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Increasing Derivatives Market Activity in Emerging Markets and Exchange Rate Exposure

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Abstract

Understanding the effects of off-balance sheet transactions on interest and exchange rate exposures has become more important for emerging market countries that are experiencing remarkable growth in derivatives markets. Using firm level data, we report a significant fall in exposure over the past 10 years and relate this to higher derivatives market participation. Our methodology is composed of a three stage approach: First, we measure foreign exchange exposures using the Adler-Dumas (1984) model. Next, we follow an indirect approach to infer derivatives market participation at the firm level. Finally, we study the relationship between exchange rate exposure and derivatives market participation. Our results show that foreign exchange exposure is negatively related to derivatives market participation, and support the hedging explanation of the exchange rate exposure puzzle. This decline is especially salient in the financial sector, for bigger firms, and over longer time periods. Results are robust to using different exchange rates, a GARCH-SVAR approach to measure exchange rate exposure, and different return horizons.

Journal of Economic Literature Classification: G15; G32; F31

Keywords: Exchange rate exposure; derivatives; emerging markets

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1. Introduction

Emerging market economies have shown more resiliency during the recent credit market related financial turbulence relative to the sharp decrease in economic activity following the Asian and LTCM crises. Notwithstanding the external source of the former volatility, better monetary and fiscal frameworks, and stronger external debt positions, improved foreign exchange risk management in deeper financial markets has been argued to be a major determinant of the muted effect. Another interesting recent development in these economies is the increase in derivatives market activity following the development of local bond markets after the financial crises of the late 1990's. These developments have been reported by various organizations including the Bank of International Settlements (BIS), Futures Industry Association, Financial Policy Forum, and in numerous studies[1]. BIS triannual survey figures in Table 1 show how dramatically the derivatives market volume (DMV) increased in emerging market countries and reveal that growth rate is much larger when compared to industrialized countries[2].

The remarkable growth in derivatives markets underscores the importance of identifying the implications for risk management and the aforementioned resiliency. In this context,

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[1] Financial Policy Forum, Special Policy Brief, 15 (2004). Futures Industry Association – Annual Survey (2003). These reports indicate that some of the emerging market derivatives exchanges Mexico's Merder, Brazillian BM&F, Korean Stock Exchange are now ranked among the top 10 derivatives exchanges in terms of the number of contracts traded. See also Fratzscher, 2003 and 2006; Basu, 2006.

[2] The growth rates of daily derivative transaction averages over the 1998-2001, 2001-2004, and 2004-2007 periods are 4.1, 76.9, and 115.6 percent for emerging markets, and –15.6, 47.3, and 29.9 for industrialized countries. The difference between the two groups is much higher when we consider some of the larger emerging market countries such as Korea, Turkey, Mexico, India and Russia.

analyzing the effects on foreign exchange exposure is especially critical given the rapid transition to more flexible exchange rate regimes in emerging markets and the growth of financial integration in the world.

In this paper, we investigate whether higher derivative market activity has translated in to lower currency exposure in emerging markets. Our methodology is composed of a three stage approach: First, we measure and report foreign exchange exposures for each year using the popularized extension of the Adler-Dumas (AD) (1984) model. Next, we use an indirect approach to estimate the derivatives market participation (DMP) at the firm level. Finally, we investigate the implications of the level of derivative market activity on a firm's foreign exchange exposure. In our analysis we use daily, firm level data spanning the 1995-2005 period for 6 large emerging market countries.

The results show that foreign exchange exposure is negatively related to DMP. This decline is especially salient in the financial sector, for bigger firms, and over longer time periods. Results are robust to using different exchange rates, a GARCH-SVAR method of measuring exchange rate exposure, using overlapping observations, and different return horizons.

The main advantage of deeper foreign exchange derivatives markets is the ability to hedge currency risk both by foreign investors and domestic businesses. The main drawbacks are potential increase in speculative positions in the absence of strict regulations, and vulnerability to higher volatility and counter party risks[3]. One implication of our main result is that in general, the positive effects of using foreign exchange derivatives outweigh the negative effects. Furthermore, notwithstanding the fact that most of the transactions in these markets are by foreign investment, there seem to be positive spillovers for domestic firms. Interestingly, the decline in exposure in response to an increase in DMP provides a dynamic support for the hedging explanation to the exchange rate exposure puzzle[4]. More specifically, as emerging market derivatives markets develop, exposure coefficients decrease and converge to the low levels observed in advanced country counterparts.

The literature offers several explanations for why a firm would choose to use derivatives. Among these are the desire to reduce cash flow volatility, operational strategies to reduce the effect on firm value, underinvestment, financial distress, tax incentives and managerial incentives[5]. It should be noted that the objective of this paper is not to determine why a firm hedges. The analysis should be seen as a measurement exercise assessing the effects of using derivatives on exposure. Nonetheless, the negative effect found in the results provides an important benchmark for future theoretical work.

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[3] Minton, Stulz, and Williamson (2005) point out that, firms with less capital can assume more risk by using derivatives, since these transactions inflate the values of these firms and allow them to be more competitive.

[4] Bartram and Bodnar (2007) state that the failure to find exposure, despite the effect of unanticipated exchange rate changes on the value of corporations (exchange rate exposure puzzle) is due to hedging, and not empirical methodology or sample selection related shortcomings.

[5] See Bartram, Brown, and Fehle (2007) for a discussion of the underinvestment, financial distress, tax incentive and managerial incentive theories of derivative usage.

Earlier work on foreign currency exposure proliferated after the collapse of the fixed exchange rate system of Bretton Woods. While a majority of the literature (Burns, 1976; Branson, 1971; Dufey, 1972; Dunn, 1970; Heckerman, 1972; Shapiro, 1975) focused on the accounting exposure of firms with foreign operations, other studies (Logue and Oldfield, 1977; Baron, 1976; Shapiro and Rutenberg, 1976) have indicated the need to measure a firm's economic exposure - not the accounting exposure - to exchange rate volatility. The latter line of literature also argues that measuring idiosyncratic risks reflected in stock prices is a better way of assessing exposure than measuring systematic risks.

Adler and Dumas (1984) were the first to provide a simple yet rigorous way of measuring idiosyncratic economic exposures using a linear regression model. The authors identify the coefficient of the exchange rate term in a model including stock prices and exchange rates as a single comprehensive indicator of economic exposure. Subsequent studies (Allayannis, 1996; Amihud, 1994; Bartov and Bodnar, 1994; Bodnar and Gentry, 1993; Bodnar and Wong, 2003; Chow, Lee and Solt, 1997; Dominguez and Tesar, 2001; Jorion, 1990; Nance, Smith and Smithson, 1993) have extended this model to quantify exposures at the firm and industry levels. These studies have primarily used data from advanced countries to examine the characteristics of firms with significant exposures by regressing exposure coefficients on firm specific variables. Exposures reported in these papers are generally found to be small both in terms of the proportion of firms exposed and the percent of variation in the stock prices explained by exchange rate movements. The majority of these papers also find that firms that trade heavily and that are smaller have been more affected by changes in the exchange rate. The proportions of firms affected negatively and positively from exchange rate depreciations (appreciations) are roughly equal. Finally, exchange rate exposure increases with the return horizon.

