

**DEVALUATION EXPECTATIONS AND THE STOCK MARKET:
THE CASE OF MEXICO IN 1994/95***

Torbjörn Becker
R. Gaston Gelos
Anthony J. Richards*

International Monetary Fund

Abstract

This paper develops a market-based measure of devaluation expectations derived from the relative stock market performance of companies with different exchange-rate exposures. The measure can be viewed as a complement to measures of devaluation expectations based on interest-rate-parity conditions, survey data or macroeconomic models. As an illustration, we analyze the Mexican devaluation of 1994. Contrary to what might have been expected given the alleged peso overvaluation, high-net-exporting firms outperformed the market beginning in late 1993. This pattern would be consistent with forward-looking stock prices that assigned an increasing probability to a devaluation.

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* International Monetary Fund, Research Department, 700 19th Street NW, Washington DC, 20431.

I. Introduction

The wave of financial crises of the 1990's has revived academics' and policymakers' interest in methods of assessing the credibility of exchange-rate regimes and given rise to a new empirical literature on leading indicators of currency crises. Traditionally, economists have relied on interest-parity conditions to gauge devaluation expectations.² However, this approach is subject to a number of empirical limitations. For example, the general evidence for uncovered interest parity is mixed, and in practice it is often difficult to find two securities denominated in domestic and foreign currency that carry the same default risks. Similarly, the new literature on leading indicators ("early warning systems") has also met with limited success.³ Moreover, the implementation of these systems is cumbersome and data-intensive, and the macroeconomic data required are typically not available in a timely fashion or at high frequencies.

This paper proposes a new, stock-market based measure of devaluation expectations. Whereas overall stock market indices do not appear to be very useful leading indicators of devaluations,⁴ we propose a closer examination of *relative* price movements. More specifically, our approach is based on monitoring the behavior of a portfolio that is constructed to react to changes in exchange-rate expectations.⁵ An example of such a portfolio would include high-net-exporting firms with positive weights and low-net-exporting firms with negative weights, so that it reflects the relative performance of high- and low net exporting companies. If there is enough ex-ante information about the exchange-rate sensitivity of such a portfolio, its performance can serve as a measure of devaluation expectations in a fixed exchange-rate regime (or as a leading indicator of a currency crisis).

Evidence from the Mexican 1994/95 crisis provides support for our approach. While the episode has been extensively analyzed, to our knowledge, no study has examined in detail the behavior of stock prices around this event. The question of whether the stock market anticipated a devaluation is particularly interesting in the Mexican case since the crisis is generally viewed as having been unanticipated. For the non-financial sector, we make use of detailed information on foreign currency exposures at the company level. The relative performance of high- and low net-exporting firms suggests that devaluation expectations started to build up approximately a year before the actual event, while relative performance

² See for example Rose and Svensson [1995].

³ See Berg and Pattillo [2000], Frankel and Rose [1996], and Kaminsky, Lizondo, and Reinhart [1997].

⁴ See Berg and Pattillo [2000].

⁵ One of the few papers that relates devaluation expectations to stock market behavior is Berglund and Löflund [1997] who study the Finnish market in 1989-94. However, they do not distinguish between sectors. The approach pursued here bears some resemblance to the more general idea of "tracking portfolios" discussed in Lamont (1999).

after the abandonment of the peg display a strong correlation with the movements of the floating exchange rate.

The fact that rather than underperforming due to an presumably overvalued currency, the high-net-exporting stocks outperformed the rest of the market in the lead-up to the devaluation, might come as a surprise to some. This cannot easily be explained without referring to investors' assessments of likely future adjustments in the exchange rate. Thus this paper provides not only a new market based measure of exchange rate expectations, but also supports the notion that in this emerging market, stock-prices are, at least to some extent, driven by forward-looking investors.

II. Measures of Devaluation Expectations

Empirical approaches to measuring devaluation expectations can broadly be classified into three categories: market-data based models, macroeconomic models, or surveys. The measure proposed in this paper falls in the market-data category. The innovative feature of our approach is that the data used are stock market data instead of the typically employed interest rates. Before the stock-market measure is presented, we provide a summary of the traditional approaches.

A. Traditional Measures

Traditionally, economists have relied on interest and exchange rates in order to assess markets' devaluation expectations. The most common departing points in this context are the so-called covered and uncovered interest parities (CIP and UIP). According to UIP, the interest differential between two assets denominated in different currencies that carry the same default risk should represent the expected depreciation rate of one currency vis-à-vis the other. Let i_t and i_t^* denote interest rates on domestic and foreign-currency denominated assets, e_t the spot exchange rates expressed in terms of domestic currency per foreign currency, and E_t the expectations operator at time t . The relationship is given by:

$$(1) \quad (1 + i_t) = (1 + i_t^*) \frac{E_t(e_{t+1})}{e_t}$$

When substituting the expected exchange rate by the forward rate, one obtains CIP. These equations have been used to deduce the expected devaluation from interest differentials or from the forward exchange rate. However, the empirical evidence in favor of either UIP or CIP is mixed at best. The forward exchange rate has proved to be a bad predictor of future exchange rate movements, and it has been argued that this reflects the

presence of large and time-varying currency premia.⁶ In practice, it is often difficult to find two securities denominated in domestic and foreign currency that carry the same default risks. For example, for the case of Mexico, Werner [1996] finds that the risk premia on the peso can partly be explained by relative supplies of dollar- and peso-denominated debt. These relative asset supplies, in turn, are endogenous, since the government reacts to changes in the cost of its debt. Additional problems that restrict the usefulness of UIP or CIP to infer devaluation expectations arise from less-than perfect capital mobility and the fact that in general, interest rates are also policy instruments, subject to various regulations, and therefore not always market-determined.

Nevertheless, most of the literature trying to assess the credibility of fixed-exchange rate regimes relies strongly on the validity of UIP. An example is Rose and Svensson [1995], who argue that in narrow target zones, the assumption of UIP may be more appropriate than under other circumstances. By contrast, without formally assuming UIP, Svensson [1991] proposes a test of target-zone credibility based on the argument that an exchange rate band implies a band for domestic currency rates of return. If the domestic interest rate is outside the rate-of-return band, then there either exist arbitrage opportunities or the exchange rate band is not fully credible.

Another approach focuses on the information contained in the prices of financial derivatives, see Söderlind and Svensson [1997] for a survey of this approach. Campa and Chang [1996] develop a test that relies on ERM cross-rate options. While, similarly to Svensson [1991], the approach has the advantage of being based on arbitrage and not on a particular model, unfortunately, however, the type of financial instruments analyzed are not available for many countries.

A different strand of the literature attempts to explain the timing of exchange rate crises based on the prediction of macroeconomic models of speculative attacks. Typically, such models rely on a money market equilibrium condition, which under a fixed exchange rate regime determines the path of central bank reserves. Based on parameter estimates from the key relationships in the models, estimates of shadow exchange rates and devaluation probabilities can be constructed. Examples of this approach include Blanco and Garber [1986], and Goldberg [1994]. However, these results are obviously strongly dependent on specific model assumptions and on a correct estimation of parameters, restricting their practical applicability somewhat. Recently, a related literature has attempted to assess probabilities of currency crises⁷ while imposing less structure and not explicitly constructing shadow exchange rates. A number of indicators such as the real exchange rate, money growth, debt levels, and reserves, are used as explanatory variables in probability models,

⁶ Note that we have already excluded differences that are due to country—or political—risks. For a survey, see Lewis [1995].

⁷ Various definitions of currency crises are used in the literature. See Berg and Pattillo [1998].

such as those of Frankel and Rose [1996], Kaminsky, Lizondo, and Reinhart [1997], and Sachs, Tornell, and Velasco [1996a]. As an in-depth evaluation of the methodology by Berg and Pattillo [1998] shows, this approach has only been moderately successful. Moreover, in practice the required macroeconomic data are generally not all available on a reliable, timely, and high-frequency basis.

The use of survey data can overcome some of these difficulties. Asking market participants directly about their expectations seems to be a sensible alternative to the more indirect methods described above. However, there are potential drawbacks. Apart from the problem that market participants may not have the right incentives to correctly reveal their expectations, the link between average expectations and the marginal pricing in the foreign exchange market is not clear.⁸ More importantly, high-frequency and timely survey data are seldom available, especially in the case of emerging markets that we are primarily interested in.

These considerations suggest that a closer look at stock markets may be fruitful in order to assess market expectations of devaluations. At least in those countries in which stock markets are liquid and trading occurs at a high frequency, prices should quickly incorporate any changes in market expectations.

