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TESTING FOR UNBIASEDNESS OF SURVEY EXCHANGE RATE EXPECTATIONS: THE CASE OF MEXICO, 1989-1997

Abstract

In this paper we present some preliminary results on testing the joint hypothesis of unconditional unbiasedness of expectations (UUH), which implies that forecast errors are random. We use a panel of Mexican firms' exchange rate forecasts at 3-month, 6-month, 9-month and 12-month horizons, during the period 1989-1997. When individual responses are tested without allowing for cross-correlated shocks, the UUH is easily rejected at all horizons. However, when we allow for cross-correlated shocks, the UUH is not rejected for the 3-month and 6-month horizons. On the other hand, when we use mean responses, the UUH is rejected for the 3-month, 9-month and 12-month horizons, although its individual components are not rejected at any horizon considered. When mean responses across all horizons are pooled, the UUH is not rejected.

Resumen

En este artículo se presentan resultados preliminares sobre la validez de la hipótesis conjunta de insesgamiento incondicional de expectativas (UUH), que implica aleatoriedad de los errores de los pronósticos. Se usa información de panel sobre expectativas de tipo de cambio de empresas mexicanas durante el periodo 1989-1997, sobre horizontes de 3, 6, 9 y 12 meses. Utilizando respuestas individuales, la UUH es rechazada para todos los horizontes cuando no se considera la existencia de correlación de corte transversal. Sin embargo, cuando esta correlación es considerada, dicha hipótesis no es rechazada para horizontes de 3 y 6 meses. Utilizando respuestas promedio, la UUH es rechazada para horizontes de 3, 9 y 12 meses, aunque sus componentes individuales no son rechazados para ningún horizonte. Al agrupar las respuestas promedio para todos los horizontes, la UUH no es rechazada.

*1. Introducción**

Since Muth's (1961) seminal paper formalizing the rational expectations hypothesis, the theory has been applied to various areas of economics. Many economists have examined the validity of this hypothesis by analyzing survey data for various economic variables, including inflation rates, interest rates and exchange rates. In this paper we address one of the two hypotheses which make up the rational expectations hypothesis, namely the unbiasedness hypothesis (UH), in the context of cross-correlated shocks and changes in exchange rate regime. To do this we employ survey data set for the Mexican peso for the period 1989 - 1997 for which individual responses are available.

This paper is organized as follows. In the next section we present the standard methodology used in the literature. Then an overview of the Mexican economy in this period is presented prior to describing the data set and methodology used to take into account cross-correlated shocks. Finally, the descriptive statistics and econometric results of the testing of the unbiasedness hypothesis are presented along with some final remarks.

2. The Literature and Standard Methodology

The existing literature on exchange rate expectations falls into three broad categories: papers which use the forward discount (Frankel 1980, Hansen and Hodrick 1980, see Hodrick 1987 for survey), those which use the mean response of survey data (Frankel and Froot 1987, Dominguez 1986) and those which use survey data for which individual responses are available (Ito 1990). Most authors test the rational expectations hypothesis as set forth in Muth (1961).[1]

Muthian rationality is made up of two hypotheses: unbiasedness and orthogonality. Unbiasedness implies that the realized value is equal to the forecast plus a purely random forecast error, which is mean zero and is uncorrelated with the forecast. Orthogonality means that the forecast error is uncorrelated with the information set[2] and implies that forecasters use all information efficiently while making their forecast.

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[1] Not all papers test exclusively Muthian rationality. For example, there are papers which take a co-integration approach (Liu and Maddala, 1992). In this paper we do not pursue a cointegration approach since.

[2] There are many interpretations of the orthogonality hypothesis in the literature. While Lovell(1986) defines *weak rationality* as the error term being uncorrelated with past realizations of the exchange rate and *strong rationality* as the error term being uncorrelated with the entire information set, Kim (1997) defines weak rationality as the error term being uncorrelated with the entire information set, while strong rationality is the joint acceptance of both unbiasedness and

Testing for rationality in the context of the forward discount is problematic in that the model assumes that the forward rate is equal to the market expectation and that the market expectation is equal to the true expectation. Formally, as set forth in Hsieh (1984), the simply efficiency hypothesis (SEH)[3] is a joint hypothesis of rational expectations and zero risk premium.

SEH

Assumption 1: the no-risk-premium hypothesis (or the forward rate reflects the market expectation)

$$F_{t,t+n} = S^{M}_{t,t+n}$$

Assumption 2: the market expectation is equal to the true expectation

$$S^{M}_{t,t+n} = S_{t,t+n}$$

The SEH is a joint test of the above assumptions (i.e. $F_{t,t+n} = S_{t,t+n}$) due to the fact that the market expectation , $S^{M}_{t,t+n}$, is unobservable. Rationality implies that the forecast error ($u_t = S_{t+n} - F_{t,t+n}$) is mean zero and serially uncorrelated (unbiasedness) and uncorrelated with the information set (orthogonality).

The empirical results[4] of the testing of the SEH are generally negative in that they yield a rejection of SEH.[5] However, a rejection of SEH can be due to various factors in addition to the market not being informationally efficient, namely that agents are not risk neutral (there exists a risk premium), and/or there exists a peso problem.[6]

Given that the evidence of a time-varying risk premium is non-conclusive,[7] many researchers[8] have used survey data to get around the problem posed by using

orthogonality. Furthermore, Fama (1970), with reference to the forward rate and the efficient markets hypothesis, defines weak rationality as the inability of traders to make abnormal profits using past prices, semi-strong rationality when the information set includes publicly available information, and strong rationality as the inability to earn abnormal profits using a trading rule which is based on public and/or private information.

[3] The simple efficiency hypothesis (also referred to as the efficient markets hypothesis, EMH) applies only to market based data such as forward rates or prices in financial markets.

[4] See Hallwood and MacDonald (1994) chapter 11.3 and/or Hodrick (1987) for surveys of the findings for the forward market.

[5] In general, not only are the coefficient estimates not equal to their hypothesized values, they often have the opposite sign, possibly due to the existence of a risk premium.