Parallel to the rapid pace of financial innovation in structured vehicles, this line of literature is starting to put more emphasis on studying the relationship between DMP and risk management. While most of these studies[6] test several theories that try to explain why firms use derivatives, few others try to measure the effect of DMP on foreign exchange exposure. Research in the latter direction was lead by Allayannis and Ofek (2001) who were the first to use notional, continuous[7] derivatives data at the firm level to study the effects on exposure. They found that firms in the United States use derivatives to hedge and not to speculate, and that while firms with high foreign trade have higher exposure; firms with high derivative/total assets ratio have lower exposure. They obtain these results using the two stage regression process of Cragg (1971). Other authors (Muller and Verschoor, 2006; Pantzalis, Simkins and Laux, 2001; Hagelin and Pramborg, 2004) have used a similar approach to study other regions and different hedging procedures.

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[6] For example see Géczy, Minton, and Schrand, 1997; Tufano, 1996; Core, Guay and Kothari, 2002; Haushalter, 2000; Brown, 2001; Lel, 2002; Allayannis, Brown and Klapper, 2003; Brown, Crabb and Haushalter, 2003, Graham and Smith, 1999; Graham and Rogers, 2002.

[7] Prior to Allayannis and Ofek (2001), most of the studies used either binary data to indicate whether firms use derivatives or not or used survey data (for example Simkins and Laux, 1997).

In this literature the proportion of studies that include emerging markets in their data set is small. An important outcome of these papers[8] is that emerging market firms have more exposure when compared to advanced country counterparts. While some of these studies find that devaluations predominantly have negative effects, others fail to find a significant pattern in the sign of the coefficient. Data limitations in these countries are the main deterrents to measuring the effect of DMP on foreign exchange exposure.

Our experiment has five distinct contributions to this literature. First and most importantly, we analyze the implications of the growth in derivatives markets on exchange rate exposure.

Second, we introduce and use a new approach to measuring DMP which is useful when derivatives data at the firm level is missing. This method can be especially important in countries where uncertainty about off-balance sheet exposures leads to inefficiencies in financial intermediation. More specifically, using a regression model, we measure the sensitivity of a firm's stock return to the total volume of trading in foreign exchange derivative instruments, and use this as a proxy for the firm's DMP.

Third, we consider second order moments of the exchange rate in measuring exposure. This nonlinearity is especially important for firms that have very volatile directions of exposure. For these firms, the coefficient of the exchange rate volatility variable may capture the exposure to exchange rate risk in cases when the first order term coefficient is insignificant.

[8] Kho and Stulz, 1999; Dominguez and Tesar, 2001; Parsley and Popper, 2002; Chue and Cook, 2007.

Fourth, we account for the correlation of exchange rate shocks with other shocks using a GARCH-SVAR model. Different from the studies using the AD model, we are able identify to unique contribution of the conditional exchange rate volatility and the level of exchange rate changes to stock price volatility. This approach provides as with two alternative measures of exposure.

Finally, using a large data set, we add to the scarce body of work related to exchange rate exposure in emerging market economies and gauge the effects of DMP on foreign exchange exposure in these countries.

The rest of the paper is organized as follows: Section 2 discusses the data set, Section 3 reports the evolution of foreign currency exposure over the 1995-2005 period. Section 4 estimates DMP proxies for each firm, reports and discusses the relationship between exchange rate exposure and DMP. Section 5 checks the robustness of the results, and Section 6 concludes.

2. Data

We compiled our data from the Datastream database. The data set includes firms listed in the stock exchanges of Brazil, Chile, Israel, Korea, Mexico, Turkey, and consists of daily observations spanning the period 1995-2005[9]. The number of firms for each country, the breakdown by sector and the stock exchanges used are reported in Table 2. The data set consists of stock prices, sector affiliation, and total assets at the firm level, a composite stock market index, and risk free interest rates for different maturities. Data availability

[9] Data for Israel was available only at the weekly frequency.

was the main determinant of the country group choice and the selection of a specific stock exchange within each country.

A majority of the literature using advanced country data gauges the significance of openness on exposure by including the foreign sales variable in regressions. We were unable to find this data at the firm level for the countries in our data set. Nevertheless we classified the firms into three categories: high trade, low trade and financial using data from both NBER–United Nations Trade (1962-2000)[10] and central bank databases. Most of the literature does not include the financial sector due to its market making property in derivatives and foreign exchange markets. We include the financial sector for three reasons. First, there is evidence that this sector has started using derivatives instruments to a greater extent for various reasons. Among these is the desire to hedge foreign currency exposure and thereby reduce risk, and to increase yield through higher leverage but become more vulnerable to exchange rate volatility[11]. Table 3 reports the increase in the domestic financial institutions' direct usage of foreign currency derivatives. The figures for emerging market countries' financial sectors are significantly higher than country averages reported in Table 1. Second, the fragilities in emerging market bank balance sheets were argued to be one of the main determinants of the severity of financial crises. Third, the recent financial turbulence in credit markets has shown that, despite the market making property, off balance sheet exposures of banks can affect their balance sheets through their contingent credit lines to conduits. There is also evidence that,

[10] Acquired from the Center for International Data at University of California, Davis.

[11] For evidence on the usage of derivatives to increase leverage see IMF, Global Financial Stability Report, October, 2007.

foreign investors – not only the domestic financial sector - play a major market maker role for structured products traded in emerging markets[12]. Therefore, it is important to determine the nature of the relationship between derivative usage and risk in the financial sector.

Trade-weighted exchange rates have performed well in models measuring a country's exchange rate exposure in aggregate. However, this variable has been argued to be inappropriate when measuring exposure at the firm level[13]. Since there is no consensus in theory as to which exchange rate is suitable for countries, in our regressions we include the Japanese Yen, British Pound, Euro/DM, US Dollar as well as trade weighted exchange rates.

Daily foreign exchange DMV data could only be gathered for Chile, Israel, Korea and Turkey. This data is available for monthly, quarterly, and annual frequencies for other countries. However, the number of observations was insufficient to apply our indirect approach to measuring derivatives market participation at the firm level to these countries. The contents and the sources of the data set are shown in Table A.1 of Appendix A.

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[12] Table 3 shows that foreign investor share of derivatives market transactions is significantly above 70% and has been increasing over the past 6 years. Foreign participation in advanced countries is much higher partially reflecting financial openness.

[13] Dominquez and Tesar (2001) show that trade weighted exchange rates can lead to an under estimation of foreign exchange exposure.

3. Evolution of Foreign Currency Exposure

To measure foreign currency exposure, we follow the common practice in the literature and utilize the following extension of the AD model:

$$R_{it} - R_{ft} = \beta_{0i} + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i}\Delta ER_t + e_t \qquad (1)$$

where R_{it} is the return on the stock of a firm, R_{mt} is the return on the value weighted stock market index, ΔER_t is the percent change in the foreign exchange rate, and R_{ft} represents the risk free rate[14]. As indicated in Bodnar and Wong (2003), using value weighted stock market index gives more weight to large firms that are more likely to be involved in international trade. In our results we could not find a significant difference when we considered an equally weighted market index. Therefore, we will report our estimation results from the model that includes a value weighted index.

