brought to practically coincide with the official band's upper limit. (See figure 1 below).

Figure 1

Policy with respect to the intervention band was different from the way the official band was managed. For instance, forex market interventions only occurred

band, the interest rate differential, cumulative inflation differentials, and the level of foreign reserves. The probability of a jump depends on the slope of the yield curve of the weak currency. They specify the complete conditional distribution of exchange rate changes which allows them to compute the probability of the exchange rate moving outside the band. They do out of sample tests and find that in the periods immediately preceding realignments probabilities of realignment are quite substantial. However, in the case of the 1992 and 1993 crises they only find small increases in realignment probabilities immediately before the 1992 ERM crisis.

[10] We do not consider a fixed crawled as daily realignment since it is not in response to any kind of pressure in forex markets.

when the exchange rate reached either limit, e.g. there were no "intramarginal" interventions[11].

Because of the periodicity of the data displayed in figure 1 it might seem as if the upper limit of the intervention band was realigned each time the exchange rate reached it. To illustrate the central bank's commitment to the intervention band in figure 2 the behavior of the exchange rate within this band is displayed together with the corresponding size of the intervention in the forex market to keep the exchange rate within it. For clarity the figure only includes daily data for the period July to October 1992. We can see that, at least for this period, more reserves were lost on interventions that kept the upper limit in place than on interventions that were followed by a realignment. So, the central bank sometimes limited reserves loss, but others was willing to defend the upper limit independently of the losses.

Figure 2

In Figure 3 the distribution of central bank interventions to defend the band's upper limit is displayed. Before the intervention band's upper limit was brought to coincide with the official band's, the exchange rate reached it on 19 occasions, and on all of them the central bank sacrificed reserves to defend the boundary. On 11 of these occasions reserves reductions were followed by realignments, on 8 they were not. As to the lower limit, it was reached on 57 occasions, and only 16 of those had reserves accumulations followed by realignments. As can be observed there was an intervention without realignment for each time there was one where the upper limit was realigned. Moreover, the central bank lost more reserves intervening to keep the upper limit in place than when it realigned after intervention.

Among the set of countries with this type of exchange rate regime it is hard to come across episodes where the central bank did not intervene intramarginally[12].

Figure 3

3. Estimating Credibility of the Central Bank's Commitment to a Currency Band

Several tests have been devised to estimate credibility in a currency band. The "Simplest test" (Svensson (1991)) is based on the fact that since the exchange rate band implies bounds on the size of appreciation and depreciation of the currency, domestic interest rates are also restricted to an implicit band. The basic idea is that given the commitment to support the limits of the exchange rate band, the maximum and minimum return in domestic currency of an investment in foreign

[11] See Banco de Mexico (1995).

[12] As recognized in Svensson's survey of the literature "...intramarginal interventions are the rule rather than the exception..." Svensson (1992, page 129).

currency are defined accordingly[13]. Whenever the return in domestic currency lies outside of the band then the band is said to be not credible.

Figure 4

Figure 4 displays the interest rate band corresponding to the 28-day nominal Treasury note payable in pesos (*Cetes*) rate, where calculation of the band limits is made consistent with the limits of the exchange rate's intervention band. The picture also displays the period of realignments of the upper limit of the intervention band. As can observed in the figure the cetes rate fails to lie within the interest rate band often between 1992 and 1993. Moreover, most exchange rate intervention band realignments correspond with periods where according to this "Simplest Test" the band failed to be credible.

Another widely used methodology is to extract agents' subjective expected rate of realignment from the interest rate differential[14]. This test relies on the assumptions that market participants are aware of the variables that make the regime viable, and that interest differentials and the exchange rate's position within the band are sufficient statistics for all this information. Since agents' actions must reflect this knowledge, this methodology attempts to filter expectations from interest differentials.

Other credibility tests look at the behavior of relevant macro variables around the time of realignments. When there are enough realignments to go by, these tests infer the capacity of these variables to predict realignments.

Given that the Mexican central bank was to some degree committed to the intervention band, in what follows I obtain an independent estimate of the probability of realignment of the upper limit of the band. I do this looking at the behavior of variables that had something to do with the viability of the regime around the time of realignments. In a second test of the band's credibility I utilize a more standard methodology. Extracting from the interest differential a measure of expected realignment, I test the relationship that this estimate holds with the variables previously considered.

4. The Probability of Realignment of the Upper Limit of the Band

Under a currency band the total expected rate of change of the exchange rate can always be expressed as the sum of two components: within the band expected rate of change, and expected rate of band realignment (the expected rate of change

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[13] The interest rate band limits are constructed as follows: $1 + \underline{R}_t^{\tau} = (1 + i_t^{*\tau})(\underline{e}/e_t)^{12/\tau}$, and $1 + \overline{R}_t^{\tau} = (1 + i_t^{*\tau})(\overline{e}/e_t)^{12/\tau}$, where $\underline{R}_t^{\tau}$ and $\overline{R}_t^{\tau}$ are the lower and upper domestic interest rate limit at time t for maturity τ.

[14] See Campa and Chang (1996) for a study that applies the same methodology using option prices.

of the central parity). The last term results from multiplying the size of realignment times its probability of occurrence.

Edin et al (1994), and Beckaert et al (1996), obtain independent estimates of both the expected size and probability of realignment. By classifying exchange rate jumps into realignments and within the band jumps, they regress them on variables they deem relevant determinants of each type of jump. The econometric models used in these studies are quite elaborate and beyond the scope of the present study. Nonetheless, a simple test that looks solely at the determinants of the probability of realignment will prove to shed much light on the hypotheses here considered[15].

Figure 5

4.1 The Data

I run a PROBIT model on daily data of observed realignments of the upper limit of the intervention band, with data going from January 2nd, 1992 to December[16] 19, 1994. Initially, I run this on the logarithm of net foreign reserves at the central bank in dollars (LRES), and on the position of the exchange rate within the band with respect to the central parity (POS). That is, $POS = \frac{e_t - c_t}{e - c_t}$, where c_t is the central parity (the arithmetic mean of the two band limits)[17]. Figure 5 displays the evolution of the variables across the sample[18].