[6] The peso problem, named for the behavior of the Mexican peso during the 1980's, refers to the market expecting an event to occur (i.e. a devaluation), which does not occur in the *sample period*. This produces non-normally distributed errors and can lead to a rejection of SEH even though the market is "rational".

[7] See Lewis (1995).

[8] Dominguez (1986), Frankel and Froot (1987), Taylor (1989), MacDonald and Torrance (1990), MacDonald (1990, 1991), Ito (1990), Cavaglia et. al. (1993, 1994), Beng and Siong (1993), Easton and Lalor (1995), Sobiechowski (1996), and Kim (1997). See Takagi (1991) for a survey of the early literature.

the forward rate by (supposedly) measuring expectations directly. However, the use of survey data has been heavily criticized for many reasons, perhaps the most relevant of which is the fact that one must assume that the survey response is equal to the true expectation. In this paper we recognize the possibility of an in-equivalence of the survey and true expectation, but take a point of view similar to that of Frankel who has been quoted as stating that at a very minimum these data are interesting in their own right.

The papers that use survey data can be grouped into three major categories: (i) those which use the mean response, (ii) those which use the mean response to form a "panel" over currencies (usually to increase power), (iii) those which use a true panel in which the expectations are measured for the same currency over various forecasters over time. The use of the mean response is necessitated by the non-availability of individual responses; however, these data may suffer from distributional problems, which lead to problems in interpretation.[9]

Indeed, Ito (1990) finds evidence of heterogeneous expectations in data for the Japanese yen, which leads us to believe that one can not necessarily test the unbiasedness hypothesis using mean response data, nor by simply adding more currencies in an attempt to increase power. What is required is a true panel of many individuals over time for the same currency.

The data set employed in this paper is very rich in that it surveys approximately 1000 firms quarterly for their expectations of the level of the Mexican peso at four horizons (3-months, 6-months, 9-months and 12-months hence). Individual responses are available. A more complete description of the data is found in section 4.1. This paper does not fully exploit the data set by testing for group effects; this is left to future work.

3. *The Mexican Economy 1989 - 1996*

In this section we provide a brief review of Mexican exchange rate policy from 1989 to 1996 that motivates our empirical study. After a hyperinflation in 1987, the government launched a price stabilization plan, the Pacto. The Pacto was an agreement signed by the government, producers, and labor groups with the immediate goal of bringing down the spiraling expectations of inflation and breaking the cycle of inflation-devaluation-inflation caused by the increasing dollarization of the economy. However, the Pacto was much more than an inflation fighting measure; it was also a

[9] In a panel there may be individual effects. A simple example is one in which certain forecasters continually get the forecast "right" while others get it "wrong". In terms of the forward rate, the efficient markets hypothesis does not require all market participants to be rational, only that someone is taking the excess profits left by others. In terms of survey data which uses the mean response, if these outliers are large and one-sided then the mean will be a biased estimator which may lead to a rejection of unbiasedness. The Currency Forecaster's Digest data, which has been extensively used in the literature, attempts to take this point into consideration by using the harmonic mean, which decreases the weight on outliers.

comprehensive stabilization policy including both an incomes policy and fiscal and monetary restraint with the aim of bringing back sustained growth. From March through December 1988, as part of the Pacto, the exchange rate in Mexico was fixed to stabilize inflation after a devaluation of 39% in November 1987. Beginning in January 1989 and continuing through November 10th, 1991 the peso/dollar exchange rate followed a pre-announced crawling peg; at the beginning of the regime the government announced the maximum level of depreciation of the peso per day vis à vis the U.S. dollar. As announced in January 1989, the peso/dollar exchange rate crawled at 1.0 peso per day. During this period there were three announced changes in the rate of crawl, resulting in the following regimes:

May 28, 1990: announced to crawl at 0.8 pesos per day
November 10, 1990: announced to crawl at 0.4 pesos per day
November 11, 1991: announced to crawl at 0.2 pesos per day.

Throughout this period inflation fell from an annual rate of 159% in 1987 to 51.67% in 1988, and was then contained below 30% per year. Also in 1989, the law regulating foreign investment was changed to allow foreigners to participate in Mexican financial markets, marking the near total opening of the capital account.

By setting the rate of crawl in terms of pesos per day, the depreciation rate over time falls gradually even within a fixed rate of crawl regime.[10] This system was used in hopes of decreasing economic uncertainty and inflationary expectations, which had caused very high real rates of interest on Cetes (Certificados de la Tesorería de la Federación, or Mexican government treasury bills) and stagnated foreign investment. On November 11th, 1991, due to increasing foreign capital inflows, the exchange rate mechanism was changed to an ever-widening band, which continued up to the change in regime to floating in December 1994.

Under this system, the floor (purchase) price was fixed at a level of 3051.2 pesos per dollar, and the ceiling (sale) price was depreciating at 0.2 pesos per day.[11] Due to various macroeconomic factors, the rate of crawl of the upper band was changed on various occasions: from 0.2 to 0.4 and then to a rate of 1.0 peso per day. This exchange rate mechanism had the advantage that the exchange rate was not forced to depreciate; rather, it would float within an increasing band due to supply and demand. Also, the band increased over time, allowing greater flexibility of the exchange rate to outside forces, such as abrupt changes in the demand for peso denominated assets. Banco de México intervened if and when the exchange rate reached either of the intervention points.

[10]This must be true: say the exchange rate today is 2500, the rate of crawl is 1 peso per day; therefore, in 30 days it will be 2530. One is a smaller percentage of 2530 than it is of 2500.

[11]On January 1, 1993, there was a currency reform, with the "new" peso equal to 1000 "old" pesos. Hence the lower bound became 3.0512 new pesos and the rate of crawl become 0.0002 new pesos per day.