The regression model measures the idiosyncratic effects of exchange rate volatility on a firm's stock return. The market index is included to account for the changes in economy specific factors that are common to every firm. This includes for example an expansionary monetary policy that would inflate stock prices and depreciate the currency concurrently[15].

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[14] T-Bill rates' maturity is consistent with the horizon over which the stock returns were calculated.

[15] One of the concerns we had with this model was the subtraction of the risk free rate from the stock return and the market return but not from the exchange rate. If the risk free rate is cointegrated with all the other variables, the exchange rate exposure puzzle can be explained by this cointegration. We checked if risk free rate was cointegrated with the market and stock returns using Johansen's test. Results are provided in Table A.5 in appendix A. The proportions correspond to the percent of stock returns that revealed significant cointegration. These figures do not indicate cointegration up to the quarterly frequency. Furthermore, we

General Method of Moments (GMM) is used as our estimation strategy. In terms of the exchange rate, we follow 3 methods. First we consider the trade weighted exchange rates. Next we consider only the Local Currency/US Dollar exchange rate. Finally, we include, one by one, the US Dollar, GBP, JPY, Euro/DM, trade weighted exchange rates[16]. For the latter method, if the exchange rate coefficient is significant for any of the currencies, we classify the firm as having a significant exposure. We call the exchange rate with the significant coefficient EMAX.

Our estimation results are provided in Tables 4 and 5. The rows correspond to the different frequencies used to measure the percent change in stock prices and exchange rates. The numbers represent the percentage of firms with significant exchange rate coefficients at the 5% level measured using robust standard errors. On one hand, using trade weighted exchange rates, consistent with the literature, yielded lower proportions of exposure. On the other hand, EMAX resulted in higher proportion of exposure compared to the US Dollar. In Table 4 we only report the experiment using the US Dollar to render our results comparable with those of other studies. Table 4 shows the proportion of firms that recorded significant coefficients throughout the whole sample period. We can see that the significance proportion falls as frequency decreases which may be due to the lower power associated with fewer observations.

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ran the same set of regressions using a model that did not include the risk free rate and found that the results were similar.

[16] In contrast to some studies, we did not include exchange rates simultaneously due to the high degree of serial correlation among advanced country currency-local currency exchange rates for an emerging market country.

In order to overcome the lack of power and make significance more comparable across different frequencies we use overlapping observations similar to Dominguez and Tesar (2006) and Bodnar and Wong (2003) and calculate returns using daily, weekly, monthly, quarterly, semi-annual, and annual horizons. In doing so, we use daily overlapping observations for weekly return horizons, and weekly overlapping observations for monthly, quarterly, semi-annual and annual frequencies[17]. We correct for serial correlation stemming from the usage of overlapping observations by employing the Newey and West (1987) method, and use robust standard errors. Results are reported in Table 5. The numbers beyond the weekly horizon are very large compared to some of the studies using advanced country data[18]. Consistent with the majority of the research (see for example, Dominguez and Tesar (2001, 2006); Bodnar and Wong (2003); Chow and Chen (1998); Chow, Lee and Solt (1997); Jongen, Muller and Verschoor (2007)), we find that significance increases with the return horizon.

We estimate the same model for each year in our sample using overlapping observations and plot the proportion of significant coefficients in Figures 1 and 2.[19] With the exception

[17] For detailed discussion on the benefits of using overlapping observations see Richardson and Smith (1991). In addition to a weekly frequency, we tried different time periods for the overlapping observations and obtained similar results.

[18] Some of the exposure proportions in the literature are as follows: Jorion (1990), 5.2% (USA); Walsh (1994), 5.6% (USA); Prasad and Rajan (1995), 4% (JPN), 5.9% (GBR), 16.7 % (DEU), 15.0% (USA); Dukas, Fatemi and Tavakkol (1996), 5%-8.3% (USA); Doidge, Griffin and Williamson (2006), 8.2% (18 countries).

[19] We omitted periods corresponding to exchange rate fluctuations exceeding 3 standard deviations within a certain year. Including these periods generated negligible differences. The figures from weekly and monthly regressions with overlapping observations are shown in Appendix A.

of daily returns, the pattern in the data indicates a declining proportion of exposure. This pattern is more evident in regressions with overlapping observations beyond the weekly frequency, and Chile, Mexico, and Israel seem to have the most uniform declines in the exposure proportions.

The decline in exposure parallels the development of local bond markets in these economies following the crisis periods of the late 90's and early 2000's. Since these financial instruments increase the availability of foreign currency hedges, the drop in foreign currency exposures can partially be attributed to greater degree of hedging. However, these countries have also reduced their foreign currency share of total debt after the financial crises[20], thereby eliminating some of their exposure to exchange rate fluctuations. Therefore, it is important to identify the unique role foreign currency hedging plays in decreasing exposure.

3.1 Exposure to Exchange Rate Volatility

The evolution of foreign currency exposure estimated with Equation (1) assumes that markets have information on firms' net foreign assets position, the maturity of their assets and liabilities. However, due to lags in data or uncertainty about off-balance sheet items, the direction of foreign currency exposure may not be available. Nevertheless, the stock of a firm with significant absolute exposure would be traded at a discount (premium) if exchange rate volatility increased (decreased).

[20] Source: IMF (2007). Foreign currency share of total debt has dropped approximately 16% in Brazil between 2002 and 2005, 33% in Indonesia between 1998 and 2005, 17% in Korea between 1997 and 2005, 29% in Mexico between 1998 and 2005, 24% in Thailand between 1997 and 2005, and 25% in Turkey between 2001 and 2005.

Several theoretical studies have implied the possibility of a nonlinear relationship between exchange rates and stock returns. Stulz (2003) shows that if cash flows are a nonlinear function of exchange rates, exposures would also be nonlinear. Shifting of production activities to different locations in response to exchange rate movements is another source of convexity outlined in Kogut and Kulatilaka (1994) and Ware and Winter (1988). Other explanations include the absence of nonlinear hedging strategies by corporations (Bodnar and Gebhart, 1999), default risk (Stulz, 2003), and pricing to market (Knetter, 1994). Furthermore, there is evidence that as emerging market countries allowed their currencies to float, the resulting higher exchange rate volatility increased the demand for exchange rate hedges (Turner, 2002). Therefore, it is important to include nonlinearity in the model to measure exposure more precisely, and to gauge the effect of derivative usage on vulnerability to volatility.

To measure nonlinear exposure, we extend the AD model by including unconditional exchange rate volatility as an additional independent variable. We measure exchange rate volatility using the coefficient of variation which provides a unit free proxy for dispersion. More specifically, we divide the standard deviation of the exchange rate in a given period by the mean value of this variable and estimate the following regression model.

$$R_{it} - R_{ft} = \beta_{0i} + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i}\Delta ER_t + \beta_{3i}\sigma_t^{er} + e_t \qquad (2)$$

σ_t^{er} represents the exchange rate volatility proxy. To calculate returns we use weekly and monthly horizons with daily and weekly overlapping observations.