4.2 The Results

Running READUMMY against LRES(-1) and POS(-1) for the whole sample results in both variables coming out of the expected sign, LRES(-1) barely statistically significant, and POS(-1) not significant[19] (see regressions 1 and 2 of table 3 below). A possible explanation for the low performance of this regression can be obtained considering the behavior of the dependent variable after the time that the upper limit of the intervention band was brought to coincide with the official.

Right after the NAFTA episode, in November 1993, no room was left to respond to market pressure with realignments of the top of the intervention band[20]. That is, up to that point, the central bank's intervention policy had been to defend the upper limit of the intervention band, and realign it whenever too many reserves were being sacrificed. After the intervention band's upper limit was brought to

[15] Notice that this test cannot be done on Mexico's *official* currency band since, for all practical matters, this band was realigned only once.

[16] The date that the central bank of Mexico decided to let the exchange rate float freely.

[17] Note that POS takes on values between -1 and 1, with these extremes included. Whenever the exchange rate is close to the lower limit of the band POS will take on a negative value close to -1, whereas when the exchange rate is close to the upper limit it will take on positive close to 1 values.

[18] Other right hand variables are considered below.

[19] I get the same result including up to the 7th lag of each variable in this regression.

[20] This, of coarse, with the exception of the collapse itself in December 1994.

coincide with the official's there was no more room, within the official band, for realignments of the upper limit of the intervention band. Whenever forex market pressures persisted shocks had to be faced either by within the band depreciation, or, when the exchange rate reached the upper limit, by considerable exchange rate losses. Nonetheless, adverse shocks after the NAFTA week were neither few nor mild, and reserves were large but certainly not large enough to face them all.

Figure 6

So, an additional mechanism was introduced to absorb the effect of adverse shocks. From November 1993 on some of the pressure on the forex market was eased via additional placements of *Tesobonos* (Mexican treasury notes payable in US dollars). Figure 6 displays the behavior of public holdings of this debt during the relevant period. As can be observed holdings of *Tesobonos* increased during November 1993, stabilized for three months, and trebled after the Colosio assassination[21].

Summarizing, there was a definite policy change, to be placed somewhere between March and April 1994, that can account for the poor performance of LRES(-1) and POS(-1) in the regression result described above.

To overcome the problem I take a sub-sample that runs up to the third week of October 1993. Regression results are displayed in Table 3. In regressions 1 to 3 I run READUMMY against LRES(-1), against POS(-1), and against these two together[22]. The variables come out with their expected signs and highly statistically significant, both on their own and when in the same regression. Moreover, the effect of a fall in one period lagged reserves on the probability of realignment is quite substantial. A fall of 1 percent in LRES(-1) increases the probability of realignment by about 2 percent.

[21] *Tesobonos* went from US $2.039 billion the last week of February to US $3.699 billion the last week of March, reaching US $10 billion by the last week of April.

[22] Running this regression on weekly or daily data does not make a difference. For both variables, LRES and POSI, the outcome is independent of whether one considers the first or up to the 7th lag.

TABLE 3
PROBIT Regression Results

	1*	2*	3*	4*	5**	6**	7**	8**	9**	10**
C	13.27	12.88	-1.78	10.55	64.11	-0.47	69.62	92.7	42.7	-1.44
	(1.75)	(1.65)	(-0.18)	(1.13)	(3.59)	(-2.95)	(3.52)	(3.58)	(1.66)	(-3.19)
LRES(-1)	-1.43	-1.39	0.29	-0.16	-6.56	--	-7.09	-9.2	-3.2	--
	(-1.86)	(-1.78)	(0.29)	(-0.17)	(-3.62)		(-3.54)	(-3.56)	(-1.14)	
POS(-1)	--	0.08	0.51	0.38	--	1.39	1.47	1.53	1.37	--
		(0.21)	(2.56)	(2.01)		(4.79)	(4.70)	(4.57)	(4.34)	
INTDIF(-1)	--	--	-0.28	--	--	--	--	-0.29	--	
			(-5.69)					(-2.33)		
REARATE(-1)	--	--	--	-0.003	--	--	--	--	-0.003	
				(-5.08)					(-2.39)	
EXPREA	--	--	--	--	--	--	--	--	--	0.91
										(1.97)
R-Squared	0.17	0.21	0.27	0.25	0.37	0.45	0.53	0.55	0.54	0.11

*(Sample: January 2, 1992 to December 19, 1994)
**(Sample: January 2, 1992 to October 22, 1993)
t-statistics in parenthesis.

So, a fall in reserves like the one observed during April 1994 (around US $10.4 billion, from US$27.4 billion) must have increased the probability of realignment of the upper limit of the band by over 75 percentage points. That is, given the history of response of realignments to reserves losses, the size of the loss right after March 1994 must have made a realignment of the upper limit of the band a highly likely event.

Previous studies of the causes that led to the Mexican currency crisis include the hypothesis that a secular real exchange rate appreciation exerted significant pressure to devalue at the end of price stabilization. I want to test whether there is evidence here in support of the idea that a loss in competitiveness increases pressures to realign the interior band's upper limit.

I used two indexes to try to capture the effect: the level of the real exchange rate, and the cumulative inflation differential between Mexico and the US[23]. The

[23] The cumulative inflation differential with the US (INFDIF) is constructed based on the monthly Consumer Price Index for both countries. Monthly inflation is divided by the number of weeks of the corresponding month and accumulated algebraically. Each week the realignment of the central parity is subtracted from the accumulated inflation differential, so that if the realignment covered the whole differential we would be starting from zero after the current realignment. Note that INFDIF takes into is corrected for central parity realignments, so it is valid measure of the change in the real exchange rate.

correlation between the two variables is very strong (72 percent). When I run any of the two measures against READUMMY in a PROBIT regression with the long sample they both come out not only of the wrong sign, but also statistically significant. The same is true for the short sample (see Table 3).