The increasing quantities of short-term foreign investment along with an anti-inflationary macroeconomic policy lead to an increasing overvaluation of the peso during 1992 and 1993. The signing of NAFTA and its application in January 1994 marked a radical change in the economy. Mexico entered 1994 with an overvalued currency, free trade with the U.S. and Canada, an increasing current account deficit and political uncertainty. After a year of political turmoil[12] in December it became obvious that the exchange rate regime could no longer be sustained and the peso was allowed to float on December 21, 1994.

The financial crisis that followed the regime change lead to high volatility of the nominal and real exchange rates. While the brunt of the crisis lasted through mid-1996, remnants still remain. These are augmented by the volatile nature of both the exchange rate and interest rate due to internal and external factors.

4. Empirical Results

In this section we describe the data and methodology, present summary statistics of the survey expectations forecast errors, and present estimation and testing results regarding the unbiasedness hypothesis.

4.1 Data and Methodology

The National Statistics Institute of Mexico (INEGI) has surveyed manufacturers quarterly since 1979 regarding various characteristics of their firm and its relation to the economy in general. The data used for this paper are quarterly surveys of exchange rate expectations from April 1989 through December 1996 of approximately 1000 firms located throughout the country. The surveys are conducted in person with the CEO or CFO the first week after the end of an economic quarter. Due to the size of the sample, it is not possible to survey all firms on exactly the same day; however, approximately 80% are surveyed during the first week, 17% the second week and 3% the third week. Exact dates for the surveys are not available. While the surveys cover only 1 - 2% of all manufacturers in Mexico, they account for approximately 85% of all manufacturing output in the country. Firms are chosen for the survey based on the Censo Económico (Economic Census) conducted by the government, with the sample comprised of the largest firms in each manufacturing sector. Individual responses are available as are individual producer characteristics.[13]

[12] January 1, start of the Chiapas rebellion; March, assassination of the PRI party's candidate; August, presidential elections; September, assassination of the PRI party boss; December 1, exit of President Salinas and swearing in of President Zedillo.

[13] These characteristics include: location within the country; manufacturing sector; does the firm have partial foreign ownership?; does the firm participate in the import market, export market, both, or neither? These characteristics can be used to look at the possible heterogeneity of expectations; however, this is left to future work.

Firms are asked to give their expectation for the **level** of the exchange rate for a given date, not horizon, with quarterly results distributed to all respondents. The dates correspond to 3-month, 6-month, 9-month, and 12-month forecasts.[14] The expectations with a 3-month and 9-month horizon are surveyed in April and October, whereas the 6-month and 12-month horizons are surveyed in July and January. This type of survey scheme has a drawback in terms of the number of available time series observations; in this 31-quarter period there are only fifteen 3-month and 9-month observations and only sixteen for the 6-month and 12-month forecasts.[15] However, this sampling scheme also has an advantage, namely that a given forecast date will have an expectation 12 months, 9 months, 6 months and 3 months ahead, allowing us to study the evolution of expectations for the same date as more information becomes available.

In this paper we evaluate unbiasedness of expectations using individual and mean responses. We follow the standard methodology with some modifications in order to allow for cross-correlated shocks at the individual responses level. In a panel data context, the unconditional unbiasedness hypothesis (UUH), in the sense of Muth (1961), implies that the realized exchange rate at time $t+1$ (X_{t+1}) is equal to the forecast ($X^{e}_{t+1,j}$) plus a purely random, mean zero, forecast error as follows

$$X_{t+1} = X^{e}_{t+1,j} + u_{t,j}, \qquad t = 1,\ldots,T,\ j = 1,\ldots,N \tag{1}$$

which implies that the forecast errors are equal to zero on average. That is

$$E(X_{t+1} - X^{e}_{t+1,j}) = E(u_{t,j}) = 0. \tag{2}$$

The validity of the UUH can, therefore, be evaluated by testing the joint null hypothesis $H_0 : \alpha = 0, \beta = 1$, in the following model

$$X_{t+1} = \alpha + \beta X^{e}_{t+1,j} + u_{t,j} \tag{3}$$

where the error term $u_{t,j}$ satisfies, by construction, the assumptions of the classical linear regression model. In model (3), OLS estimators of α and β will be unbiased,

[14]We refer to the expectations as 3-month, 6-month, 9-month, and 12-month even though that is not technically correct. For example, the 3-month expectations are really 2 month and 3 week expectations for 80% of the sample, 2 month and 2 week expectations for 17% of the sample, and 2 month 1 week expectations for 3% of the sample.

[15]The sample does not ask every quarter for the respondent's expectation of the exchange rate three months ahead. The 3-month horizon is sampled every six months, as are the 6-, 9-, and 12-month horizons.

consistent and efficient both under the null ($H_0 : \alpha = 0, \beta = 1$) and under the alternative ($H_1 : NotH_0$) hypothesis.

In the cases of panel individual responses, however, it is likely that shocks are correlated across individuals. In other words, since individuals live in the same macroeconomic environment, they are affected by common shocks and tend to make forecast errors that go in the same direction. If this is indeed the case, the testing of the UUH would require explicitly taking into account the proper covariance matrix of errors in order to exploit the data efficiently. To accomplish this task, we use 2-step iterated FGLS, which is asymptotically equivalent to MLE. In the case of mean individual responses we use the regression

$$X_{t+1} = \alpha + \beta X^e_{t+1} + v_t \qquad (4)$$

where $X^e_{t+1} = (1/N)\sum_{j=1}^{N} X^e_{t+1,j}$ is the average of the expectations across the N individual responses. In this case, we still apply OLS but make inferences based on Newey-West HAC standard errors.