Results displayed in Table 6 show that exposure increases significantly when we consider exchange rate volatility. The figures reported in the first row and second row correspond to models including only percent changes in the exchange rate and exchange rate volatility respectively. Proportions of firms with at least one significant coefficient are reported in the third row. With the exception of Turkey, the decline in exposure was more gradual when we included exchange rate volatility. This pattern is evident when we compare Figures 2 and 3. Consistent with the majority of the literature we find that the sign of the exchange rate coefficient is evenly split between positive and negative. However, the sign of exchange rate volatility was negative in most of the cases (implying that in general an increase in exchange rate volatility has decreased share values).

Fraction of firms with significant exchange rate coefficients is not a good indicator of exposure if the magnitude of the coefficients is economically insignificant. Therefore we also measure and report the average absolute value of the exchange rate coefficients. The numbers reported in Table 7 reveal that the size of exposure has decreased parallel to the decline in the proportion of firms with significant exposure. Furthermore, although the magnitudes of the exchange rate coefficients were significantly higher than advanced country coefficients at the start of the sample period, [21] they converged to these levels towards the end.

Having found evidence supporting a decreasing sensitivity to exchange rate movements both in terms of fraction of firms and magnitudes, we investigate if this is due to the

[21] Jorion (1990): maximum exposure = 0.56, 1971-1989, US. Dominguez and Tesar (2006): 0.17-0.56, 1980-1999, 6 non-US advanced countries. Hagelin and Pramborg (2002): 0.52, 1997-2001, Sweden.

developments in the derivatives markets. In doing so, we test the hedging explanation of the exchange rate exposure puzzle.

4. Effect of Derivatives Market Activity on Exposure

In the absence of derivative market activity at the firm level, it is not possible to measure the effect of derivatives usage on a firm's exchange rate exposure directly. Nevertheless, we can use a formulation similar to that employed in Section 4 to estimate the level of DMP at the firm level. More specifically, we replace the exchange rate variable with the aggregate DMV, and estimate the following:

$$R_{it} - R_{ft} = \gamma_{0i} + \gamma_{1i}\left(R_{mt} - R_{ft}\right) + \gamma_{2i} DMV_t + e_t \qquad (3)$$

where DMV_t is the derivatives market volume variable defined in Section 2. This equation captures the idiosyncratic effects of derivatives market volume on a firm's stock return[22]. Hence, we use the coefficient $\hat{\gamma}_{2i}$ as a proxy for DMP. The intuition is as follows: On one hand, if a domestic firm takes advantage of the greater depth and variety in the derivatives markets to lower their exchange rate associated risks, demand for this stock would increase, and $\hat{\gamma}_2$ would be significant and negative. On the other hand, if a firm uses these instruments for higher leverage to increase return, $\hat{\gamma}_2$ will be significant and positive. For either case, the absolute value of $\hat{\gamma}_2$ would measure the sensitivity of stock returns to the availability of derivatives instruments, and thereby indicate the degree of derivatives market participation.

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[22] We have excluded R_{mt} from equation (3) to estimate the sensitivity to DMV_t and found similar results.

Sensitivity of stock returns to macroeconomic variables has been the subject of numerous studies, especially after Chen, Roll and Ross (1986) and Fama (1981). These studies (see for example: Schwert, 1990; He and Ng 1994; Bilson, Brailsford and Hooper 2001 and Ibrahim, 1999) find that macroeconomic variables such as industrial production, goods' prices, money supply, interest rates, inflation rates have explanatory power over stock returns. Some of these studies also mention that local macroeconomic variables in emerging markets have higher explanatory power over stock returns compared to advanced countries since they are partially segmented from global capital markets. The macroeconomic variable we consider here is the derivatives market volume. Related in essence to our analysis, there is a plethora of research that examines the relationship between financial development and stock returns. While most of these are at the country level, there are few studies that examine stock market returns (Dellas and Hess 2005).

To measure the effects of DMP on exchange rate exposure we follow a three step approach.

1. We estimate the exposure coefficients, $\hat{\beta}_{2i}$ and $\hat{\beta}_{3i}$ using equation (2) for each year, and retain only the significant coefficients using weekly overlapping observations and a monthly return horizon[23].

2. We measure the proxy for DMP, $\hat{\gamma}_{2i}$ using equation (3) for each year using weekly overlapping observations and a monthly return horizon[24]. Retain only the significant coefficients.

[23] We have also estimated exposures using levels and volatility separately. Results were qualitatively similar.

3. We construct our panel data set using the exposure and DMP coefficients measured for each year and firm for a specific country in steps 1 and 2. Next, we regress the exposure coefficients on the market participation proxy as follows:

$$\hat{\beta}_{2it} = \lambda_0 + \lambda_1 \hat{\gamma}_{2it} + \nu_t \qquad (4)$$

We use the absolute values of $\hat{\beta}_{it}$ and $\hat{\gamma}_{it}$ in equation (4). Therefore, a negative sign of $\hat{\lambda}_1$ indicates that foreign exchange exposure decreases when a firm participates more in the derivatives market.

Pagan (1984) proves that in models with generated regressors similar to that in equation (4), if the hypothesis to be tested is $\gamma_{2i} = 0$, the OLS estimator of the variance of $\hat{\gamma}_{2i}$ is consistent and the asymptotic t-statistics are valid. Furthermore, some studies have used maximum likelihood estimation to deal with the generated regressor problem (McAleer and Mackenzie, 1991, 1994). Finally, Arrelano and Bover (1995) propose a GMM strategy for panel data that is superior to OLS when the dependent variable is not stationary, there are unobserved firm specific effects, and there is reverse causality (when a firms' stock return affects the return on the market index and/or the exchange rate). In our experiments we have used all three of the methods mentioned above. Since results were similar, we report the output from the GMM estimation of equation (4) in Tables 8 and 9.

Reported coefficient values measure the percent change in exchange rate exposure in response to a one percent change in the sensitivity to derivatives market volume. There

[24] Using daily overlapping observations and a weekly return horizon yielded similar results.

are four salient observations. First, all of the low trade sector coefficients are insignificant, and a majority of the high trade sector coefficients are significant and negative. Hence, foreign currency exposure of firms classified under sectors that trade heavily is more sensitive to DMP. The insignificance for low-trade firms can be partially explained by the fewer number of significant exchange rate and DMV coefficients in the first and second stage regressions that give us fewer observations in the third stage. This result is consistent with the finding of higher usage of derivatives by firms with more foreign sales and trade in several studies (Allayanis and Ofek, 2001; Nydahl, 1999; Muller and Verschoor, 2006).

Our second finding is that the financial sector participation coefficients are negative, higher than the high trade sector coefficients in absolute value, and more significant. On one hand, the higher number of observations for this group of firms can similarly explain partially the greater significance. This observation provides support for the numbers reported in Table 3. On the other hand, the higher values of coefficients imply that financial firms which participate in derivatives markets were more efficient in reducing their foreign currency exposures compared to non-financial firms. Furthermore, the negative coefficients imply that derivatives market transactions of these firms were predominantly due to hedging motives rather than speculation.

Third, using EMAX increases sensitivity of exposure to the participation proxy slightly for exchange rate levels. Furthermore, using EMAX does not result in a discernable difference in coefficients estimated from regressions using exchange rate volatility.