To illustrate whether actual realignments can be predicted by estimated realignment probability out of regression 7 in Table 3 the dependent variable's fitted values and actual values are displayed in figure 7. As can be observed estimated realignment probabilities do very well predicting actual realignments considering that the estimation is based on information up to the previous week. Notice, for example, how estimated probabilities are able to predict the realignment during the NAFTA episode. Estimated realignment probability during the week of the NAFTA voting in the US congress approached 0.5, indicating that, given information up to the previous week, a realignment was considerably probable. This perception was validated the week later. Other realignments are predicted just as well.

Figure 7

Finally, it is interesting to see how estimated realignment probability does out of sample and whether it is able to predict the collapse of the regime in December. In figure 8 an out of sample forecast of the probability of realignment is displayed. Notice how the combination of within the band exchange rate depreciation and reserves losses after the Colosio assassination in March 1994 raise the probability of realignment from below 0.1 to above 0.8. A second adverse shock in the middle of the year brings realignment probability to 0.9, stabilizing there for a while to fall slightly afterwards. From then on it fluctuates up and down always above the 0.9 mark, and closes the year near 1.

Figure 8

5. A Standard Test

Under the assumption of UIRP an estimate of the expected rate of realignment can be obtained by subtracting from the interest differential estimated within the band depreciation. Following the literature I estimate the expected change in the exchange rate inside the band regressing the observed monthly change in the logarithmic deviation of the exchange rate from the central parity, $e_{t+4} - e_t$, on the logarithmic deviation of the exchange rate from the central parity[24]. Using weekly data, from the first week of January 1992 to the fourth week of October 1993, estimates are obtained for both the official and the intervention band. The results are reported in Table 4[25].

[24] See Werner (1995) where this technique is applied to measure credibility of the Israeli and Mexican currency bands. The sample for the Mexican band covers up to the third quarter of 1993.

[25] Because of the usual overlapping observations problem I found evidence of autocorrelation in both regression equations of table 4. However, after clearing the data from this problem all coefficients retain their sign and remain statistically significant.

From these results it seems clear that the degree of mean reversion provoked by the band is substantial in both cases. Not surprisingly, mean reversion for the intervention band comes out almost double of that for the official band. Moreover, since during most of 1993 the intervention band's width stayed near 2%, an exchange rate 1% above the central parity is associated with an expected rate of appreciation of 0.63%.

Table 4

$$\ln(e/cp)_{t+4} - \ln(e/cp)_t = \beta_0 + \beta_1 \ln(e/cp)_t$$

Band	β_0	β_1
Official Band	-0.0005	-0.36
	(-1.61)	(-4.21)
Intervention Band	0.02	-0.83
	(0.95)	(-9.18)

where: e is the exchange rate, and cp the central parity. t-statistics in parenthesis.

The previous estimates can be used to obtain a measure of expected realignment. This is done subtracting from the monthly interest differential the estimated expected change in the exchange rate within the band. Figure 9 displays the resulting measure of expected realignment as well as the interest differential, where we can see that expected realignment comes out more volatile than the interest differential. This is because of the variability of the exchange rate inside the band. That is, fluctuations in domestic interest rates are being smoothed away because of the flexibility of the exchange rate inside the band.

Few studies have considered the relationship between estimated expected realignment and macroeconomic variables that indicate viability of the regime[26]. In order to use the estimate of expected realignment obtained here to contrast with the result out of the PROBIT model, I test the relationship between estimated expected realignment and the real exchange rate, the inflation differential, and reserves at the central bank. I did this for both sample lengths: Jan 2, 1992 to Dec 19, 1994 (long sample), and Jan 2, 1992 to Oct 22, 1993 (short sample). In all regressions there was

[26] See Lindberg et al (1991).

some evidence of serial autocorrelation so either one or two autoregressive factors had to be included to improve the fit[27]. For the long sample (regressions 7 to 13) both measures of the effect of the real exchange rate on expected realignment come out with the wrong sign and not statistically significant. LRES(-1) also does not perform very well in the long sample, coming out of the right sign but not significant when the regression is corrected for serial autocorrelation[28]. The story is different for the shorter sample. Both measures of the effect of the real exchange rate come out significant and of the right sign, the same being true for LRES(-1).

TABLE 5

OLS Regression Results

	1*	2*	3*	4*	5*	6*	7**	8**	9**	10**	11**	12**
C	10.76	11.18	24.7	31.7	20.4	25.17	22.7	10.0	22.9	9.8	21.4	10.4
	(3.69)	(2.19)	(2.63)	(2.79)	(2.67)	(2.69)	(3.41)	(0.79)	(3.29)	(0.77)	(3.21)	(0.84)
LRES(-1)	-1.01	-1.05	-2.5	-3.2	-2.3	-2.9	-2.2	-0.9	-2.2	-0.9	-1.8	-0.7
	(-3.39)	(-2.04)	(-2.52)	(-2.71)	(-2.56)	(-2.67)	(-3.30)	(-0.73)	(-3.15)	(-0.69)	(-2.53)	(-0.57)
INFDIF(-1)			0.07	0.1	--	--	--	--	0.01	-0.01	--	--
			(2.01)	(2.4)					(0.13)	(-0.14)		
REARATE(-1)	--	--	--	--	0.001	0.001	--	--	--	--	-0.001	-0.001
					(2.04)	(2.41)					(-1.59)	(-0.65)
AR(1)	--	1.39	--	0.8	--	0.5	--	1.1	--	1.1	--	1.1
		(12.27)		(6.04)		(6.03)		(13.45)		(13.36)		(13.28)
AR(2)	--	-0.54	--	-0.5	--	-0.4	--	-0.3	--	-0.3	--	-0.3
		(-4.64)		(-3.38)		(-3.31)		(-4.22)		(-4.21)		(-4.17)
R-Squared	0.11	0.79	0.07	0.35	0.07	0.34	0.1	0.69	0.1	0.69	0.08	0.69
Durbin Watson	0.29	1.75	1.02	1.85	1.02	1.86	0.43	2.12	0.43	2.13	0.44	2.12

*(Sample: January 2, 1992 to October 22, 1993)
**(Sample: January 2, 1992 to December 19, 1994)
t-Student statistics in parenthesis.