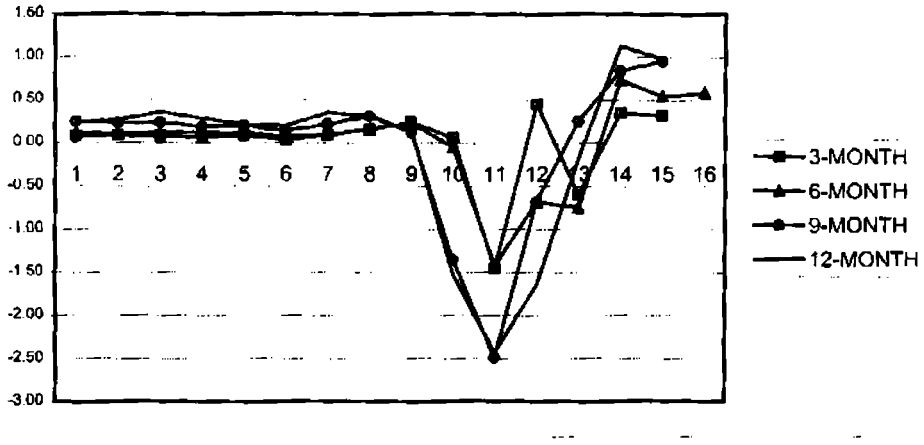
In this paper we do not implement a cointegration approach because not only the time dimension of sample is too small, but also it appears that there is a regime change in the data as would become apparent in the next section.

4.2 Descriptive statistics of the forecast errors

In this section we present descriptive statistics on the mean forecast error[16] for various horizons. As is apparent in figure 1, the mean forecast error is a function of the horizon, with longer horizons corresponding to larger mean errors. This is to be expected for various reasons, primarily that the currency was expected to depreciate based on PPP differentials and the fact that at longer horizons there is more uncertainty about shocks to the exchange rate.

[16]Descriptive statistics on alternative measures of central tendency can be found the appendix.

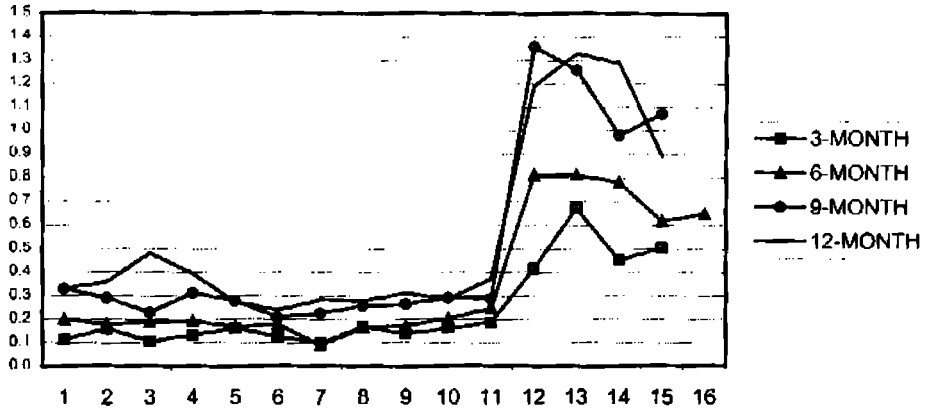
FIGURE 1: MEAN OF FORECAST ERRORS



It is also apparent that forecasters, in making their forecasts in October for the end of December, were not expecting a devaluation of the magnitude that actually occurred, as evidenced by the huge forecast error associated with the devaluation. However, once the devaluation materialized, the mean forecast error does not appear to be significantly affected, rather the effect is on the volatility.

In fact, as shown in Figure 2, there is a marked increase in the volatility of the mean associated with the devaluation and change in regime. As with the mean, the increased volatility is also a function of the forecast horizon, with longer forecast horizons experiencing larger volatility, as is expected. However, there is little difference between the 9-month and 12-month horizons, indicating that during the floating rate regime these horizons were so far hence that forecasters perceived them to be similar in risk. It is important to remark, however, that given that only a few observations are available for the post-crisis period, it is not clear whether there is a change to a regime with much higher volatility or the high volatility is only transitory.

FIGURE 2: VOLATILITY OF FORECAST ERRORS



4.3 Results on the unbiasedness hypothesis

As previously stated, we use the results from regressions (3) and (4) to test the joint null hypothesis ($H_0 : \alpha = 0, \beta = 1$), with non-rejection of this hypothesis giving support to the UUH. In addition, we evaluate each of the previous individual hypotheses separately ($H_0 : \alpha = 0$ and $H_0 : \beta = 1$). Tables 1 through 3 summarize the estimation and testing results. In all cases a dummy variable is included to control for the extremely large forecast errors which occurred during the peso crisis. The results on the dummy variable in all cases are significant but are suppressed to save space.

When using the entire panel with individual responses we find that when cross-sectional correlation across the errors is not taken into account, the joint UUH is rejected in all cases. Also when the individual hypotheses are evaluated, they are rejected in all cases. These results are presented in Table 1.

TABLE 1:
OLS estimates and rationality tests.
(panel with individual responses)

HORIZON	ESTIMATIONS RESULTS[1]			HYPOTHESIS TESTING[2]		
	α	β	Adj. R^2	H_0: α=0	H_0: β=1	H_0: α=0,β=1
3 MONTHS	-0.021066 (-9.440092)	0.996301 (644.27147)	0.976678	F= 89.1153 (0.00000)	F= 5.7194 (0.01680)	F= 895.078 (0.00000)
6 MONTHS	0.003011 (0.956447)	0.982894 (465.51323)	0.952981	F= 0.914791 (0.338868)	F= 65.6347 (0.00000)	F= 316.571 (0.00000)
9 MONTHS	-0.003727 (-0.877643)	0.966274 (346.55201)	0.927004	F= 0.770257 (0.380158)	F= 146.302 (0.00000)	F= 1056.72 (0.00000)
12MONTHS	0.060614 (13.795473)	0.905208 (308.47246)	0.923068	F= 190.3151 (0.00000)	F= 1043.45 (0.00000)	F = 2240.35 (0.00000)

Note: 1 = numbers in parenthesis are t-ratios. 2 = numbers in parenthesis are p-values. There are 10170 observations for the 3-, 9- and 12-month horizons, and 10848 observations for the 6-month horizon.

However, once cross-sectional correlation is allowed for the results are different. As is apparent in table 2, the joint null hypothesis ($H_0 : \alpha = 0, \beta = 1$) is not rejected at the 1% significance level (p-values are higher than 0.01) for the 3 and 6-month horizons, while tests for the 9- and 12-month horizons do reject UUH. These results are consistent with the descriptive statistics in section 4.2 which show that the shorter the horizon the better the forecasts.