B. A New Stock Market Measure

The measure we propose is based on the assumption that returns on stocks (or portfolios) can be explained by a multi-factor model of stock returns.⁹ However, the purpose of the paper is not to provide a test of ICAPM or multi-factor (APT) models of returns. Instead, the stock return equation will be used to derive a time series of an unobserved factor that we are interested in, namely expectations about the exchange rate. Formally, the model we use to derive the exchange rate measure is

$$(2) \quad r_{i,t} = \mathbf{a}_i + \mathbf{b}_{i,1}r_{m,t} + \mathbf{b}_{i,2}E_t + \mathbf{b}_{i,3}X_t + \mathbf{e}_{i,t},$$

where $r_{i,t}$ is the return on asset i , $r_{m,t}$ is the return on the market portfolio, E_t is the exchange rate factor and the main object of interest, X_t is another (set of) factor(s), the \mathbf{a}

⁸ For a survey of these issues, see Takagi [1991]. For a study using survey data, see Goldfajn and Valdéz [1997].

⁹ See, e.g., Chen, Roll and Ross [1986] for an example of using macroeconomics variables as factors, and Fama and French [1993] for an example where firm characteristics are used to form factor portfolios.

and \mathbf{b} 's are coefficients and \mathbf{e}_t is an error term. Rather than explaining $r_{i,t}$, we will be ultimately interested in uncovering E_t .

The reason to use stocks rather than other assets to assess devaluation expectations is that stock returns are generally available at a high frequency without lags, and typically not subject to interventions by the monetary and exchange rate authority.¹⁰ Thus the stock market potentially provides a “cleaner” market signal with respect to expected exchange rate movements.

The key to producing our proposed measure is to identify a portfolio that can *a priori* be expected to respond in a systematic and predictable way to changes in the expected exchange rate. Consider for the moment the simplest form of such a portfolio, namely the stock of a single company that has a significant exchange rate exposure in its operations. Changes in the exchange rate will affect both its current and future profits, and therefore its stock valuation. For a firm with debt or assets denominated in foreign currency, changes in the exchange rate will directly affect its balance sheet, while for companies that rely on imported inputs or export their final goods, the effect will be present in all the future periods if the change in the exchange rate is permanent. Obviously, the precise impact on future profits, and thus the value of the firm, will depend on such factors as domestic and foreign market structures, the persistence of deviations from PPP or some other form of long-run equilibrium of the real exchange rate, and the degree of sector specificity of capital.¹¹

It is important to note that the exchange rate factor that we have in mind as affecting the current stock price does not include only the current exchange rate, but, due to the forward looking nature of stock prices, represents the expectation about the entire future path of exchange rates. Therefore, returns on portfolio i should respond to both unforeseen actual changes in the exchange rate as well as changes in expectations about future exchange rates. In particular, returns should be sensitive to changes in devaluation expectations in a fixed exchange rate regime, even if we do not observe any actual exchange-rate movements.

In such a fixed regime, the exchange rate factor in (2) is an unobservable and precisely the variable that we would like to estimate. In that case, we do not know the true parameters or the error term, but if we had an estimate of the exchange-rate beta $\hat{\mathbf{b}}_{i,2}$ (obtained, e.g., from a data sample where the exchange rate was floating or from cross-country estimates) in principle, we could use

¹⁰ There is of course a recent counter example in Hong Kong, but in general, the traditional markets for government intervention has been the foreign exchange and money/bond market.

¹¹ See Becker, Gelos and Richards [2000, Appendix II] for a more formal discussion of the exchange rate sensitivity of stock prices.

$$(3) \quad \hat{E}_t = \frac{ar_{i,t}}{\hat{b}_{i,2}},$$

to obtain an estimate of the exchange rate factor, where $ar_{i,t}$ is the abnormal return on asset i . For now, the measure for abnormal returns can be thought of as a similar measure to those used in standard event studies (i.e., the actual minus the predicted return on asset i —see, e.g., MacKinlay, 1997) but some details need to be addressed in an empirical implementation. See the appendix for derivations of the formulas and a discussion of these details. Note that even if we did not have a very good estimate of $\hat{b}_{i,2}$, our assumption of its constancy over time would enable us to obtain a qualitative picture of changes in \hat{E}_t over time.

In the following empirical example of the Mexican devaluation of 1994 and the subsequent floating of the peso, we will argue that we can define a portfolio that will help us us to unearth \hat{E}_t . However, the example also illustrates some of the difficulties involved in obtaining an estimate of $\hat{b}_{i,2}$ needed for precise estimation of \hat{E}_t . The methodology and results presented in this paper may also be of interest beyond the specific Mexican experience presented below, not least since the recent financial crises in Asia have sparked questions about early warning indicators, where the market's exchange rate expectations could be of particular interest.

III. Deriving Exchange Rate Expectations for Mexico

This section contains a brief discussion of different views of the Mexican crisis and the applicability of more traditional measures in gauging devaluation expectations before presenting the empirical implementation of our measure.

A. The Macro Perspective

A variety of explanations have been offered for the collapse of the Mexican peso on December 20, 1994, and we will not discuss them in detail nor add a new one here. However, a few facts that are likely to have played a role in this context may be stated. First, partly fueled by growing capital inflows, the real exchange rate had been appreciating continuously under a crawling peg regime since 1987 and had reached levels similar to those seen before the 1982 and 1986 devaluations. This is illustrated in Figure I.

Second, since the liberalization of the financial sector, banks had been engaged in what—at least ex-post—could be regarded as imprudent lending. The mild recession of 1993 had already partly exposed these weaknesses and the share of non-performing loans was growing. Third, it has been argued that this in turn led the Mexican authorities to maintain low interest rates, adopting a monetary policy that most likely was too loose to be compatible with maintaining the fixed exchange rate regime. In particular, credit to the financial system

expanded sharply after March 1994.¹² Fourth, influenced by the upcoming presidential elections in August, fiscal policy was also expansionary, and the current account deficit continued to widen throughout 1994, reaching nearly 8 percent of GDP in that year.

Interestingly, interest differentials with the U.S. (shown in Figure II) were declining from the beginning of 1993 until March 1994, when the assassination of the presidential candidate Colosio resulted in increased political uncertainty. However, interest rates came down again in August 1994 and differentials remained low until shortly before the crisis.¹³

This behavior of interest rates has led many researchers to conclude that there had been no loss in confidence in the exchange rate regime.¹⁴ However, Werner [1996] has suggested that the currency risk premium is positively related to the share of peso-denominated debt in total debt. In particular, the authorities had been replacing peso-denominated government bonds (CETES) with short-term bonds repayable in U.S. dollars (Tesobonos). When Werner adjusts the observed interest differential for changes in the composition of external debt, the adjusted measure remains at high levels through 1994, suggesting low levels of confidence in the announced currency band.

However, the debate as to whether the collapse of the exchange rate regime was a result of growing concerns about deteriorating fundamentals as opposed to a financial panic is not yet settled.¹⁵ Essentially, two main views have been proposed. One explanation is related to the conventional theory of speculative attacks and argues that the devaluation was expected, while another interpretation is that the crisis was largely unexpected, and that the devaluation triggered a panic. A variant of the latter view, as proposed by Agénor and Masson [1999], is that the devaluation revealed the true preferences of the government regarding the costs of raising domestic interest rates versus maintaining exchange-rate stability.

In view of the somewhat inconclusive existing evidence, one main goal of our analysis is to ascertain the extent to which the stock market may have anticipated a devaluation. A cursory look at the overall stock market performance, shown in Figure III, is, however, not very revealing. There is no apparent correlation between movements in the index and any of the indicators discussed above. After a continuous rise in 1993, the index started to drop sharply in February 1994, but soon recovered, nearly reaching its previous

¹² See Masson and Agénor [1996].

¹³ The interest differential between dollar denominated debt (Tesobonos) and US CD's, a measure of default risk, also dropped to very low levels after an increase in March 1994. See Masson and Agénor [1996].

¹⁴ For a discussion, see Masson and Agénor [1996]. See Domowitz, Glen, and Madhavan [1998] for a discussion of country and currency risk premia in Mexico prior to the devaluation.

¹⁵ See for example Agénor and Masson [1999], Calvo and Mendoza [1996], Gil-Díaz and Carstens [1996], and Sachs, Tornell, and Velasco [1996b].

high in October of that year. The market then declined steadily until the end of March 1995. In the analysis that follows, we take a disaggregated look at the stock market, using company-level data. [Maybe footnote in theory section relating to macro risk variables. In the case of a devaluation, additional issues relate to the whether the devaluation happens in a “controlled” fashion or whether the currency collapses, inducing a widespread recession and possibly a cut-off from international capital markets.]

B. The Exchange Rate Sensitivity of Stock Prices

Data

We work with two databases. Company-level data on exports and intermediate imports for non-financial firms were obtained from a database published by the Mexican business newspaper *Expansión*, covering the 500 largest companies in Mexico.¹⁶ The earliest data available are for the end of 1994, which we use in all analysis. While it might be preferable to have had access to earlier information, the devaluation only occurred in the last days of December of 1994, and therefore had little effect on export and import figures for that year. The database also contains information on the share of foreign currency-denominated debt in total liabilities.