Figure 9

Few studies have considered the relationship between estimated expected realignment and macroeconomic variables that indicate viability of the regime[29]. In order to use the estimate of expected realignment obtained here to contrast with the result out of the PROBIT model, I test the relationship between estimated expected

[27] The criteria was the Q-test on the residuals.
[28] The same is true when LRES(-1) is run by itself with the long sample.
[29] See Lindberg et al (1991).

realignment and the real exchange rate, the inflation differential, and reserves at the central bank. I did this for both sample lengths: Jan 2, 1992 to Dec 19, 1994 (long sample), and Jan 2, 1992 to Oct 22, 1993 (short sample). In all regressions there was some evidence of serial autocorrelation so either one or two autoregressive factors had to be included to improve the fit[30]. For the long sample (regressions 7 to 13) both measures of the effect of the real exchange rate on expected realignment come out with the wrong sign and not statistically significant. LRES(-1) also does not perform very well in the long sample, coming out of the right sign but not significant when the regression is corrected for serial autocorrelation[31]. The story is different for the shorter sample. Both measures of the effect of the real exchange rate come out significant and of the right sign, the same being true for LRES(-1).

In figure 10 the fitted values of regression 2 in table 5 are displayed together with an out of sample forecast. It is not hard to draw parallelisms with forecasted probability of realignment out of the PROBIT model (see figure 8). They both forecast a realignment prior to the NAFTA episode. Moreover, from both estimates it can be concluded that it was highly likely that a realignment occur sometime during 1994, with this likelihood increasing as the end of the year approached.

Figure 10

In order to test how accurately estimated expected realignment is able to predict actual realignments go back to regression 4 in table[32] 3. There I run READUMMY against the estimate of expected realignment of the upper limit of the intervention band illustrated in figure 9. The result is quite encouraging since EXPREA comes out positive and statistically significant at the 5% level.

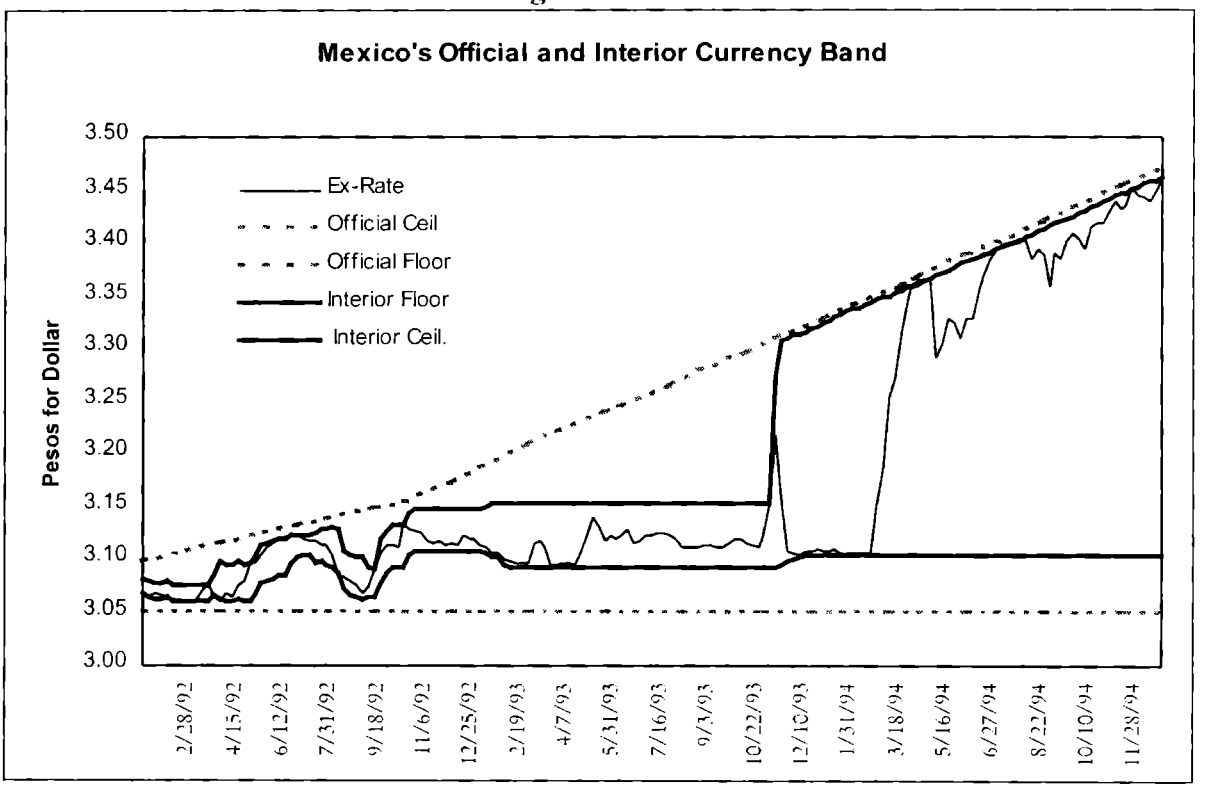
6. Conclusions

The present study is an attempt at an empirical assessment of the credibility of Mexico's central bank commitment to maintaining the Mexican peso-dollar exchange rate within a currency band. We estimated the expected rate of realignment of the upper limit of the intervention band using two independent measures. In order to account for a structural change provoked by the currency switch of government debt holdings, we divided the analysis using two different sample lengths. We find that expected realignment could be predicted somewhat accurately using information for the period between the point when the regime was established to the week prior to the US congress voting of the NAFTA. We find evidence on the effect on expected realignment of the lagged values of the position of the exchange rate within the band and the level of reserves at the central bank. We also look at the relationship between our estimates and other macroeconomic indicators usually associated with the viability of the system. We obtained two independent out of sample forecasts of the probability of realignment that predict actual realignments reasonably well. Several studies of the episode that led to the

[30] The criteria was the Q-test on the residuals.
[31] The same is true when LRES(-1) is run by itself with the long sample.
[32] Notice that this is the only regression on this table that is ran on weekly data.

collapse of the Mexican peso in late 1994 concluded that investors were caught by surprise since there did not seem to be anything that indicated that such a collapse could occur. From our analysis we conclude that, based on information up to the US congress voting of NAFTA (when the intervention band's upper limit was brought to coincide with the official band's) there were clear signs of a regime shift that accentuated as the economy approached the end of 1994.