Finally, we find that exchange rate volatility exposure is less sensitive to DMP, partially reflecting the fewer number of significant exchange rate volatility exposure coefficients compared to exchange rate levels.

5. Robustness

5.1 GARCH-SVAR

The analysis so far has the following caveat: Exchange rate fluctuations, the change in the exchange rate, and the market return are highly correlated. This in turn makes the coefficient estimates unreliable. Therefore, it is important to identify the shocks to volatility, and the exchange rate that are independent of the shocks to other variables. In this respect, we follow a three step procedure similar to Jorda and Salyer (2003). First, we estimate a Vector Auto Regressive (VAR) model with the following ordering: $\left[R_m \;\; ER \;\; R_i\right]$ using weekly returns and lags up to two periods. We assume that individual stock returns do not affect macroeconomic variables. The other restriction we need in order to obtain the orthogonalized shocks is the independence of market returns from the change in exchange rates. To do this, we use the residuals from a regression of market returns on exchange rates, and consider the component of market returns that are not affected by exchange rates by construction. Next, we fit a GARCH(1,1) model to residuals from the exchange rate equation, and estimate the conditional variances, $\hat{\sigma}^{er}$. Finally we incorporate this conditional exchange rate volatility in a VAR model with the following ordering: $\left[\hat{\sigma}^{er} \;\; R_m \;\; ER \;\; R_i\right]$.

We are particularly interested in the effects of the exchange rate and exchange rate volatility on a firm’s stock returns. It is straightforward to gauge this effect using decomposition of variance from our model. We measured the variance decompositions for forecast horizons 1 to 10 weeks ahead for each firm and constructed our two additional foreign exchange exposure proxies (SVAR proxies): percentage of variation in stock returns explained by exchange rates and by conditional exchange rate volatility. Despite slight differences, these two ratios were stable over different forecast horizons. Therefore, we used the results from 3 period ahead forecasts in our experiments.

Using these proxies in our third stage regressions, we obtain the results reported in Table 8. Similar to Section 4, coefficients of the participation term are negative in general. The disparity between financial, high trade and low trade sectors is much more apparent. Furthermore, these coefficients are more significant compared to those obtained using the AD model proxies. This is partially due to the fact that all of the annual observations for every firm were included in the third stage unlike in Section 4. Hence, larger number of observations caused a drop in the standard errors. We also find, consistent with Section 4 that the sensitivity of exposure to DMP is very large in Korea compared to the other countries.

To eliminate the effect of power in this disparity, we followed two methods. First, we considered only the annual data with variance ratios over certain values so as to equate the number of observations in SVAR and AD proxies. Second, we considered all the observations in the SVAR proxies. Results were similar. Overall, the negative effect of

DMP on exchange rate exposure was robust to a more precise method of measuring the effect of exchange rate volatility on stock returns.

5.2 Different Period Lengths

So far we have used exposures and derivative market participation coefficients measured annually in the third stage. In this section we repeat the exercise in Section 4 but extend the time period to three years. This modification increases the number of observations and therefore the power of our estimation results in the first stage. However the power of the results in the third stage decreases as we use lower frequencies. Results from using EMAX are displayed in Table 9. The figures in the table point to a sharp increase in the size and significance of the coefficients. Furthermore, exchange rate volatility that was insignificant in regressions using annual data is more significant and larger with lower frequency. Coefficients corresponding to the sectors are qualitatively similar to previous regressions and are omitted.

These results are not surprising since the growth in the derivative market volume variable is much more apparent over three years. Therefore, using a longer time period is more helpful in terms of measuring DMP.

5.3 Size Classification

A majority of the studies measuring exchange rate exposure for different size firms finds that larger firms are more exposed than smaller firms (e.g. Parsley and Popper, 2002; Kho and Stulz (1999); Jorion, 1990; Nance, Smith and Smithson, 1993). Using data for

Chile[25], we test how foreign exchange exposure sensitivity to DMV is related to a firm's size.

We divide the firms in to three equal size groups[26], and implement our third stage experiment for each of them using weekly overlapping observations and a monthly return horizon. There are three main conclusions we inferred from the results displayed in Table 10. First, larger firms participate more in the derivatives markets. This result is consistent with a number of studies (Geczy, Minton and Schrand, 1997; Froot, Scharfstein and Stein, 1993; Allayannis and Ofek, 2001, Minton, Stulz and Williamson, 2006; Bartram, Brown and Fehle, 2007) that find evidence supporting the fixed start up costs in hedging theory. Second, large firms reduced their exposure to a greater extent over the sample period compared to smaller firms. Finally, the decline in exposure to exchange rate volatility was bigger for smaller firms. The last observation can possibly be interpreted as the ability of smaller firms to signal to the market that they are hedging some of their less transparent foreign exchange exposures. In contrast, bigger firms' direction of exposure is more transparent and the decline in their exposure is better gauged with the change in the exchange rate.

5.4 Absolute Exposure

Exchange rate coefficient estimates in equations (1) and (2) measure exchange rate exposure relative to the market. A finding of an insignificant coefficient in this setting only means that the residual exposure - not the total exposure - of the firm is negligible.

[25] This data was not available for other countries.
[26] Share of a firm's total assets in the industry total is averaged for the 1995-2206 period to classify the firms.

To measure the effect of DMP on total exposure, we omit the aggregate market index and the risk free rate from equation (1), and use the following model to construct our exposure proxies. We measure exchange rate exposure and DMP using weekly overlapping observations and a monthly return horizon for each year and firm.

$$R_{it} = \beta_{0i} + \beta_{1i}\Delta ER_t + \beta_{2i}\sigma_t^{er} + e_t \qquad (5)$$

As displayed in Table 13 the results do not change with the alternative measurement and indicate a negative effect of DMP on exposure.

6. Conclusion

The rapid pace of financial integration and innovation has improved the efficiency of financial intermediation, and enabled firms to diversify risks. However, these developments also introduced challenges to identify the underlying risks in these markets. The negative consequences of these risks were brought home with the recent credit market related financial turmoil. Given the complex and less transparent nature of off-balance sheet transactions, it is essential to develop methods to gauge these risks.

In this paper, we identified a declining trend in emerging market firms' exchange rate exposure using various measures. Next, we investigated whether the growing scale of derivatives market activity in emerging market countries was partially responsible for this observation. Given the absence derivatives data at the firm level, we proposed a method to measure derivatives market participation, and using different experiments, we found that higher levels of participation reduce exchange rate exposure.

Our focus on emerging markets was due to several reasons. First these countries are recently pursuing more active monetary policies and more flexible exchange rate regimes. Hence, understanding how firms cope with exchange rate uncertainties is important for assessing the risks to financial stability in these markets. Our finding that these economies are much more exposed to exchange rate fluctuations justifies our choice.

Second, together with the low volatility in the world, these countries have experienced large capital inflows in the last five years. This flow of capital brought together with it demand for more complex financial instruments. In our opinion, it is critical to identify how domestic firms fare from this growth in financial innovation. Furthermore, higher capital integration among emerging and advanced economies, and emerging markets growing share of world output underscore the emphasis.