Of the companies for which import and export data are available, there were 39, plus four financial firms, for which stock price data for 1993-95 are also available in the Emerging Markets Database (EMDB) produced by the International Finance Corporation (IFC). Data on weekly stock returns for these companies were calculated based on U.S. dollar prices, dividends, and capital adjustments as given in the EMDB. The reason that we limit our sample period both before and after the devaluation is that we want to avoid the case where too many stocks appear and disappear in the database, which would make the issue of sample selection bias a potential problem.¹⁷

Constructing Exchange-Rate Sensitive Portfolios

Based on economic theory¹⁸, we construct portfolios with clearly defined exchange-rate sensitivities based on firm characteristics like net exports. For each company, to obtain a

¹⁶ “Las Empresas Más Importantes de México,” Banco de Datos Expansión, Mexico. The Mexican Stock Exchange (BMV) collects similar information on exports, but no data on imports were available for 1994. Comparing export and sales data from the two sources, we found a very close match.

¹⁷ Four stocks (Grupo Aluminio, Bancomer BCP, Grupo Video Visa, and Spicer) initially covered by the IFC were dropped from the Mexican stock market during this period. Our understanding is that the circumstances of their exclusion from the EMDB do not raise any “survivorship” problems.

¹⁸ As discussed in, e.g., Becker, Gelos and Richards [2000].

variable measuring net exchange rate exposure, we subtracted imports from exports and divide this amount by the total sales of the company. We then formed four portfolios, one consisting of the four financial institutions in the sample, one low net export portfolio consisting of two thirds of the remaining companies (with net exports below 10 percent of sales), one high-net-export portfolio (comprising the remaining thirteen companies), and finally one portfolio long in the high-net-export portfolio and short in the low net-export-portfolio, representing the relative performance of high- and low-net-exporting stocks. We also experimented with other cut-off points, and the results discussed later were robust to these modifications.

Did this classification make sense *ex-post*? In order to assess this question, here we provide a brief discussion of the behavior of stocks *around the event*. As explained above, our approach is based on a purely *ex-ante* identification of an exchange-rate sensitive portfolio. However, since this is a first application of the methodology, here we complement this *ex-ante* selection by an *ex-post* evaluation of the exchange-rate sensitivity of our portfolio around the devaluation event. In other words, after constructing portfolios based on firm-specific characteristics, we test whether, around the devaluation event, they behaved as predicted by theory. It should be clear, however, that this is not a necessary step in our strategy, but merely intended to provide the reader with more information on the *ex-post* efficiency of our portfolio selection.

We first used a regular market model to derive excess returns on individual stocks around the time of the devaluation, and then regressed these excess returns on the company characteristics mentioned above, see Section B of the Appendix for further details. The exercise confirmed that stocks with high net exports indeed had statistically significant excess returns in the event week. Most of the effect seemed to be associated with exports rather imports, with one possible explanation being that exported final goods may be more easily observed by investors than imported inputs (i.e., it is easy to observe that Ford exports cars, but it is less obvious where the components in the car come from). More surprising was that foreign-currency denominated debt had no significant explanatory power for excess returns. One possible explanation may be that our measure did not capture the true asset and liability position, since it omits derivatives.

We also applied the event-study methodology to the portfolios rather than to the individual stocks. Figure VI displays the abnormal returns during the event window, i.e., for the four weeks before and after the devaluation, with the almost horizontal lines representing plus or minus two standard errors. The figure clearly indicates that the high-net-export portfolio outperformed the market in the event week in a statistically significant way. Again this exercise confirmed that the portfolios responded as expected in the devaluation event, and in particular it is worth noting that the difference portfolio showed a statistically significant excess return in the event week. This constituted the last step in confirming that we can sensibly use net exports as a mean to create our exchange rate sensitive asset discussed in Section II.

C. The Stock Market Measure as a “Shadow” Exchange Rate

In order to assess changes in **devaluation expectations** prior to the event, we could sum up the abnormal returns shown in Figure VII to obtain a series for cumulative abnormal returns in the period before the devaluation. However, since estimation-period abnormal returns are the residuals from an ordinary least squares regression, they must by definition sum to zero in the estimation period, and can only yield limited information about changing expectations in that period. Therefore, we use a rolling regression technique as discussed in the appendix to model the evolving relative performance of different sectors.

We then estimate cumulative abnormal returns for each portfolio as the sum over time of the individual abnormal returns. Figure VIII displays these cumulative abnormal returns for the four portfolios over the entire sample period. Some rather striking patterns emerge from these estimates. In particular, after about November 1993, the high-net-export portfolio exhibits positive and generally increasing cumulative abnormal returns for the remainder of the sample period. The reverse is true for the low-net-export portfolio, and even more so for the bank portfolio. Note that the strong performance of the net exporters is remarkable given the alleged overvaluation of the peso around that time, which was viewed to be primarily affecting the tradable sector.

These differences in relative performance are noteworthy and interesting per se. However, the next step is to use these estimates to produce a stock-market measure of exchange-rate expectations. To do this, we focus our attention on the performance of the difference portfolio, since this provides a summary measure of the relative performance of high- and low net exporting stocks and also has the potential benefit of removing other common factors that may be driving the returns of the two portfolios.

Estimating the Exchange-Rate Elasticity

One step needed to arrive at a precise measure of exchange-rate expectations is to produce an estimate of the exchange-rate beta ($\hat{b}_{i,2}$ in Equation 3). There are various conceivable ways of producing such an estimate. For example, it could be derived from the reaction of the chosen portfolio to exchange-rate movements in historical periods of floating exchange rates. If, for example, at any point in time, the exchange rate had followed a random walk, it would have equaled the rational expectation of future exchange rates at the moment. Calculating the sensitivity of the chosen portfolio during historical periods during which the exchange rate followed a random walk could therefore provide a good indication of how the stock valuation of the portfolio reacts to changes in exchange-rate expectations during a fixed exchange rate regime. Alternatively, estimates for similar portfolios could be used. However, as mentioned earlier, while there remains a scaling problem, the direction of changes in exchange-rate expectations will be captured correctly even with a wrong estimate for $\hat{b}_{i,2}$.

Here, for illustration purposes, we again follow an ex-post approach that in principle runs counter to the spirit of the methodology, and which should be viewed as providing additional background for the usefulness of our approach instead of a prerequisite to implementing it. Due to lack of data for a pre-devaluation floating exchange-rate regime, we focus on the post-devaluation period instead, that is, we use data that was not available prior to the event to estimate $\hat{b}_{i,2}$.

The first somewhat heroic assumption that we adopt in this case is that the relationship between abnormal returns and the exchange-rate factor is the same before and after the devaluation, i.e. constancy of $\hat{b}_{i,2}$ over time. The second assumption is that in the post-devaluation period, the actual change in the exchange rate (which is observable) is the only relevant variable for forecasting future exchange rates. As mentioned before, this would be the case if the exchange rate followed a random walk after the devaluation.¹⁹ If the cumulative abnormal returns are scaled by the exchange rate-elasticity and level-adjusted, the resulting series can be interpreted as a shadow exchange rate.

A straightforward way of estimating the exchange-rate beta in the post-devaluation period is to run a regression with the cumulative market-adjusted return of the difference portfolio displayed in Figure VIII as the dependent variable on the log of the exchange rate. Over the post-devaluation period, this generates a beta estimate of 0.92 that is highly significant (the t-statistic is 9.62). To use this estimate to generate a shadow exchange rate, the cumulative abnormal return series is first scaled with the estimated elasticity and then level-adjusted so that the derived series starts at the same level as the actual exchange rate. This latter adjustment is valid if the exchange rate was at its equilibrium level at the start of the sample (i.e., the devaluation expectations were close to zero at that date).²⁰ The shadow exchange rate measure generated in this way is shown as the dotted line in Figure IX together with the log of the actual exchange rate.²¹ If the scaling and level adjustment are correct, one

¹⁹ Empirically, a unit root cannot be rejected for the post devaluation exchange rate. Furthermore, when an ARMA(1,1) model is estimated, it suggests that the lagged values of the exchange rate do not add much explanatory power to forecasts of the exchange rate, so the random walk assumption seems fairly consistent with the actual data.

²⁰ Without these (or similar) assumptions regarding the scaling of abnormal returns, we

would not be able to generate a quantitative estimate of the exchange rate, and only

qualitative statements of increasing or decreasing devaluation expectations could be made.

²¹ Another issue that naturally arises here is the question of confidence intervals. The measure we present is the point estimate of the shadow exchange without confidence bounds. Introducing confidence bounds would allow us to say when the cumulative abnormal return

interpretation is that there was a build-up of exchange-rate expectations starting at the end of 1993, and that the initial sharp depreciation after the devaluation was not expected to last. In other words, this measure would suggest that the stock market anticipated the devaluation and that there was an initial overshooting of the exchange rate in the first months after it was allowed to float.²²

The shadow exchange rate described above and shown in Figure IX is obviously dependent on the estimated elasticity, and the potential non-stationarity of the data suggests that the previous simple approach can be improved on by estimating a more conventional first-differences model. Accordingly, we estimated a version of Equation (2), explaining the return on the difference portfolio in the post-devaluation period by the market return and the change in the actual nominal exchange rate. Since the contemporaneous exchange rate change was not significant, we also included one lag of the exchange rate change. Table II presents the estimates for different starting dates for the sample periods both to study the stability of the estimates and because the response to exchange-rate movements in the immediate post-float period may not be representative due to uncertainty about the new exchange rate- and policy regime and the overshooting of the exchange rate that is often experienced in countries that float their currencies.