Figure 1


Mexico's Official and Interior Currency Band
Pesos for Dollar
3.50
3.45
3.40
3.35
3.30
3.25
3.20
3.15
3.10
3.05
3.00
Ex-Rate
Official Ceil
Official Floor
Interior Floor
Interior Ceil.
2/28/92
4/15/92
6/12/92
7/31/92
9/18/92
11/6/92
12/25/92
2/19/93
4/7/93
5/31/93
7/16/93
9/3/93
10/22/93
12/10/93
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3/18/94
5/16/94
6/27/94
8/22/94
10/10/94
11/28/94

Figure 2

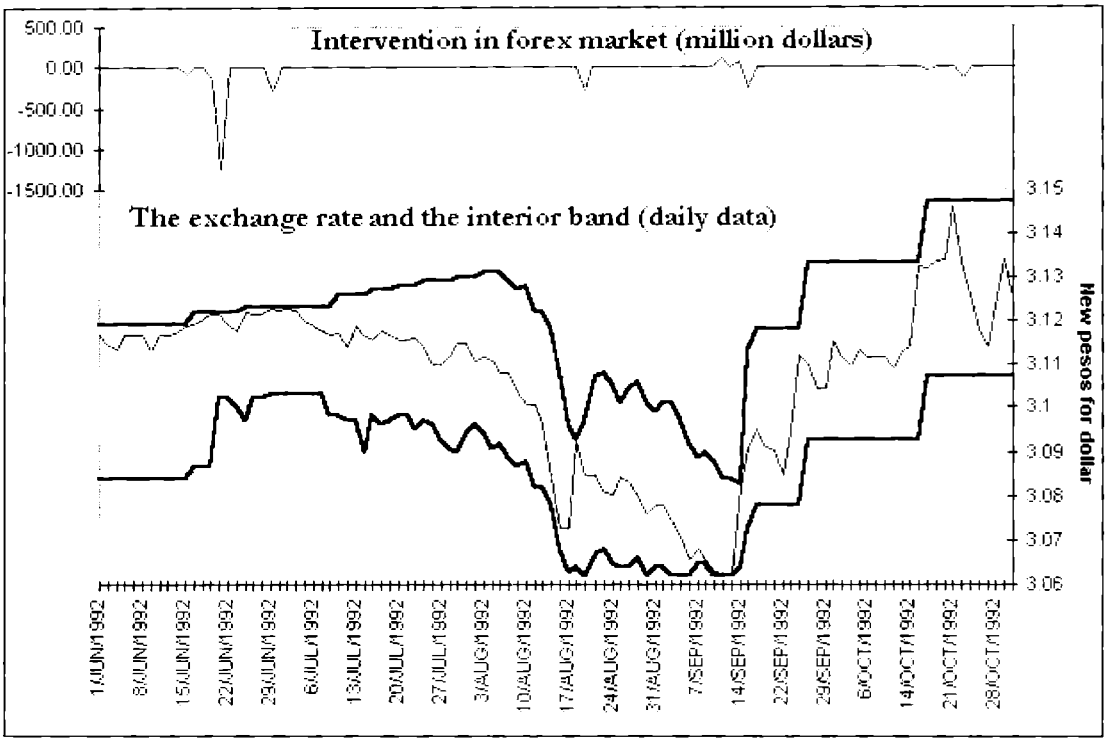


Figure 3

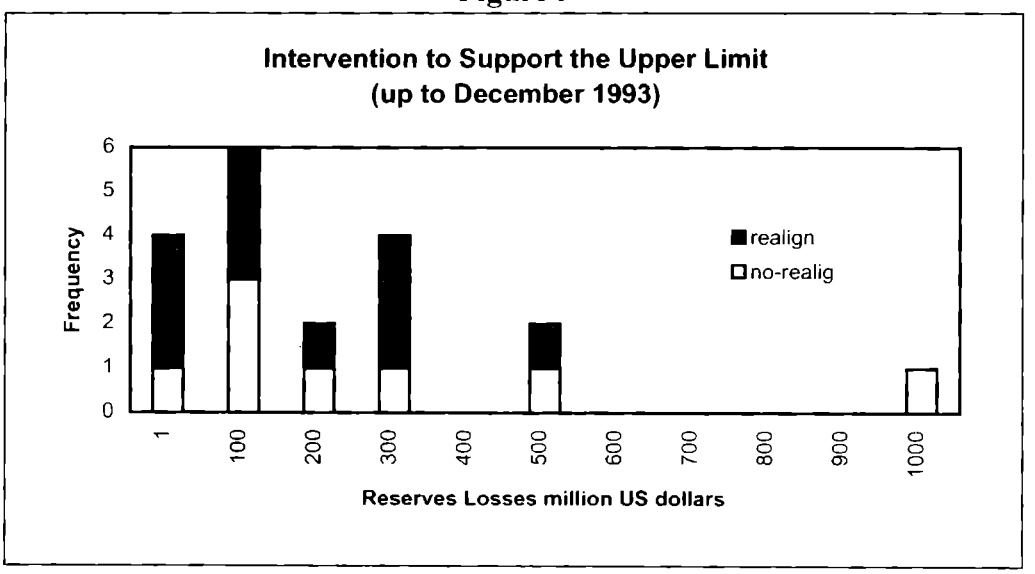


Figure 4

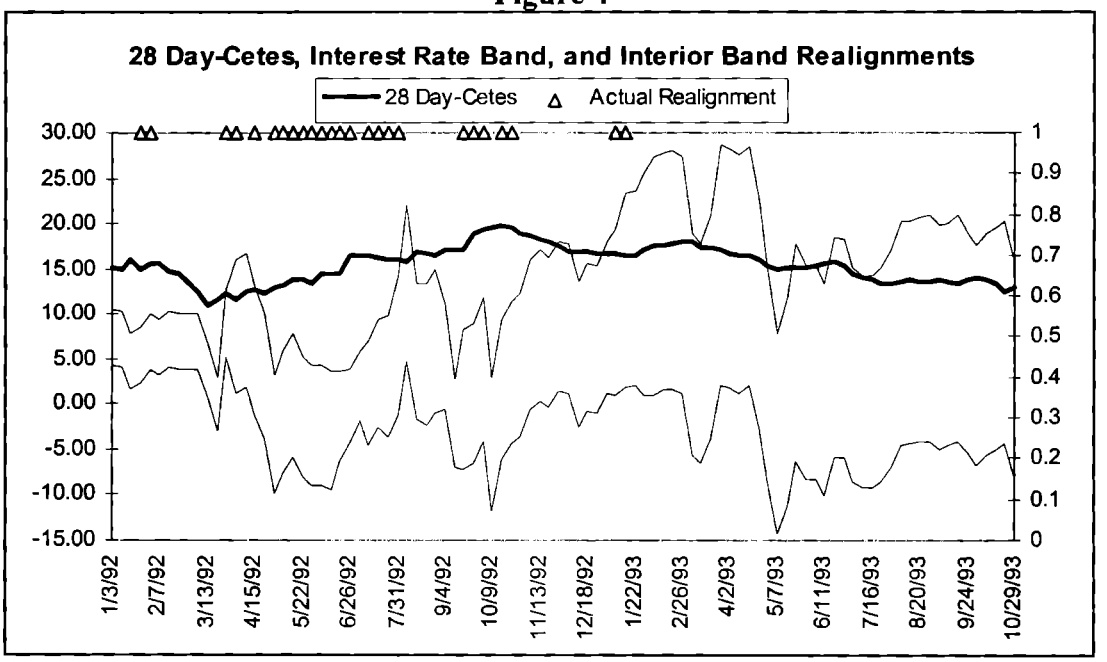

28 Day-Cetes, Interest Rate Band, and Interior Band Realignments
28 Day-Cetes
Actual Realignment
30.00
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1/3/92
2/7/92
3/13/92
4/15/92
5/22/92
6/26/92
7/31/92
9/4/92
10/9/92
11/13/92
12/18/92
1/22/93
2/26/93
4/2/93
5/7/93
6/11/93
7/16/93
8/20/93
9/24/93
10/29/93