The recent financial turmoil has shown us that the systematic risks associated with using asset backed securities remain, despite the reduction in idiosyncratic risks. Our paper finds evidence that the proportion of firms with exposure has decreased over time and that this decline is due to higher level of activity in derivatives markets. These findings do not imply that a sharp reversal of capital, especially in these less liquid markets, will not lead to a financial crisis. Countries will hopefully sustain the more improved financial and monetary frameworks of recent years to cope with these events.

References:

Adler, M., Dumas, B., “Exposure to currency risk: Definition and measurement”, Financial Management, 13, (Summer), 41-50, 1984.

Allayannis, G., "Exchange rate exposure revisited", working paper, New York University, New York, NY, 1996.

Allayannis, G., Brown, G., Klapper, L., “Capital structure and financial risk: evidence from foreign debt use in East Asia”, Journal of Finance 58 (6), 2667– 2710, 2003.

Allayanis, G., Ihrig, J., and Weston, J., “Exchange-Rate Hedging: Financial versus Operational Strategies”, American Economic Review, 2001.

Allayanis, G., Ofek, E. “Exchange rate exposure, hedging and the use of foreign currency derivatives”, Journal of International Money and Finance, 2001.

Amihud, Y., “Exchange rates and the valuation of equity shares” In: Amihud, Y., Levich, R.M. (Eds.), Exchange rates and corporate performance. Irwin, New York, 1994.

Arellano, M., Bover, O., "Another Look at the Instrumental-Variable Estimation Components Models", Journal of Econometrics, 68, 29-52, 1995.

Baron, D.P., “Flexible Exchange Rates, Forward Markets and the Level of Trade”, American Economic Review, pp. 253-266, 1976.

Bartram, S.M., Bodnar, G. M., ”The exchange rate exposure puzzle”, Managerial Finance, 33(9),642 – 666, 2007.

Bartov, E., Bodnar, G. W. ”Firm valuation, earning expectations and the Exchange rate exposure effect”, Journal of Finance, (December), 1755-1786, 1994.

Bartram, S.M., Brown, G. W., and Fehle, F.R., "International Evidence on Financial Derivative Usage" Financial Management, forthcoming.

Basu, S., Bappaditya, M., “Derivatives in Asia-Pacific Markets”, Journal of Emerging Market Finance, 5, 207, 2006.

Bilson, C.M., Brailsford, T.J., and Hooper, V.J. “Selecting macroeconomic variables as explanatory factors of emerging stock market returns”, Pacific-Basin Finance Journal, 9, 401–426, 2001.

Bodnar, G.M., Gebhardt, G., “Derivatives Usage in Risk Management by U.S. and German Non-Financial Firms”, Journal of International Financial Management and Accounting 30, 3, 153-187, 1999.

Bodnar, G. M., Gentry, W. M. “Exchange rate exposure and industry characteristics: Evidence from Canada, Japan and the USA”, Journal of International Money and Finance, 12, 29-45, 1993.

Bodnar, G. M., Wong, M. H. F., “Estimating exchange rate exposure some weighty issues”, Financial Management 32, 35–67, 2003.

Branson, W., “The Trade Effects of the 1971 Currency Realignments”, Brookings Papers on Economic Activity, Vol. 1972, No. 1. pp. 15-69, 1972.

Brown, G., “Managing Foreign Exchange Risk with Derivatives”, Journal of Financial Economics, 60, 2/3, 401-449, 2001.

Brown, G., Crabb P., and Haushalter D., “Are Firms Successful at Selective Hedging?”, University of North Carolina, Chapel Hill, NC, working paper, 2003.

Burns, J., “The Economic Implications of Existing Accounting Standards”, AEI/Treasury Conference on Exchange Rate Flexibility, April, 1976.

Chen, N.F., Roll, R., Ross, S.A., “Economic forces and the stock market”, Journal of Business 59, 383–403, 1986.

Chow, E.H., Chen, H.L., “The determinants of foreign exchange rate exposure: evidence on Japanese firms”, Pacific-Basin Finance Journal 6, 153–174, 1998.

Chow, E.H., Lee, W.Y., and Solt, M.E., “The economic exposure of US multinational firms”, The Journal of Financial Research 20, 191–210, 1997.

Chue, T.K., Cook, D.E., "Emerging Market Exchange-Rate Exposure", working paper, 2007.

Core, J.E., Guay, W.R., and S.P. Kothari, “The Economic Dilution of Employee Stock Options: Diluted EPS for Valuation and Financial Reporting”, Accounting Review 77,3,

627-653, 2002.

Cragg, J., “Some statistical models for limited dependent variable with application

to the demand of durable goods”, Econometrica, 39, 829-844, 1971.

Dellas, H., Hess, M., “Financial Development and Stock Returns: A Cross-Country Analysis”, Journal of International Money and Finance, 24, 6, 891-912, 2005.

Doidge, C., Griffin, J., and R. Williamson, R., "Measuring the economic importance of exchange rate exposure", Journal of Empirical Finance, 4, 5, 550-576, 2006.

Dominguez, K.M.E., Tesar, L.T., “A re-examination of exchange rate exposure”, American Economic Review 91, 396–399, 2001.

Dominguez, K.M.E and Tesar, L.T., "Exchange Rate Exposure", Journal of International Economics, 68, 188-218, 2006.

Dominguez, K.M.E.,Dufey, G., “Corporate Finance and Exchange Rate Variations”, Financial Management, Summer, 1972.

Dukas, S.P., Fatemi, A.M., and Tavakkol, A., “Foreign exchange rate exposure and the

pricing of exchange rate risk”, Global Finance Journal, 7, 2, 169-189, 1996.

Dunn, R., “Flexible Exchange Rates and Oligopoly Pricing: A Study of Canadian Markets”, The Journal of Political Economy, Vol. 78, No. 1. pp. 140-151, 1970.

Fama, E.F., “Stock returns, real activity, inflation and money”, American Economic Review 71, 545–565, 1981.

Fratzscher, Oliver, ‘Emerging Derivative Market in Asia’ in EAP Flagship on Asian Financial Market and Development, 2006.

Froot, K., Scharfstein, D., and Stein, J., “Risk management: coordinating corporate investment and financing policies” Journal of Finance, 48 (December), 1624–1658, 1993.

Geczy, C., Minton, B., and Schrand, C., “Why firms use currency derivatives?” Journal of Finance 52, 1997. (September), 1324–1354.

Goldstein, M., Turner P., “Controlling currency mismatches in emerging markets”, Institute for International Economics, Washington DC, 2004.

Graham, J.R., Rogers, D.A., “Do Firms Hedge In Response to Tax Incentives?”, Journal

of Finance 57, 2, 815-840, 2002.

Graham, J.R., Smith, Jr. C.W., “Tax Incentives to Hedge.” Journal of Finance 54, 6, 2241-2263, 1999.

Griffin, J.M., Stulz, R.M., “International competition and exchange rate shocks: A cross country industry analysis of stock returns.”, Review of Financial Studies, 14, 215-41, 2001.

Hagelin, N., Pramborg, B., “Hedging Foreign Exchange Exposure: Risk Reduction from Transaction and Translation Hedging”, Journal of International Financial Management & Accounting, 15(1), 1-20, 2004.