The estimations show that the contemporaneous change in the exchange rate has an effect on returns that is insignificantly different from zero, while the lagged exchange-rate change has a positive and significant coefficient in all sub-samples.²³ The magnitude of this coefficient is not stable over the whole sample, however, with a substantial increase around three months after the devaluation. The coefficient then stabilizes around 0.4. The fact that it is the lagged exchange rate change rather than the contemporaneous one that affects the

is statistically significant from zero, and could potentially be used as a signal of crisis as is done in the early warning literature. However, it is not completely obvious what a good measure of the standard error is in this case, where the event is not defined a priori, but is something to forecast. In the previous event study part, the standard error in the estimation window was used, but in this case where a rolling regression is used, it is less clear what the relevant standard error should be.

²² The correlation between the two series in the post-devaluation period in Figure IX is not surprising since the exchange rate beta is estimated using these data. However, the pre-devaluation period data are not used to estimate the exchange rate beta, so the similarity of the initial actual depreciation and the cumulative prior stock market performance is quite noteworthy.

²³ When a lag of the market index is added to the equation the coefficient is always

insignificant. This suggests that the delayed response to exchange rate changes is not purely a result of non trading biases.

returns is not in line with a fast-responding efficient market; however, a similar behavior is documented in Glaum et al. [1998] for a mature market. There, the authors show that lagged exchange-rate changes helped explain movements in the German stock market index during the 1980s. Although this apparent anomaly in timing may have implications for prediction exercises using the exchange-rate measure, it has a very limited impact on the more general question that we are addressing: the possible build-up in devaluation expectations in the year before the actual devaluation and float.

While there is clearly substantial uncertainty regarding any point estimate of the exchange-rate elasticity, we use the estimate of 0.47 based on the latter half of the sample. However, there still remains the question of the appropriate initial condition determining the *level*, given that we are only estimating returns as a function of *changes* in the exchange rate. In the previous graph, the level of the shadow exchange rate was assumed to coincide with the level of the first actual exchange-rate observation in the sample.²⁴ If this assumption is maintained, the paths for the cumulative returns adjusted with the estimated exchange-rate elasticity are the ones displayed in Figure X.

The graphs shows the importance of the elasticity for the derivation of more precise statements regarding the magnitude of the change in the expected exchange rate. However, as mentioned before, qualitative statements about the direction of the exchange-rate expectations can be made without scaling.

Were Other Factors Driving Abnormal Returns?

In the above discussion, the factor driving the results is assumed to be the exchange rate or expectations of an exchange-rate change. However, as pointed out in the appendix, one assumption we make is that there are no other omitted factors in the market model that could explain the observed path of the abnormal returns. There are several interpretations of the factors in the finance literature, with, for example, Fama and French [1996] using company characteristics such as low and high book-to-market as a factor, while Chen, Roll and Ross [] use macroeconomic variables as factors.

In thinking of different macroeconomic factors, it is also useful to distinguish between ones that are changing continuously and others that change only rarely. The distinction between factors that are observable and those that are unobservable is also important, since observable factors can potentially be controlled for by including them in the

²⁴ An alternative strategy is to assume that the exchange rate was at equilibrium at the end of the sample period, when the float had allowed it to adjust. We could then compute the over or under valuation of the currency in the pre-devaluation period based on this assumption about the equilibrium exchange rate. This graph can be produced by simply shifting the shadow exchange rate in Figure X so that it correspond to the last rather than first observation of the actual exchange rate.

estimated market model, while the introduction of another unobservable would basically make it nearly impossible to distinguish that unobservable from the unobservable exchange-rate factor. When it comes to the discrete nature of other factors, it is important to note that with forward-looking and efficient stock markets, unanticipated events only generate infrequent abnormal returns and would not be able to explain a continuous build-up of abnormal returns.

For example, one event that coincides with the beginning of the divergence in relative performance is the passage of NAFTA, which also turns out to generate significant abnormal returns on the difference portfolio in two particular weeks [see Becker, Gelos and Richards, 2000, Appendix IV for a formal study of that and other events]. However, if the stock market was forward-looking, and all of the NAFTA-relevant information was revealed by the time the U.S. Congress and Senate passed the bill, this would give rise to a pattern for the net exporters quite different to the observed one: cumulative abnormal returns should have been rising during the period when NAFTA was becoming more likely to be implemented, and then remaining at that level thereafter. The explanation we are suggesting, on the other hand—that there was a continuous build-up in devaluation expectations from late 1993 until the actual event December 1994—is consistent with forward-looking stock prices. The exchange-rate explanation is also in line with the behavior of the financial sector companies, which displayed a declining relative performance during the second half of the estimation period, as a result of concerns over the unhedged currency exposures of banks—which were borrowing cheaply in U.S. dollars and lending in pesos—but also as weaknesses in this sector became more and more apparent throughout 1994.

Another explanation for the observed build-up in abnormal returns could be a continuous improvement in demand factors affecting the export-oriented sector. In other words, the higher abnormal returns of the export sector might have been the result of persistently positive news regarding the demand for Mexican exports at a given exchange rate, rather than of a build-up in devaluation expectations. To investigate this hypothesis empirically, we need a measure of news about Mexican export demand at a relatively high frequency, which rules out using official export statistics. A first attempt to study this alternative hypothesis can be found in Becker, Gelos and Richards [2000, Appendix V], where updates of Consensus forecasts for U.S. GDP were used as a proxy for news about Mexican export demand.²⁵ Although there were indeed a number of upward revisions of expected U.S. GDP during the period, they explain very little of the observed difference in relative performance. In addition, this type of story does not explain the observed performance of the financial sector discussed earlier. Thus a build-up in devaluation expectations appears to remain a more plausible explanation of the observed relative performance.

²⁵ In some sense, this can be viewed as another unobservable, since there are no real measures that we can use at a weekly data frequency. However, by using lower frequency data, we should hopefully be able to get an indication of the importance of this factor.

One may also think that the performance of the export-oriented sector could be correlated with the U.S. stock market, and that such a correlation would explain the build up in cumulative excess returns in 1994. However, this argument does not seem to provide a relevant alternative explanation, since the US stock market actually lost ground during 1994. In other words, if this had been a relevant variable that was left out of the analysis, this would suggest that devaluation expectations increased more than what is suggested by our analysis that omits this factor.

Finally, related to company-specific factors rather than economic events, there is the question of whether company characteristics like book-to-market or price-earnings ratios should be included, as in Fama and French [1999]. In appendix III of Becker, Gelos, and Richards [2000], we discuss some of these factors. The conclusion is that there is little reason to suspect that differences along these dimensions between the low- and high-net exporting portfolios would generate the excess returns on the difference portfolio that is observed in the year prior to the devaluation. It is also hard to reconcile that this effect would dominate the developments in 1994, while there was no sign of the overperformance in 1993 (unless we think that all of a sudden these valuation ratios changed at the end of 1993).

IV. Conclusions

In this paper we pursued a simple idea—that changes in devaluation expectations should have dissimilar effects on the stock valuation of companies that differ in their exchange-rate exposure. In principle, this idea could be exploited to assess the credibility of fixed-exchange-rate regimes. In order to gauge the usefulness of this approach, we examined the Mexican case around the 1994-95 crisis.

We constructed portfolios based on the stocks' share of net exports in sales and examined the behavior of these different portfolios before and after the devaluation. We found that starting in late 1993, net importers and financial companies began to continuously underperform the market, while net exporters showed continuously positive abnormal returns. This is particularly noteworthy given the fact that one might have expected the exporting sector to underperform with respect to the overall market due to the alleged overvaluation of the peso.

Using estimates for the exchange-rate sensitivity of the different sectors, we attempted to construct a measure of the "shadow exchange rate" prior to the devaluation. This measure pointed to an ongoing build-up of devaluation expectations starting approximately a year prior to the devaluation. However, more precise inferences concerning the exact magnitude of changes in devaluation expectations depend on the estimated exchange-rate elasticity, about which there is a fair amount of uncertainty. Moreover, despite the fact that the results do not appear to be driven by events such as the passage of NAFTA, revised expectations about U.S. demand, political news, or company factors other than

exchange-rate exposure, we are obviously not able to fully control for all conceivable alternative factors behind these results.