TABLE 2:
FGLS estimates and rationality tests.
(panel with individual responses)

HORIZON	ESTIMATIONS RESULTS[1]			HYPOTHESIS TESTING[2]		
	α	β	Adj. R^2	H_0: α=0	H_0: β=1	H_0: α=0,β=1
3 MONTHS	-0.042672 (-1.006178)	1.013205 (34.401586)	0.976382	F= 1.012394 (0.314354)	F= 0.2010 (0.65390)	F= 2.28786 (0.101535)
6 MONTHS	-0.030572 (-1.29536)	1.009686 (63.501763)	0.952020	F= 1.677957 (0.255088)	F= 37114 (0.542394)	F= 3.37391 (0.034291)
9 MONTHS	-0.070153 (-2.797293)	1.015961 (61.284318)	0.917035	F= 7.824848 (0.005163)	F= 0.8516 (0.35611)	F= 23.9826 (0.00000)
12 MONTHS	-0.0180007 (-0.677246)	0.960918 (53.894297)	0.899942	F= 0.458662 (0.498265)	F= 4.8048 (0.02840)	F= 51.6172 (0.00000)

Note: 1 = numbers in parenthesis are t-ratios. 2 = numbers in parenthesis are p-values. There are 10170 observations for the 3-, 9- and 12-month horizons, and 10848 observations for the 6-month horizon.

At the mean response level, the joint null hypothesis is rejected in the cases of 3-, 9- and 12-month horizons (Table 3). Only expectations at 6-month horizon seem to be unbiased. However, the individual hypothesis can not be rejected separately in all horizons. This result might be due to the fact that the number of observations is relatively small (15 observations are used for each regression). In the

last row of Table 3 we present results for the overall sample (pooling across all horizons). In this case we find evidence in support of the UUH.

TABLE 3:
Estimates and rationality tests.
(mean responses)

	ESTIMATIONS RESULTS[1]			HYPOTHESIS TESTING[2]		
HORIZON	α	β	Adj. R^2	H_o: α=0	H_o: β=1	H_o: α=0,β=1
3 MONTHS	-0.058448 (-0.7866)	0.989132 (43.7453)	0.988900	F= χ^2= 0.6187 (0.446773)	F= χ^2= 0.231019 (0.639413)	F= 12.29507 (0.001244) χ^2 = 24.5901 (0.000005)
6 MONTHS	0.087269 (0.538899)	0.959473 (19.1265)	0.970501	F= χ^2= 0.290412 (0.599064)	F= χ^2= 0.65266 (0.4337)	F= 0.407779 (0.673344) χ^2= 0.81556 (0.665126)
9 MONTHS	-0.000504 (-0.002573)	0.947385 (15.77958)	0.963773	F= χ^2= 0.00000 (0.997989)	F= χ^2= 0.76801 (0.398039)	F= 8.259146 (0.005551) χ^2= 16.5183 (0.000259)
12 MONTHS	0.048724 (0.304447)	1.070028 (19.76557)	0.967499	F= χ^2= 0.09269 (0.766003)	F= χ^2= 1.67331 (0.220161)	F= 99.13734 (0.00000) χ^2= 198.275 (0.00000)
OVERALL	0.050117 (0.294459)	0.980406 (22.07354)	0.961031	F= χ^2= 0.08671 (0.769516)	F= χ^2= 0.19462 (0.660829)	F= 0.167383 (0.846305) χ^2= 0.33477 (0.845876)

Note: 1 = numbers in parenthesis are t-ratios. 2 = numbers in parenthesis are p-values. There are 15 observations for the 3-, 9- and 12-month horizons, 16 observations for the 6-month horizon, and 61 observations in the case of the overall regression.

5. Final Comments

In this paper we have evaluated the unconditional unbiasedness hypothesis (UUH) using exchange rate survey panel data for which individual responses are available which allows us to take into account cross-correlated shocks. We also present results at the mean response level.

Using the panels with individual responses we find that if cross-correlation is not taken into account the UUH is rejected at all horizons. However, once we allow for cross-correlation across individuals, we find support of the UUH for the 3- and 6-month horizons, while the UUH does not seem to hold for the 9- and 12-month horizons.

At the mean response level we have found that although the UUH can be rejected as a joint hypothesis, none of its individual components is rejected when

evaluated separately at any horizon considered. Also, individual and joint hypotheses are not rejected in the overall case (i.e. when we pool across horizons).

It should be remarked that our results are preliminary. At this point we are extending our work by including more observations, explicitly taking into account the implied moving average patterns when forecast dates do not match forecast horizons, and testing for orthogonality. All these will allow us to make more robust statements on the rationality of Mexican firm's exchange rate forecasts.

TABLE A1: DESCRIPTIVES OF FORECAST ERRORS (3 MONTHS)

PERIOD	MEAN	MEDIAN (.5TH)	0.5TH	.95TH	STD. DEV
DC-89	0.0772	0.054	-0.046	0.354	0.1128
Jun-90	0.0858	0.0558	-0.0202	0.2615	0.1592
DC-90	0.0763	0.0526	0.0026	0.2526	0.1043
Jun-91	0.0632	0.0156	-0.0194	0.2843	0.1303
DC-91	0.0852	0.034	0.004	0.329	0.1628
Jun-92	0.0369	0.0112	-0.0418	0.2374	0.1255
DC-92	0.0843	0.051	0	0.28	0.0970
Jun-93	0.1584	0.133	0.013	0.383	0.1673
DC-93	0.2370	0.223	0.093	0.493	0.1371
Jun-94	0.0599	0.01	-0.14	0.362	0.1613
DC-94	-1.4546	-1.5	-1.61	-1.1	0.1853
Jun-95	0.4464	0.565	-0.235	0.765	0.4138
DC-95	-0.5971	-0.69	-1.2875	0.31	0.6722
Jun-96	0.3462	0.337	-0.0705	1.137	0.4533
DC-96	0.3237	0.136	-0.264	1.136	0.5044