Figure 5

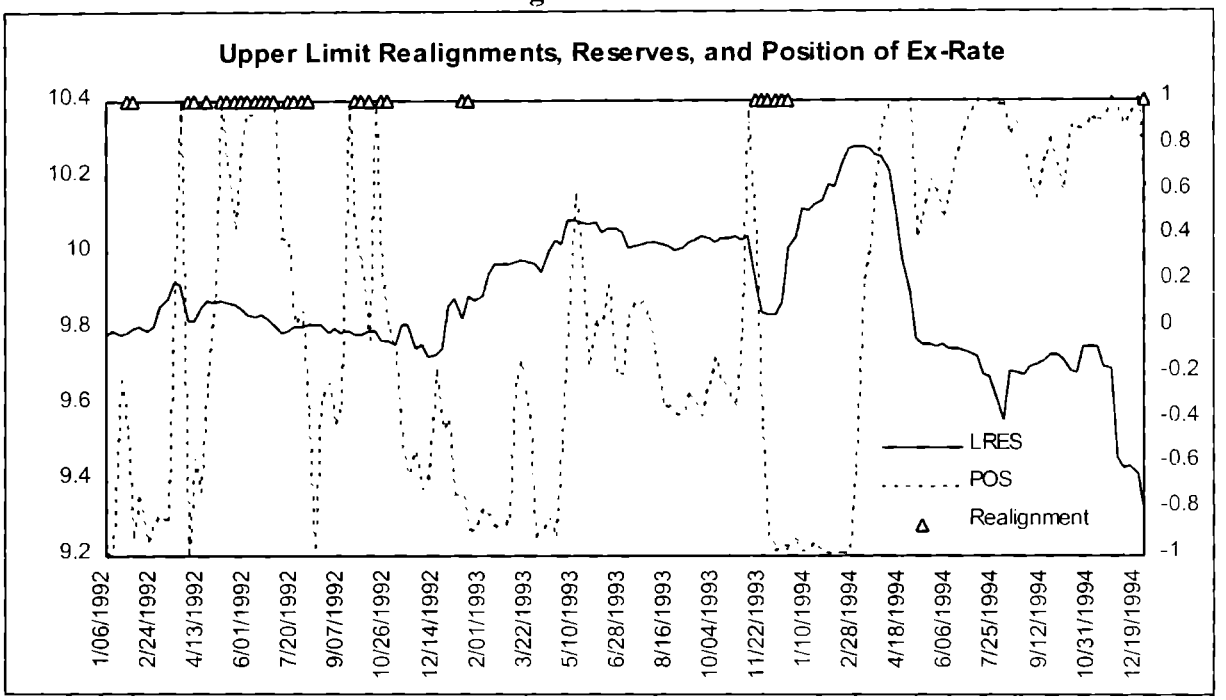


Figure 6

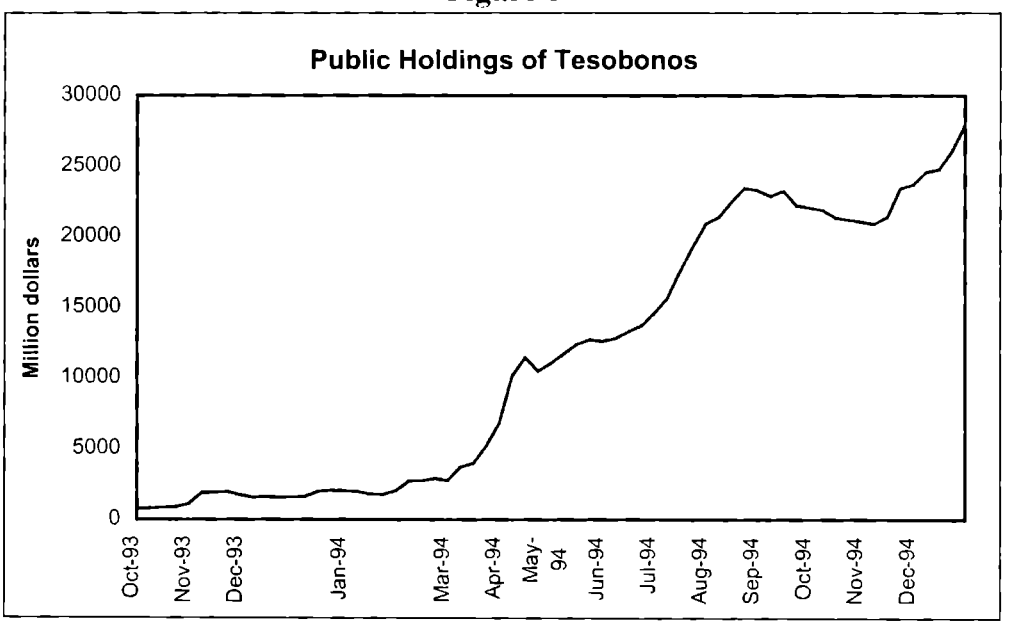


Figure 7