An important remaining question is: if the above interpretation of the results is correct, why should devaluation expectations be reflected in the stock market, but less so in the bond market? A possible explanation is related to informational asymmetries. If domestic investors have an informational advantage over foreign investors, and domestic investors tend to dominate the stock market, while foreigners represent the marginal investor for dollar-denominated Mexican bonds, this could potentially help to explain the puzzle. In the Mexican case, there is some evidence that domestic investors may have responded more quickly than nonresidents in the period surrounding the devaluation.²⁶ Another potential reason may be that, as Werner [1996] noted, risk premia on the peso could partly be explained by relative supplies of dollar- and peso-denominated debt. These relative asset supplies, in turn, are endogenous, since the government reacted to changes in the cost of its debt. Another related explanation that also serves as a motivation for using the stock market rather than more standard measures based on prices in the money, bond and foreign exchange markets, is that these latter markets, the government frequently intervenes to defend a fixed exchange rate. This may potentially distort the picture one obtains, and the stock market may provide an “intervention free” measure of devaluation expectations. While some governments now also intervene in the stock markets, this is still rare and viewed by most as an unorthodox tool for conducting monetary and exchange-rate policies.

In summary, the results of this paper support the potential usefulness of this type of indicator for measuring the credibility of fixed exchange-rate regimes. Stock-market-based measures such as this—which are available at a high frequency—could potentially prove to be a valuable addition to the more traditional leading indicators of changes in exchange-rate parities. In future work, we intend to examine the more general applicability of our stock-market based measure by using a panel of other emerging markets.

²⁶ See International Monetary Fund [1995] and Frankel and Schmukler [1996] for evidence supporting this proposition, and Gil-Díaz and Carstens [1996] for suggestions to the contrary.

Appendix

A. Derivation of a Stock Market Measure of Changes in Exchange-Rate Expectations

In extracting the impact of unobserved exchange-rate expectations on stock returns, we have in mind multi-factor model of the stock market²⁷, according to:

$$(4) \quad r_{i,t} = \mathbf{a}_i + \mathbf{b}_{i,1}r_{m,t} + \mathbf{b}_{i,2}E_t + \mathbf{b}_{i,3}X_t + \mathbf{e}_{i,t} ,$$

where $r_{i,t}$ is the return on asset i , $r_{m,t}$ is the return on the market portfolio, E_t , is the exchange-rate factor and the main object of interest that we will return to shortly, X_t is another (set of) factor(s), the \mathbf{a} and \mathbf{b} 's are coefficients, and \mathbf{e}_t is an error term.

For expected returns we use,

$$(5) \quad \hat{r}_{i,t} = \hat{\mathbf{b}}_{i,1}r_{m,t} ,$$

where a hat indicates an estimated value. We will return shortly to why this formulation is chosen and under what assumptions it will generate a well behaved measure.

With this definition of expected returns, the corresponding abnormal return is defined as

$$(6) \quad ar_{i,t} = r_{i,t} - \hat{r}_{i,t} = \mathbf{a}_i + (\mathbf{b}_{i,1} - \hat{\mathbf{b}}_{i,1})r_{m,t} + \mathbf{b}_{i,2}E_t + \mathbf{b}_{i,3}X_t + \mathbf{e}_{i,t} .$$

Solving for the variable of interest, the exchange-rate factor, we get

$$(7) \quad E_t = \frac{ar_{i,t} - \mathbf{a}_i + (\mathbf{b}_{i,1} - \hat{\mathbf{b}}_{i,1})r_{m,t} + \mathbf{b}_{i,3}X_t + \mathbf{e}_{i,t}}{\mathbf{b}_{i,2}} .$$

The proposed estimate of the exchange-rate factor is simply

$$(8) \quad \hat{E}_t = \frac{ar_{i,t}}{\hat{\mathbf{b}}_{i,2}} .$$

To understand the properties of this measure, define the estimation error according to

²⁷ This model should be thought of as an ex-post model of stock returns, rather than as an *ex ante* CAPM-type model: it makes no assertions about the number of *ex ante* priced factors in a CAPM-type framework.

$$(9) \quad u_t \equiv E_t - \hat{E}_t = \frac{ar_{i,t}}{\mathbf{b}_{i,2}} - \frac{ar_{i,t}}{\hat{\mathbf{b}}_{i,2}} - \frac{\mathbf{a}_i + (\mathbf{b}_{i,1} - \hat{\mathbf{b}}_{i,1})r_{m,t} + \mathbf{b}_{i,3}X_t + \mathbf{e}_{i,t}}{\mathbf{b}_{i,2}}.$$

The estimator is unbiased, that is, $E(u_t) = 0$, if $E(\hat{\mathbf{b}}_{i,1}) = \mathbf{b}_{i,1}$, $\hat{\mathbf{b}}_{i,2} = \mathbf{b}_{i,2}$, $E(\mathbf{a}_i) = 0$, $E(\mathbf{b}_{i,3}) = 0$, and $E(\mathbf{e}_{i,t}) = 0$.²⁸ More loosely, if the intercept and other factors are negligible and we either know or can obtain good estimates of the betas, the estimate of the exchange-rate factor should be well behaved from an unbiasedness perspective. However, we are confronted with two potential estimation problems. First, the estimate of $\hat{\mathbf{b}}_{i,1}$ may suffer from omitted variable bias, and second, there is no obvious way of obtaining an estimate of the exchange-rate elasticity $\hat{\mathbf{b}}_{i,2}$. In the following, we will assume that the omitted variable bias in the market-beta estimate is relatively unimportant²⁹, while the latter estimation problem is “solved” by using post-devaluation data, something that is discussed in Section III.

To understand why the assumption on the intercept is imposed, we need to discuss the estimation strategy. First of all, the measure is to be used as a way of generating a market prediction of a devaluation and as such, the model we estimate should only use information available at point t to make the prediction in period t . In the empirical implementation this means that the above model is estimated on a rolling basis, with coefficients potentially changing over time. Since the exchange-rate factor is the unobservable that is of interest, it can obviously not be included in the regressions used to obtain the coefficient estimates. This has the effect that the rolling intercept will capture both the true intercept and the changing mean of the omitted exchange-rate factor. To avoid this, we make the assumption that the true intercept is zero and attributes this part entirely to the exchange-rate factor.³⁰ Ex ante, that should be a relatively uncontroversial assumption, consistent with e.g. CAPM. Ex post, the intercept could potentially be different from zero if there are other omitted factors that had non-zero means in the sample period, but our assumption here is that that is not the case.

²⁸ Note that the condition on the exchange rate coefficient, $\hat{\mathbf{b}}_{i,2}$, is stated in actual value rather than expectations. This is because it appears in the denominator, which complicates things if only the expectations version of the condition is used. If it is regarded as a constant, we do not have to consider its co-variation with $ar_{i,t}$ to obtain the two first terms to cancel out in the estimation error equation.

²⁹ This is indeed the case in the post-devaluation period, where the estimate of the market beta does not change when the exchange rate is omitted.

³⁰ Another issue is that the cumulative abnormal returns will sum to zero over the estimation period if only the residual is used as a measure of abnormal returns. In other words, if the model were not estimated on a rolling basis and the intercept were not attributed to the exchange rate factor, the sum of changes in the exchange rate factor would be zero.

This last observation is also linked to the assumption that $\mathbf{b}_{i,3}$ is equal to zero, so that the only relevant factors are the market and exchange-rate factors. Again, this is an assumption that can potentially be invalid, and will depend on the asset studied. In the paper, we use portfolios of stocks as the asset, and construct them such that they respond to exchange-rate events. The assumption is then that the portfolios are aggregated enough to minimize the impact of other factors that could be relevant to individual portfolios. To investigate this in the empirical part, we also study some other event that may be relevant to the portfolios, but find little evidence that our results regarding expected exchange-rate changes are driven by other factors.

B. The Devaluation Event and Company Characteristics

The methodology employed for studying the devaluation event is to estimate a market model for a pre-event or estimation window, and use these estimates to compute abnormal returns during the event window (see Figure IV).

In order to compute abnormal returns for each stock i in period t , $ar_{i,t} = r_{i,t} - \hat{r}_{i,t}$, we first estimate individual market models for the pre-event estimation period according to:

$$(10) \quad r_{it} = \mathbf{a}_i + \mathbf{b}_i r_{m,t} + \mathbf{e}_{it},$$

where r_{it} is the return of an individual stock and $r_{m,t}$ is the market return as before.

Throughout the paper, we use the equally weighted portfolio of all the stocks included in our sample as our proxy for the market. There are of course other proxies that could be used, with one candidate being the Bolsa index. However, the correlation of returns between our market portfolio and the Bolsa is around 95%, so the estimates should be reasonably robust in this respect. The normal or predicted returns \hat{r}_{it} in the event window are then calculated by using the parameter estimates of the intercept and slope coefficients obtained in the estimation window, while the standard errors from the estimation window are used to compute confidence intervals for the estimated abnormal returns. Carrying out an event study around the devaluation date presupposes that, while it might have been partially anticipated, the actual event provided relevant news for the stock market.