Haushalter, G.D., “Financing Policy, Basis Risk, and Corporate Hedging: Evidence from Oil and Gas Producers”, Journal of Finance 55, 1, 107-152, 2000.

He, J., Ng, L.K., “Economic Forces, Fundamental Variables, and Equity Returns”, The Journal of Business, 67, 4, 599-609, 1994.

Heckerman, D., "The Exchange Risks of Foreign Operations," The Journal of Business, Vol. 45, No. 1, pp. 42-48, 1972.

Ibrahim, M., “Macroeconomic Variables and Stock Prices in Malaysia: An Empirical Analysis”, Asian Economic Journal 13, 2, 219–231, 1999.

International Monetary Fund (2007a): “The development of bond markets in emerging market countries”. Note prepared for the G7 Deputies meeting. February.

Jongen, R., Muller, A., and Verschoor, W.F.C., "Using Survey Data to Resolve the Exchange Risk Exposure Puzzle: Evidence from U.S. Multinational Firms", working paper, EFA, 2007

Jorda, O., Salyer, K., "The Response of Term Rates to Monetary Policy Uncertainty," Review of Economic Dynamics, Academic Press for the Society for Economic Dynamics, vol. 6(4), pages 941-962, 2003.

Jorion, P., “The exchange rate exposure of U.S. multinationals”, Journal of Business 63, 331–345, 1990.

Kho, B., Stulz, R.M., “Banks, the IMF and the Asian Crisis”, Working Papers 7361, National Bureau of Economic Research, Inc, 1999.

Knetter, M.M., “Is Export Price Adjustment Asymmetric? Evaluating the Market Share and Marketing Bottlenecks Hypothesis”, Journal of International Money and Finance, 13, 1, 55-70, 1994.

Kogut, B., Kulatilaka, N., “Operating flexibility, global manufacturing, and the option value of a multinational network”, Management Science 40, 1, 123-139, 1994.

Lel, U. “Corporate Hedging Policy Around the World”, University of Indiana working paper, 2002.

Logue, D.E., Oldfield, G.S., “Managing Foreign Assets When Foreign Exchange Markets are Efficient”, pp 16-22, 1977.

McAleer, M., McKenzie, C.R., “When are two step estimators efficient?”, Econometric

Reviews, 10, 235–252, 1991.

McKenzie, C. R., McAleer, M., “On the effects of misspecification errors in models with

generated regressors”, Oxford Bulletin of Economics and Statistics, 56, 441–455, 1994.

Minton, B.A., Stulz, R.M., and Williamson, R.G., "How Much do Banks use Credit Derivatives to Reduce Risk?", AFA 2007 Chicago Meetings Paper, 2006.

Muller, A., Verschoor, W.F.C., “Foreign exchange risk exposure: Survey and suggestions”, Journal of Multinational Financial Management, vol. 16, issue 4, pages 385-410, 2006.

Muller, A., Verschoor, W.F.C., "European Foreign Exchange Risk Exposure", European Financial Management, Vol. 12, No. 2, pp. 195-220, March 2006.

Nance, D.R., Smith Jr. C.W., and Smithson, C.W., “On the determinants of corporate hedging”, Journal of Finance, 48, 267-284, 1993.

Newey, W.K., West, K.D., “A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix”, Econometrica, 55, 3, 703-708, 1987.

Nydahl, S., “Exchange Rate Exposure, Foreign Involvement and Currency Hedging of Firms:Some Swedish Evidence,” European Financial Management 5 (1999), pp. 241-257.

Pagan, A., “Econometric Issues in the Analysis of Regressions with Generated Regressors”, International Economic Review, 25, 221–247.

Pantzalis, C., Simkins, B.J., and Laux, P.A., “Operational hedges and the foreign exchange exposure of US multinational corporations”, Journal of International Business Studies 32, 793–812, 2001.

Parsley, D.C., Popper, H., "Foreign Exchange Exposure and Exchange Rate Arrangements in East Asia", HKIMR Working Paper No. 17/2002, 2002.

Prasad, A.M., Rajan, M., “The Role of Exchange and Interest Risk in Equity Valuation: A Comparative Study of International Stock Markets”, Journal of Economics and Business, 47, 5, 457-472, 1995.

Richardson, M., Smith, T., “Tests of Financial Models in the Presence of Overlapping Observations”, Review of financial Studies 4, 227-234, 1991.

Schwert, G.W., “Stock returns and real activity: A century of evidence” Journal of Finance 45, 1237–1257, 1990.

Shapiro, A., “Exchange Rate Changes, Inflation, and the Value of the Multinational Corporation”, The Journal of Finance, Vol. 30, No. 2, 1975.

Shapiro, A., “When to Hedge Against Devaluation”, Management Science, 20, 12, 1974.

Shapiro, A. C., Rutenberg, D. P., “Managing Exchange Risks in a Floating World”, Financial Management 16, 48-58, 1976.

Simkins, B., Laux, P., ”Derivatives use and the exchange rate risk of investing in large U.S. corporations” Working Paper, Case Western Reserve University, 1997.

Stulz, R.M. “Risk Management and Derivatives”, Southwestern Publishing Co., Cincinnati, OH, 2003.

Tufano, P., “Who Manages Risk? An Empirical Examination of the Risk Management Practices in the Gold Mining Industry” Journal of Finance, 51, 4, 1097-1137, 1996.

Turner, P., “Bond markets in emerging economies: an overview of policy issues”, BIS papers, 11, 2002.

Walsh, E.J., “Operating income, exchange rate changes and the value of the firm: an empirical analysis”, Journal of Accounting, Auditing and Finance, 9, 703–724, 1994.

Ware, R., Winter, R., “Forward Markets, Currency Options and the Hedging of Foreign Exchange Risk”, Journal of International Economics 25, 3/4, 291-302, 1988.

Table 1. Derivatives Market Volume (Daily Averages, Millions, US Dollar)

	1998	2001	2004	2007
Brazil		1,881	1,238	685
Chile	466	635	942	1,967
Colombia		82	242	565
Czech Republic	2,998	1,245	1,429	3,631
Hungary	464	226	2,141	4,658
India	1,290	1,848	3,457	24,015
Indonesia	1,037	534	1,355	1,357
Korea	1,046	3,950	10,269	17,819
Malaysia	800	895	854	1,812
Mexico	2,397	4,186	4,543	10,795
Peru		36	45	214
Philippines	403	605	338	1,256
Poland	541	3,341	4,604	6,820
Russia	873	154	6,153	16,190
Slovakia		497	1,459	3,246
Slovenia		9	30	152
South Africa	5,206	7,858	8,032	10,568
Taiwan	1,524	1,669	4,636	6,725
Thailand	2,228	1,315	1,979	4,931
Turkey		678	2,232	3,311
Emerging Countries Average	1,520	1,582	2,799	6,036
Industrialized Countries Average	50,640	42,757	62,995	81,831
Emerging Countries Total	23,271	32,967	55,750	120,717
Industrialized Countries Total	1,337,907	1,186,071	1,757,614	1,800,271

Source: BIS Triannual Survey. Includes Over the Counter (OTC) outright forward, swap, options and other foreign currency derivatives.
Industrialized countries are: Belgium, Canada, Denmark, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Saudi Arabia, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States.