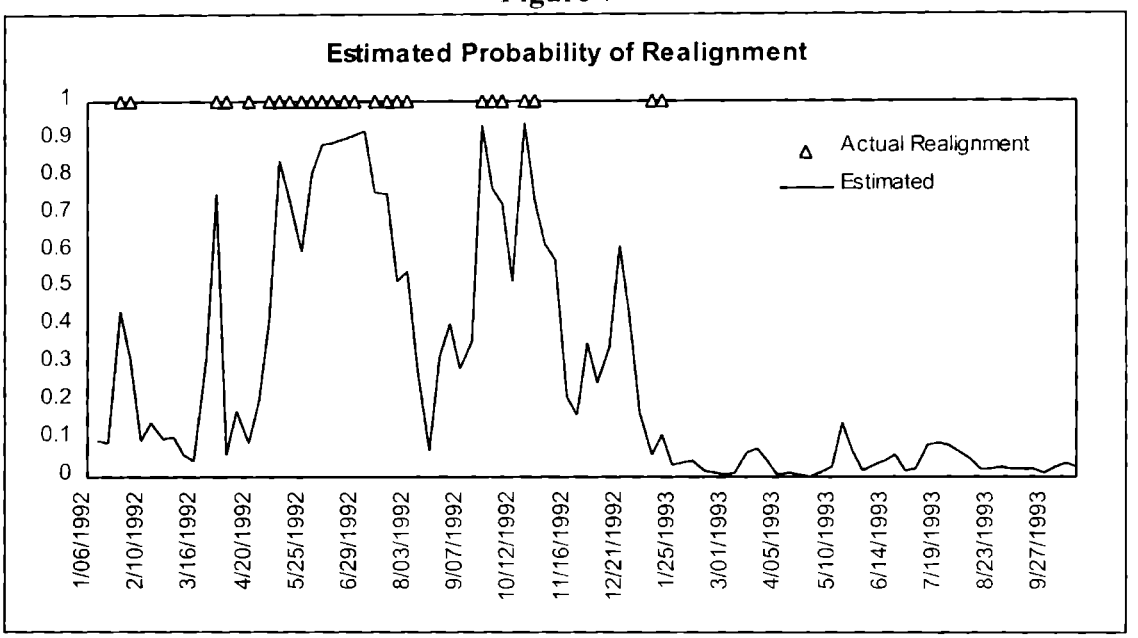


Figure 8

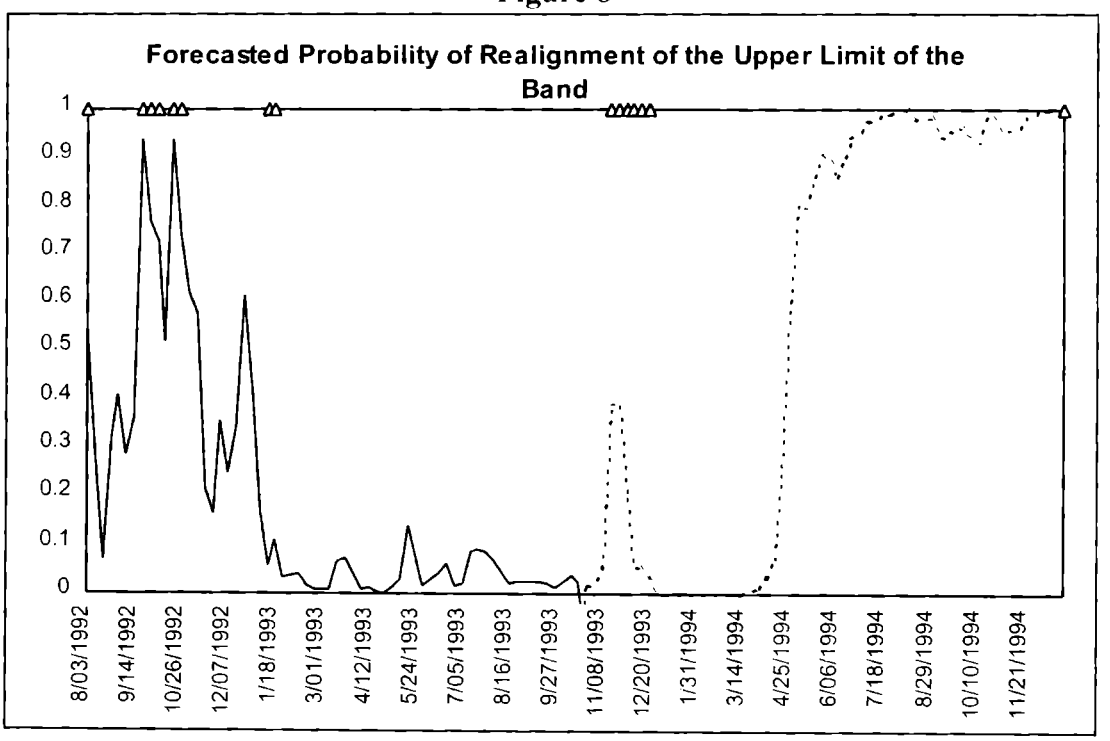


Figure 9

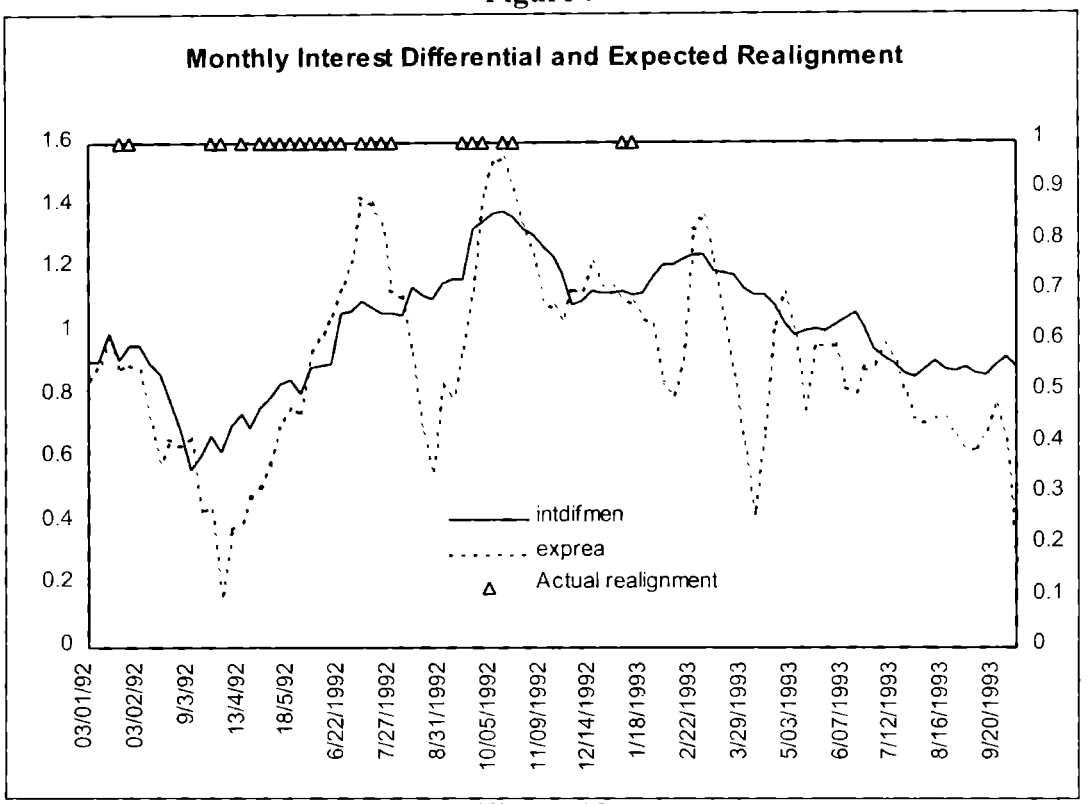