TABLE A2: DESCRIPTIVES OF FORECAST ERRORS (6 MONTHS)

PERIOD	MEAN	MEDIAN (.5TH)	0.5TH	.95TH	STD. DEV
DC-89	0.1088	0.054	-0.046	0.354	0.2004
Jun-90	0.1014	0.0683	-0.0388	0.3798	0.1770
DC-90	0.1166	0.0676	-0.0004	0.47695	0.1849
Jun-91	0.1174	0.0806	-0.0194	0.4806	0.1910
DC-91	0.1135	0.039	0.006	0.429	0.1680
Jun-92	0.0786	0.0282	-0.0218	0.3782	0.1773
DC-92	0.0965	0.079	0.007	0.31	0.0874
Jun-93	0.1577	0.123	0.033	0.383	0.1632
DC-93	0.2286	0.193	0.043	0.593	0.1721
Jun-94	-0.0510	-0.09	-0.27	0.310	0.2029
DC-94	-1.4227	-1.5	-1.7	-1	0.2465
Jun-95	-0.6825	-0.735	-1.735	0.765	0.8117
DC-95	-0.7462	-0.69	-1.705	0.41	0.8114
Jun-96	0.7292	0.637	-0.263	2.037	0.7810
DC-96	0.5404	0.486	-0.164	1.714	0.6174
Jun-97	0.5843	0.555	-0.045	1.555	0.6472

TABLE A3: DESCRIPTIVES OF FORECAST ERRORS (9 MONTHS)

PERIOD	MEAN	MEDIAN (.5TH)	0.5TH	.95TH	STD. DEV
Jun-90	0.2489	0.1798	-0.0202	0.6798	0.3300
Dec-90	0.2282	0.1426	0.0026	0.6526	0.2910
Jun-91	0.2366	0.1806	0.0377	0.6336	0.2279
Dec-91	0.1857	0.079	-0.011	0.7790	0.3121
Jun-92	0.2018	0.0982	-0.0108	0.8782	0.2798
Dec-92	0.1427	0.08	-0.0066	0.4825	0.2085
Jun-93	0.2198	0.1425	0.033	0.77875	0.2244
Dec-93	0.3111	0.223	0.063	0.843	0.2571
Jun-94	0.1217	0.11	-0.1515	0.61	0.2651
Dec-94	-1.3526	-1.415	-1.7	-0.800	0.2920
Jun-95	-2.4873	-2.57	-2.7865	-1.935	0.2880
Dec-95	-0.6748	-0.69	-2.673	1.9335	1.3576
Jun-96	0.2585	-0.063	-1.263	2.437	1.2590
Dec-96	0.8412	0.736	-0.317	2.548	0.9801
Jun-97	0.9498	0.755	-0.145	3.055	1.0708

TABLE A4: DESCRIPTIVES OF FORECAST ERRORS (12 MONTHS)

PERIOD	MEAN	MEDIAN (.5TH)	0.5TH	.95TH	STD. DEV
Jun-90	0.2489	0.1798	-0.0202	0.6798	0.3300
DC-90	0.2663	0.1526	0.0167	0.8526	0.3589
Jun-91	0.3545	0.2106	0.07515	0.9806	0.4816
DC-91	0.2813	0.179	0.00485	0.9290	0.3937
Jun-92	0.2146	0.1282	-0.00725	0.8782	0.2730
DC-92	0.2007	0.1265	0.016	0.6824	0.2390
Jun-93	0.3519	0.3519	0.0547	0.883	0.2826
DC-93	0.3115	0.218	0.083	0.893	0.2766
Jun-94	0.1419	0.06	-0.19	0.71	0.3108
DC-94	-1.5180	-1.53	-1.85	-1.000	0.2882
Jun-95	-2.4310	-2.495	-2.835	-1.735	0.3714
DC-95	-1.6510	-1.69	-3.19	0.31	1.1897
Jun-96	-0.1743	-0.263	-2.063	2.437	1.3294
DC-96	1.1298	1.036	-0.364	4.136	1.2878
DC-97	0.9787	0.944	-0.056	2.444	0.8905

FIGURE A1: MEAN AND QUANTALES OF FORECAST ERRORS (3 MONTHS)

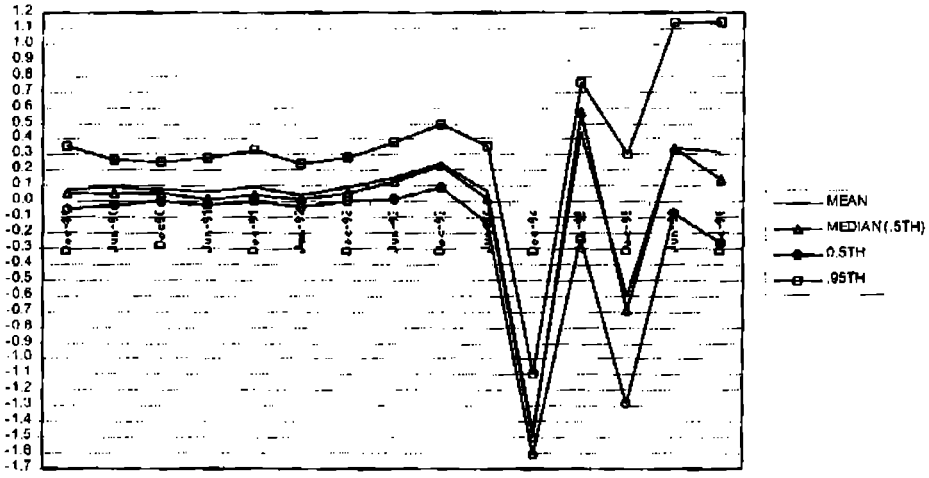


FIGURE A2: VOLATILITY OF FORECAST ERRORS (3 MONTHS)