Once the abnormal returns for the devaluation week are obtained, we test if company characteristics have explanatory power for the differences in performance. We regress the abnormal returns of individual stocks on a set of explanatory variables Z , in particular those that determine the foreign exchange exposure of the firms as discussed previously: exports, imports and foreign currency denominated debt.

$$(11) \quad ar_{i,event} = \mathbf{g} + \mathbf{d}Z + \mathbf{h}_i,$$

Here, \mathbf{g} and \mathbf{d} are the parameters to be estimated and \mathbf{h}_i is the error term. These estimates constitute a first test of the hypothesis formulated in the previous section, i.e. that the impact of exchange-rate changes on firms' stock valuation depends on certain key firm characteristics, including their exports and imports.

Equation (10) was estimated by OLS for the period starting January 1993 until four weeks prior to the devaluation.³¹ We investigated five company characteristics. Using exports (X), imports (M), and sales (S), we created the variables scaled net exports (X-M)/S, scaled exports X/S, and scaled imports M/S. We also employed a dummy for financial sector firms (BANK) and information on the ratio of foreign-currency-denominated debt to total debt (FEX). Table I shows the results from different regressions using these variables.

The results indicate that net exports as a share of sales indeed significantly help to explain abnormal returns during the devaluation week. However, using net exports imposes the restriction that the coefficients on imports and exports are of equal magnitude but with opposite signs, while the results in column (3) indicate that they are not. As expected, X/S has a positive and highly significant impact on abnormal returns, while imports and foreign currency debt both have small and statistically insignificant positive coefficients. One explanation for the insignificant effect of imports is that imports do not vary much across firms and are strongly positively correlated with exports; with a limited sample this can yield poor estimates of the coefficient on imports.³² The results also indicate that the bank stocks underperformed in the week of the devaluation.

³¹ We also estimated the market model with a GARCH specification, and the main results are robust to that specification change.

³² Another possible explanation which is hard to square with rational behavior, is that investors actually only take the revenue composition of the firm into account. In one of the few studies that uses company-level data on exports and imports to explain exchange rate sensitivities of stock prices, Martínez Solano [1998] finds that exports appear to matter much more than imports for Spanish stocks. One possible explanation is that investors can observe a company's output more easily than its inputs, so stock prices respond more to output.

C. Constructing Portfolios

Since we are ultimately searching for a measure of exchange-rate expectations, we want to aggregate the results for individual stocks into a variable that summarizes the relative performance of different types of companies. One way of doing this is to form portfolios of stocks. Forming portfolios also has the advantage of reducing noise stemming from idiosyncratic shocks, thus reducing the likelihood that b_3 in Equation (2) is not equal to zero, which is one of the assumptions we make in deriving the exchange-rate measure. Together with the theoretical considerations of Becker, Gelos and Richards [2000, Appendix II], the estimates from Equation (11) will guide us in forming portfolios of firms which differ systematically in their sensitivity to exchange-rate movements.³³ The devaluation event-study methodology presented above will then be used to assess the impact of the devaluation on the relative performance of these different portfolios. In all of the following empirical investigations, we will focus on the performance of portfolios rather than individual stocks.

The regression results in Table I and theoretical considerations suggest that either exports or net exports should be used as sorting variables. Figure V displays the two series with the stocks sorted by net exports. In the remainder of the paper, we sort by net exports, since this is more in line with the theoretical arguments made in Becker, Gelos and Richards [2000, Appendix II], despite the fact that exports alone seem to perform slightly better from an empirical point of view in explaining abnormal returns.

The stocks are divided into three equally weighted portfolios: a bank portfolio consisting of the four banks in the sample (portfolio 1), a low-net-export portfolio consisting of two thirds of the non-bank stocks (2), and finally a high-net-export portfolio, consisting of the top third of non-bank stocks (3). In addition to these portfolios, a portfolio long in 3 and short in 2 is also included in the analysis; this portfolio is labeled the difference portfolio (4). This portfolio then measure the *relative* performance of the high and low net exporting companies.

³³ Taking a slightly different perspective, one could argue that the main difference in the portfolios is not their exchange-rate sensitivity, but differences in their insulation from domestic demand shocks. In the Mexican case, if investors were mainly preoccupied with the possibility of a recession as a result of the devaluation, export-oriented firms could have been perceived as more insulated from a likely drop in domestic demand. In other words, quantity as opposed to price effects as derived in Appendix I could have been viewed as most important. The analysis that follows is—except for the last part of the paper—not substantially affected by adopting this view; indeed, in most cases one could simply replace the words “exchange rate expectations” by “crisis expectations”.

The reason that only a third—rather than half—of the stocks are included in the high-net-export portfolio is that, below the 66-percentile, net exports of the companies represent less than ten percent of sales, so that these firms cannot be meaningfully labeled as exporters. It is worth mentioning that we experimented with some other cut-off points to evaluate the robustness of the results; the general conclusion is that the results are robust to such changes, especially in the upper end of the sorting. This is also confirmed by studying the individual performance of the stocks in the portfolio around the event, where a majority of high-net-export stocks display excess returns in the event week. Furthermore, if exports is used as the sorting variable, only three stocks change portfolios, and the results regarding abnormal returns in the devaluation week are again robust to these changes.³⁴

D. Abnormal Returns on Portfolios

In order to compute abnormal returns for the portfolios, we now estimate market models for the portfolios in the pre-event period (i.e., the index i in Equation (10) now refers to a portfolio rather than an individual stock). Figure VI displays the abnormal returns during the event window, i.e., for the four weeks before and after the devaluation, with the almost horizontal lines representing plus or minus two standard errors. The figure clearly indicates that the high-net-export portfolio outperformed the market in the event week in a statistically significant way.³⁵ The low-net-export portfolio experienced a significant negative effect and the difference portfolio a significant positive impact (which is not surprising given the other results). Furthermore, the bank stocks were strongly adversely affected by the developments in the devaluation week. This is then an indication that we indeed can find assets that respond to exchange-rate news, which is the important first step in deriving a measure of devaluation expectations. Again, it should be noted that our hypothesis is that although there may have been expectations about a devaluation, the event was not perfectly predicted and thus when it occurred provided news about the future path of the exchange rate.

It should also be noted that there was only a slightly positive abnormal return for the difference portfolio in the week prior to the devaluation, suggesting that devaluation expectations did not change in a significant way shortly before the event. It is worth mentioning that the extent to which new information is incorporated quickly in emerging

³⁴ In Becker, Gelos and Richards [2000, Appendix III], we examine other aspects of these portfolios in more detail, comparing both balance sheet, operational, and stock market characteristics for the different portfolios.

³⁵ While a conventional p-value may not be entirely appropriate when information on exchange rate sensitivity in the event-week has been used to form the portfolios, the p-value on the difference portfolio is less than 0.0001.

markets' stock market is in itself an area of research; the results presented here are supportive of the efficiency of the Mexican stock market.³⁶

It is also of interest to consider how the magnitude of the abnormal returns recorded in the devaluation week are compared with other weeks prior to the event. Figure VII indicates that the devaluation week was indeed a special event, and that there are no observations of the same magnitude either before or after the devaluation. (There are some other dates that produce significant observations, but from a statistical point of view this would be expected when studying a large number of pre-event observations. If abnormal returns are t-distributed, approximately five significant observations can be expected with 100 observations.)³⁷

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³⁶For other studies addressing the efficiency of the Mexican stock market, see Bailey and Chung [1995], Clark and Berko [1996], and Bhattacharya et al. [1999].

³⁷In Becker, Gelos and Richards [2000, Appendix IV], we also include some other potentially relevant events preceding the devaluation in order to gain further insights into the way stock prices are affected by news that should have dissimilar effects on different portfolios.

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Table I. Regression of Abnormal Returns on Company Characteristics

	(1)	(2)	(3)
Constant	-0.041 (0.039)	-0.017 (0.019)	-0.054** (0.024)
(X-M)/S	0.277*** (0.098)	0.298*** (0.097)	
Bank	-0.070 (0.064)	-0.094* (0.054)	-0.057 (0.057)
FEX	0.042 (0.062)		
X/S			0.308*** (0.093)
M/S			0.047 (0.203)
Adj. R ²	18%	19%	28%

Note: White heteroskedasticity consistent standard errors in parenthesis. (**, ***) indicate significantly different from zero at 10% (5%, 1%) level. 43 observations in each regression.