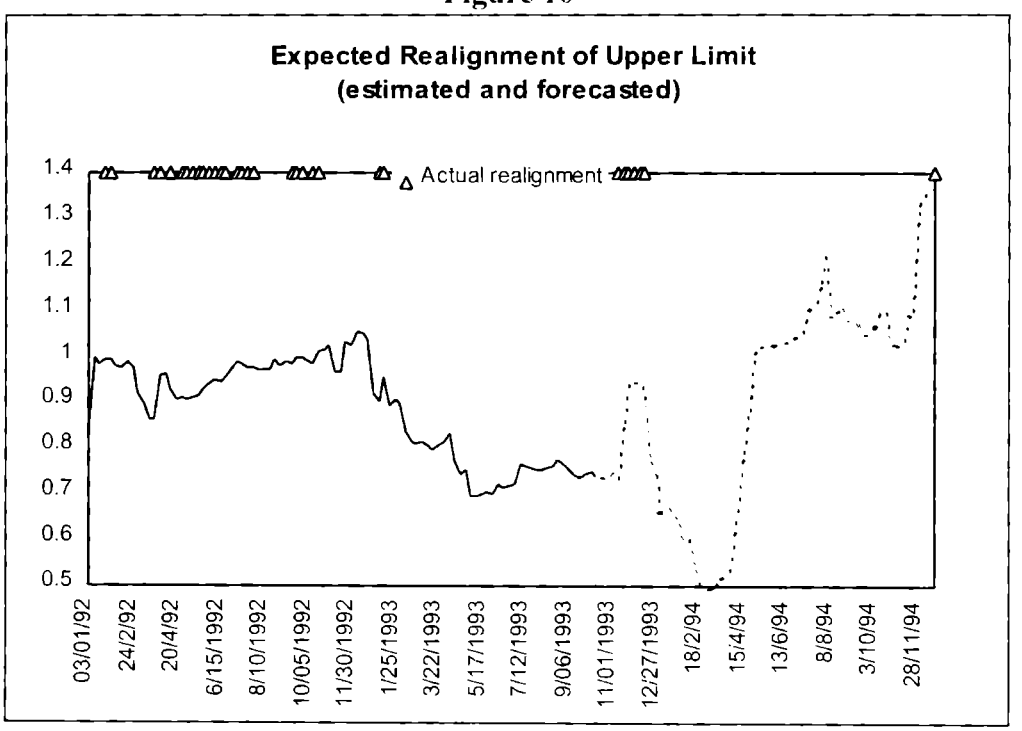


Figure 10



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