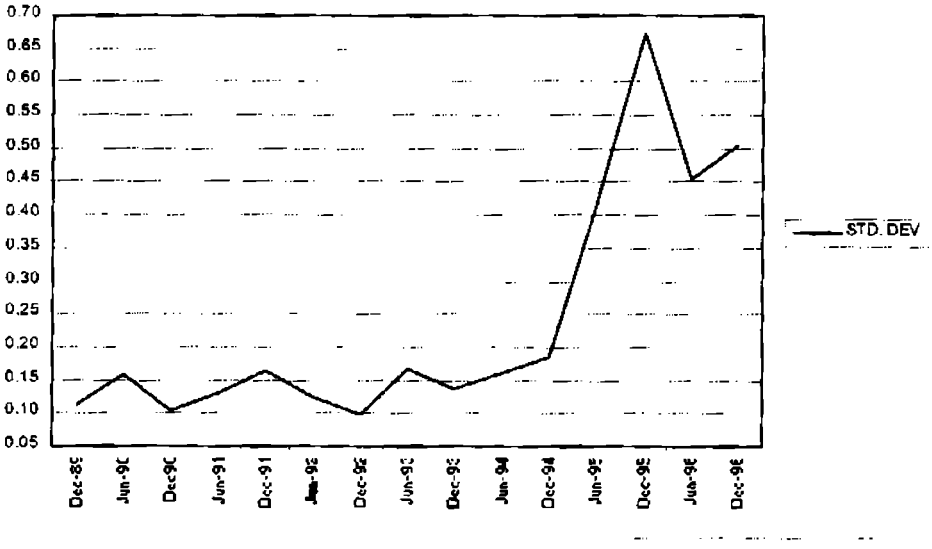


FIGURE A3: MEAN AND QUANTALES OF FORECAST ERRORS (6 MONTHS)

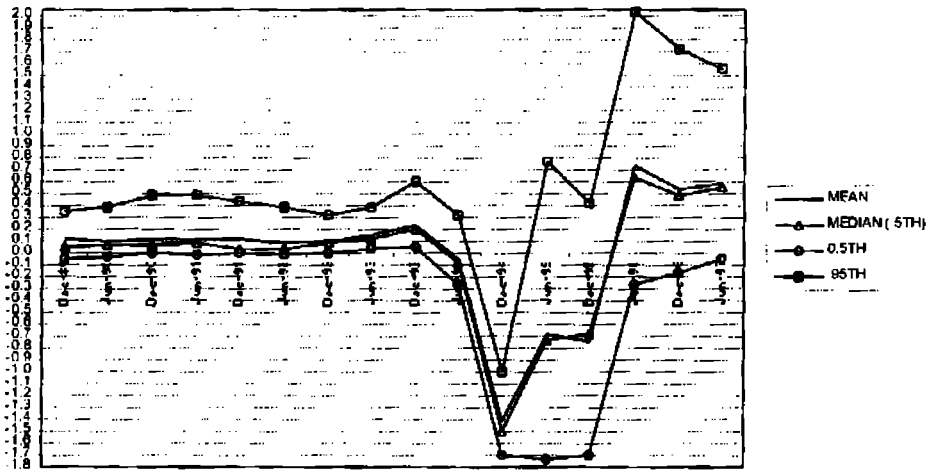


FIGURE A4: VOLATILITY OF FORECAST ERRORS (6 MONTHS)

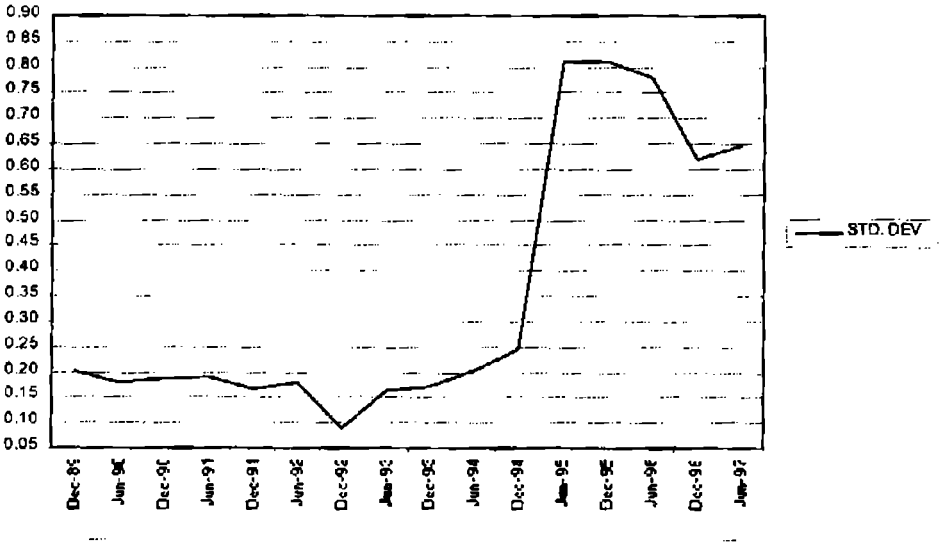


FIGURE A5: MEAN AND QUANTALES OF FORECAST ERRORS (9 MONTHS)