Source: Authors' calculations based on data from IFC and Expansión

Table II. Estimation of the Exchange Rate Elasticity

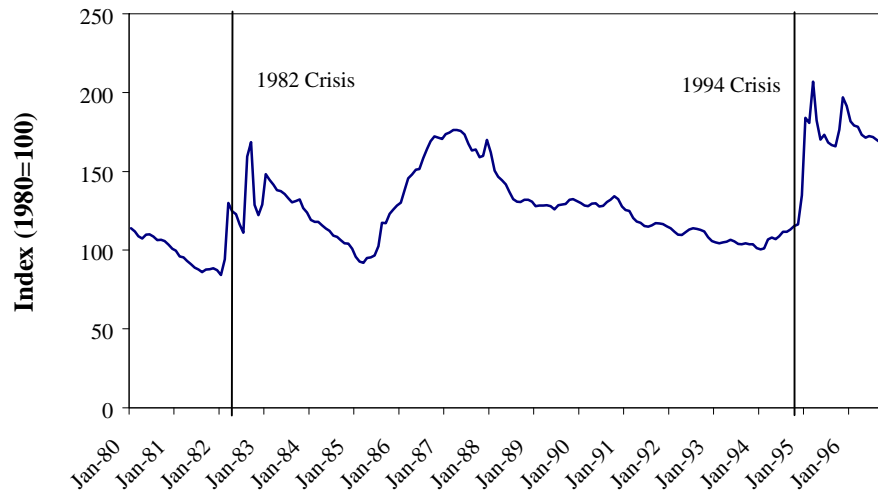
	Sample start			
	Jan. 1995	April 1995	June 1995	Aug. 1995
Constant	0.006** (0.003)	0.006** (0.003)	0.001 (0.003)	0.002 (0.004)
$r_{m,t}$	-0.286*** (0.088)	-0.279** (0.120)	-0.250* (0.126)	-0.332*** (0.101)
Δe_t	0.066 (0.117)	-0.240 (0.163)	-0.145 (0.212)	-0.010 (0.166)
Δe_{t-1}	0.138* (0.078)	0.374*** (0.087)	0.475*** (0.130)	0.401** (0.146)
Adj. R ²	24.9%	23.1%	25.5%	57.6%
Observations	52	39	31	22

Note: Newey-West standard errors in parenthesis. The *, **, *** indicate significance at 10, 5, and one percent levels, respectively. All samples end last week of 1995. The regression

$$r_{4,t} = \mathbf{a} + \mathbf{b}_{4,1}r_{m,t} + \mathbf{b}_{4,2}\Delta e_t + \mathbf{b}_{4,3}\Delta e_{t-1} + \mathbf{e}_{4,t}.$$

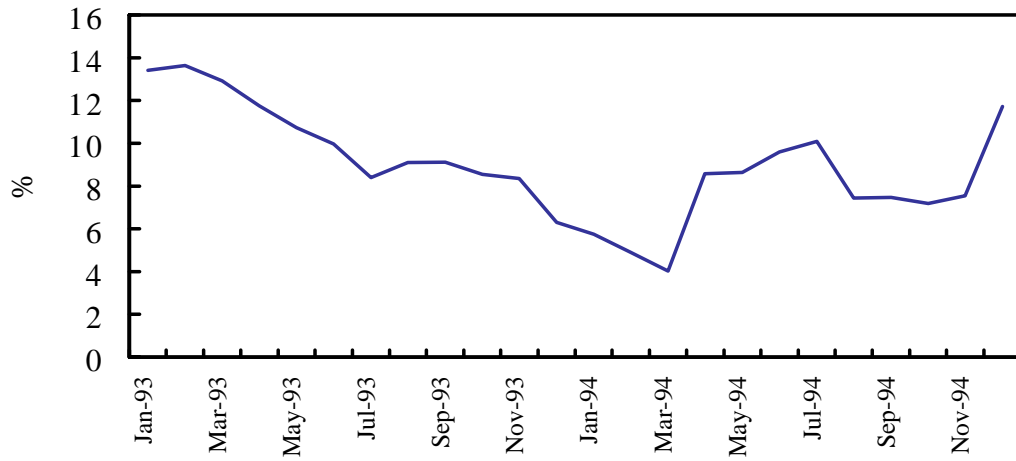
Source: Author's calculations based on data from IFC and Expansión.

Figure I. The Real (Effective) Exchange Rate



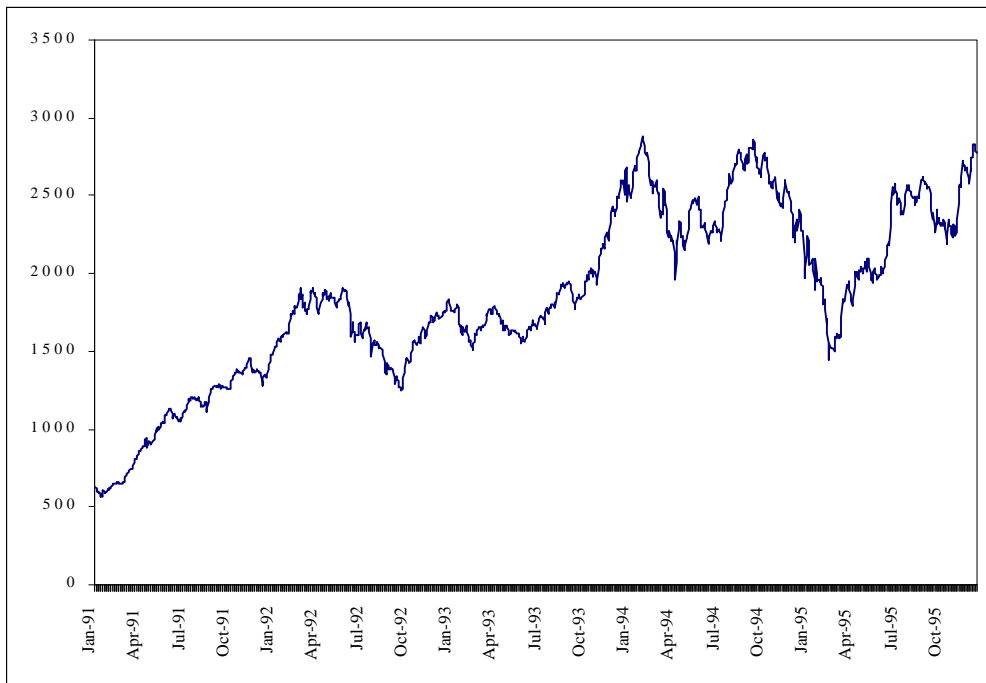
Source: Banco de México

Figure II. Interest Rate Differentials, 1993-94.



Note: Calculated as difference between yields on Tesobonos (U.S. \$-linked) and CETES (Peso-denominated). For 1/93-7/93 the figures are based on 1-month maturities, for the later period on 3-month bonds.
Source: Banco de México.

Figure III. Stock Market Index (Mexbol)



Source: Bloomberg.

Figure IV. The Event Time Line

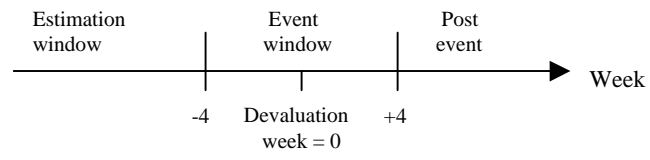
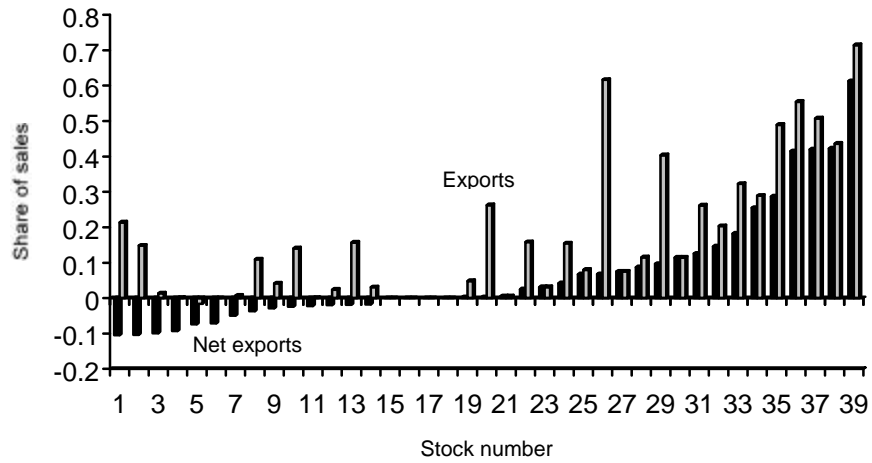
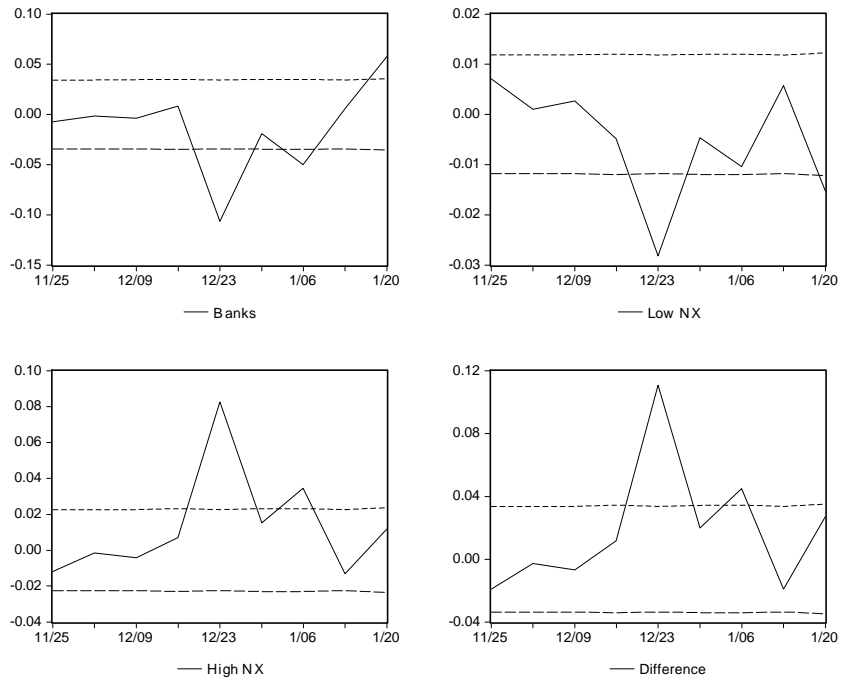