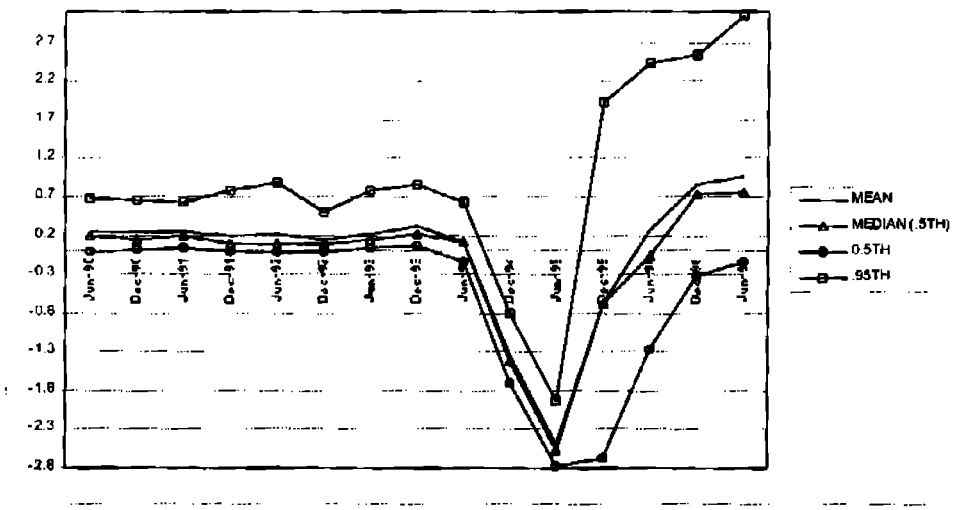


FIGURE A6: VOLATILITY OF FORECAST ERRORS (9 MONTHS)

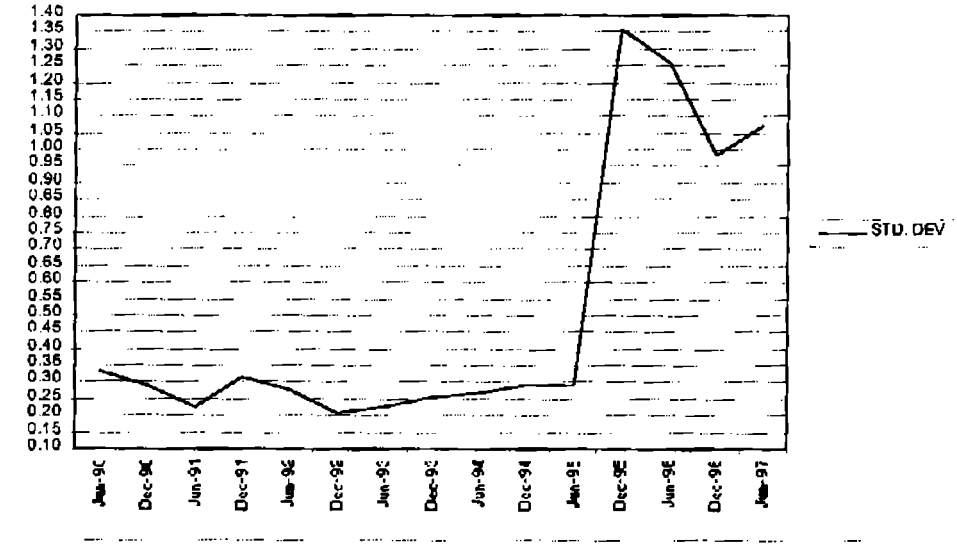


FIGURE A7: MEAN AND QUANTALES OF FORECAST ERRORS (12 MONTHS)

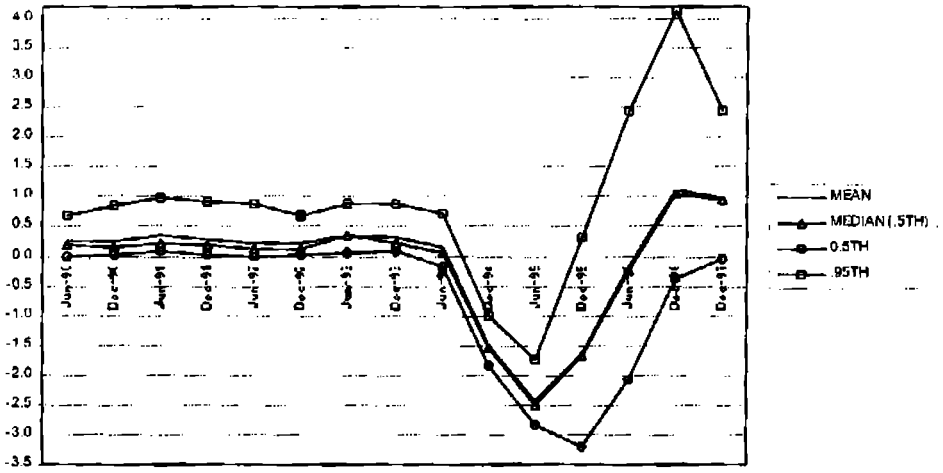
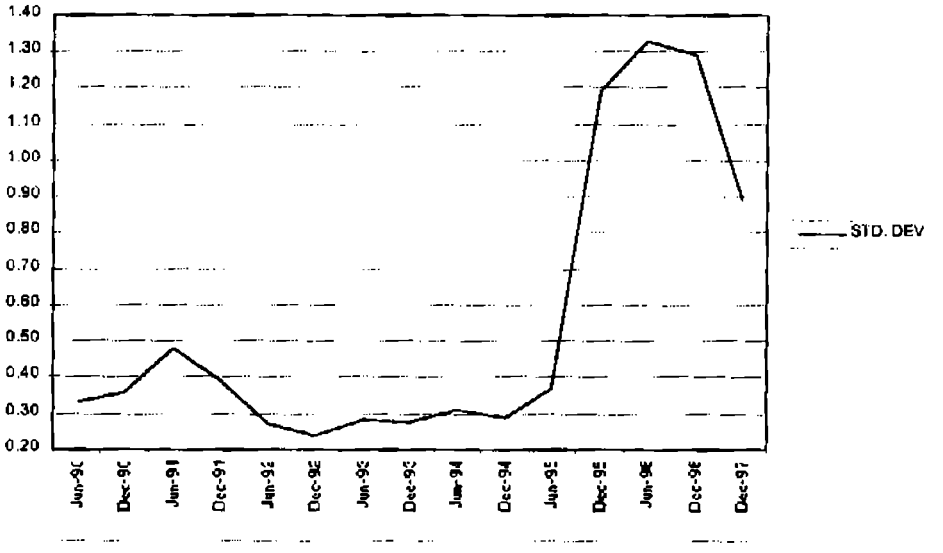


FIGURE A8: VOLATILITY OF FORECAST ERRORS (12 MONTHS)



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