Figure V. Net Exports and Exports
(As Shares of Total Sales)



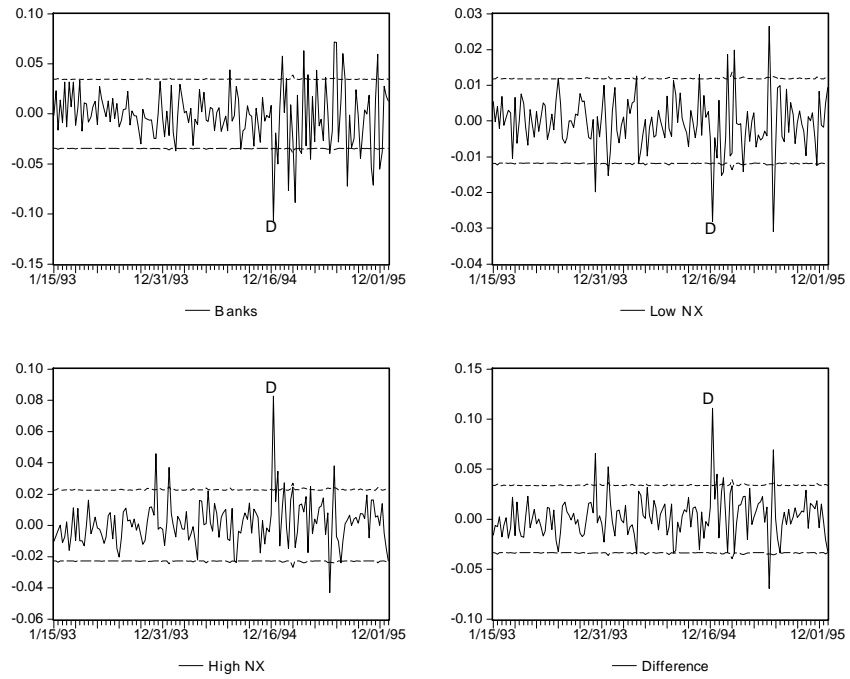
Source: Authors' calculations based on data from Expansión.

Figure VI. Abnormal Returns in the Event Window



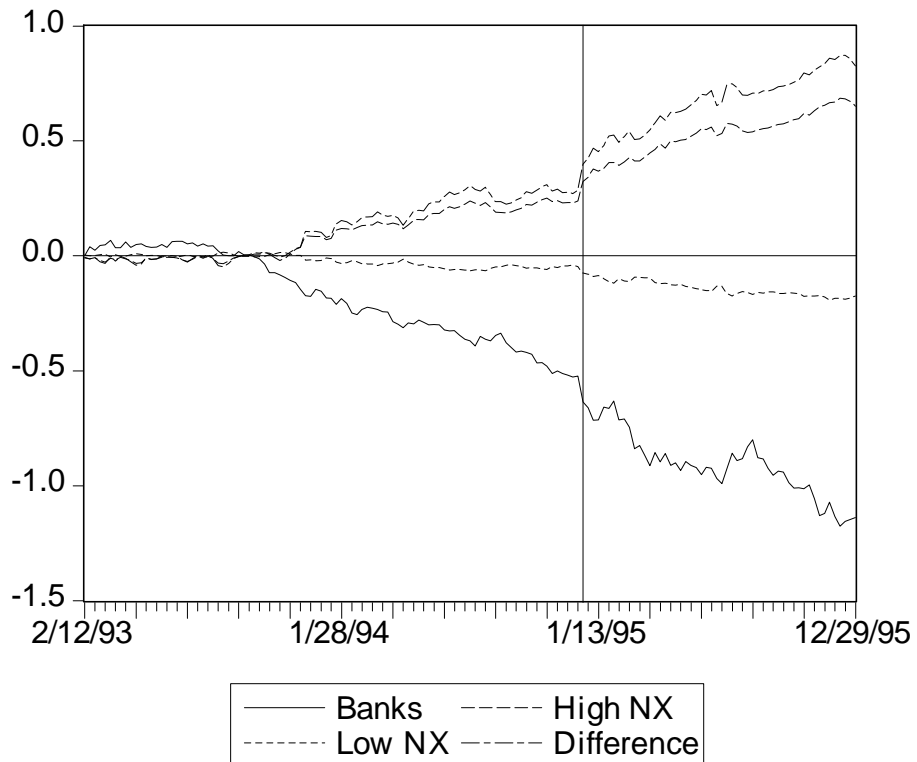
Source: Authors' calculations based on data from IFC and Expansión

Figure VII. Abnormal returns for the entire sample period



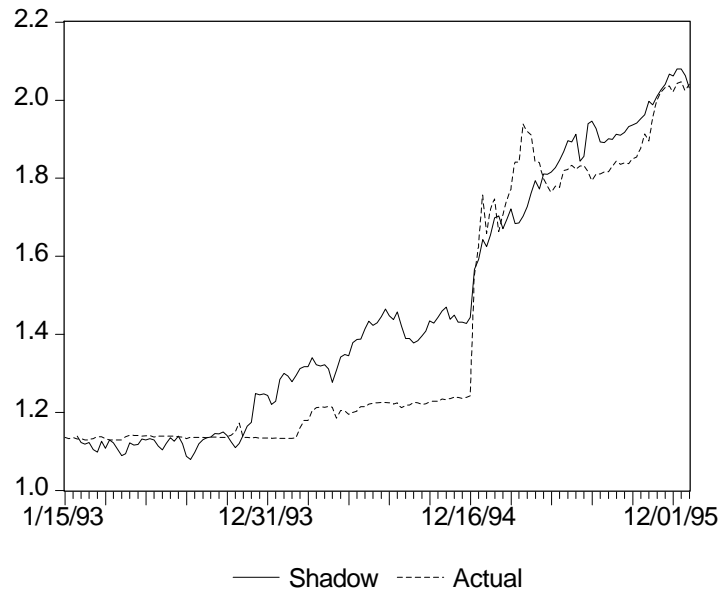
Source: Authors' calculations based on data from IFC and Expansión

Figure VIII. Cumulative Abnormal Returns on the Four Portfolios



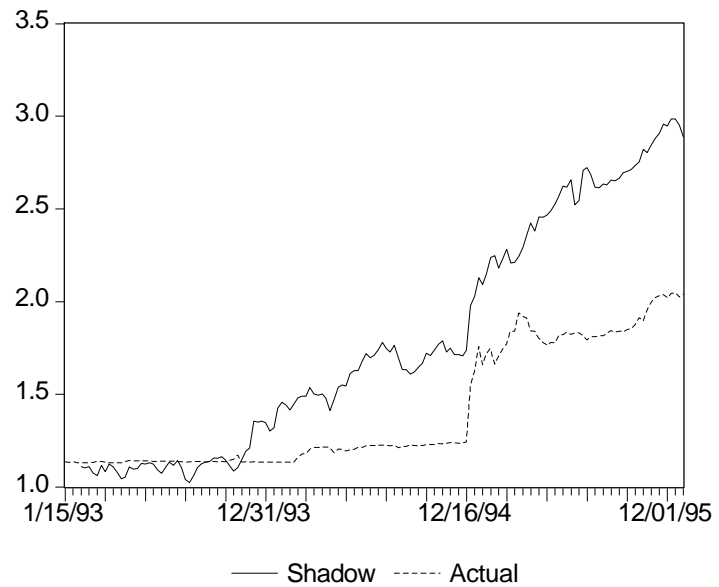
Source: Authors' calculations based on data from IFC and Expansión

Figure IX. The Actual and “Shadow” Exchange Rates from Level Estimation
(in logarithms)



Source: Authors' calculations based on data from Expansión and IFC.

Figure X. The Actual and “Shadow” Exchange Rates from Difference Estimation
(in logarithms)



Source: Author's calculations based on data from IFC and Expansión