Table 2. Number of Firms by Sector

	Brazil	Chile	Israel	Korea	Mexico	Turkey
	Sao Paulo Stock Exchange (BOVESPA)	Santiago Stock Exchange (SSE)	Tel Aviv Stock Exchange (TASE)	Korea Stock Exchange (KSE)	Bolsa Mexicana de Valores (BMV)	Istanbul Stock Exchange (ISE)
Aluminum	12	1	12	6	0	1
Auto Parts	33	1	13	28	10	7
Automobiles	22	0	12	26	0	2
Banks	76	20	19	45	26	15
Brewers	13	4	12	19	6	5
Building Mat.& Fix.	45	10	23	32	13	29
Business Support Svs.	15	25	22	22	21	11
Comm. Vehicles,Trucks	16	1	12	35	6	5
Commodity Chemicals	33	11	17	56	12	19
Containers & Package	28	2	7	34	1	6
Electrical Equipment	29	3	13	23	11	8
Electricity	43	22	12	29	0	4
Exploration & Prod.	35	0	23	28	0	0
Farming & Fishing	11	4	13	22	1	1
Fixed Line Telecom.	32	5	14	8	4	0
Food Products	108	15	19	23	22	23
Food Retail,Wholesale	20	7	20	32	20	9
Footwear	20	3	18	73	14	40
Forestry	7	1	0	7	0	0
Gas Distribution	12	1	10	8	0	1
Heavy Construction	18	0	22	27	10	2
Industrial Machinery	7	7	18	34	11	24
Investment Services	11	3	32	77	1	7
Paper	45	1	10	13	3	2
Pharmaceuticals	8	4	44	84	6	6
Pipelines	10	0	32	12	0	0
Real Estate Hold, Dev	19	12	12	22	2	3
Specialty Chemicals	11	8	8	48	2	6
Specialty Finance	14	29	24	54	51	25
Steel	26	3	12	22	7	0
Tobacco	18	0	17	25	0	0
Unclassified	12	32	41	51	67	12
Total	**809**	**235**	**558**	**1025**	**327**	**273**

Table 3. Financial Sector's and Foreign Investor's Derivative Usage(*)

	2001	2004		2007	
	% Foreign	Domestic Financial	% Foreign	Domestic Financial	% Foreign
Emerging	62.1	89.8	65.7	236.3	72.0
Advanced	88.5	58.7	91.3	183.8	89.3

(*) % Foreign represents the % Non-local institutions' and dealers' share of OTC outright forward and swap transactions. Domestic Financial Columns show the percentage increase in outright forward and swap transactions of the domestic financial sector over the past three years.

Table 4. Percentage of Firms with Significant Exchange Rate Exposure (95-05) (*)

	Brazil	Chile	Israel	Korea	Mexico	Turkey
Daily	4.7	5.5		16.9	10.6	28.2
Weekly	3.4	4.7	6.5	14.0	4.7	15.4
Monthly	3.0	6.8	6.8	15.7	9.5	12.1
Quarterly	6.8	6.0	5.0	12.7	7.5	7.3

(*) The numbers represent the percentage of firms that have a significant β_2 coefficient at the 5% level in the following regression: $R_{it} - R_{ft} = \beta_{0i} + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i}\Delta ER_t + e_t$. Rows correspond to the different horizons used. Local Currency/US Dollar exchange rate is used in the estimation.

Table 5. Overlapping Observations,% of Firms with Signif. ER Exposure (95-05) (*)

	Brazil	Chile	Israel	Korea	Mexico	Turkey
Daily	4.7	5.5		16.9	10.6	28.2
Weekly	12.9	14.5	6.5	31.6	16.5	38.1
Monthly	18.9	34.0	12.0	47.1	24.4	44.3
Quarterly	27.4	47.2	28.5	52.1	29.5	42.5
Semi Annual	32.4	55.7	41.0	56.0	36.6	51.6
Annual	35.7	60.9	53.6	66.1	37.8	54.2

(*)The numbers represent the percentage of firms that have a significant β_2 coefficient at the 5% level in the following regression: $R_{it} - R_{ft} = \beta_{0i} + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i}\Delta ER_t + e_t$. Daily, overlapping observations are used for the weekly return horizons. Weekly overlapping observations are used for monthly, quarterly, semi-annual, and annual return horizons. Rows correspond to the different horizons. Local Currency/US Dollar exchange rate is used in the estimation.

Table 6. Including Exchange Rate Volatility, % of Firms with Sig. Exposure (95-05)

	Brazil	Chile	Israel	Korea	Mexico	Turkey
Weekly						
ER	12.1	14.0		31.0	15.7	37.7
ER_Vol	7.9	9.8		23.5	5.9	23.4
Either Coeff	14.1	19.6		43.7	17.7	47.6
Monthly						
ER	18.9	34.0	9.7	47.4	24.0	45.1
ER_Vol	15.6	35.7	12.4	42.0	21.7	32.6
Either Coeff	24.6	45.1	20.1	59.5	29.9	50.2
% of Neg ER	48.8	51.6		50.4	46.2	54.7
% of Neg ERVol	67.2	60.9	87.0	85.1	53.3	68.8

(*) Exchange rate volatility is proxied by the standard deviation of the US Dollar exchange rate divided by its mean value in the respective period.
Weekly horizons with daily overlapping observations and monthly horizons with weekly overlapping observations are used to calculate the returns. Either coefficient row reports the percentage of firms with a significant β_2 and/or β_3 coefficient at the 5% level in the following regression:

$$R_{it} - R_{ft} = \beta_{0i} + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i}\Delta ER_t + \beta_{3i}\sigma_t^{er} + e_t$$

Table 7. Average Exchange Rate Coefficients

	Brazil	Chile	Israel	Korea	Mexico	Turkey
1995	0.86	0.66	1.36	0.62	1.47	1.87
1996	1.72	0.82	1.03	0.37	0.94	1.41
1997	1.67	0.71	0.72	0.38	0.71	2.13
1998	1.70	0.67	0.69	0.56	0.80	1.93
1999	0.50	0.61	0.77	0.64	0.79	2.15
2000	0.95	0.70	0.65	0.53	0.66	1.92
2001	0.53	0.39	0.54	0.40	0.60	0.41
2002	0.31	0.44	0.54	0.18	0.58	0.35
2003	0.27	0.38	0.52	0.29	0.54	0.45
2004	0.29	0.35	0.43	0.42	0.42	0.49
2005	0.17	0.35	0.45	0.21	0.41	0.38

(*) Figures represent the simple average of the absolute value of $\hat{\beta}_{2i}$ coefficients estimated from the following: $R_{it} - R_{ft} = \beta_{0i} + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i}\Delta ER_t + e_t$. The coefficients represent the percent change in stock returns in response to a one percent change in exchange rates.
Weekly return horizons are used in estimation.

Table 8. Third Stage Regressions (US Dollar)

	Chile	Israel	Korea	Turkey
ER: USD	**-0.36**	**-0.51**	**-8.28**	-2.47
	(0.12)	(0.11)	(2.61)	(1.49)
Low Trade	0.06		-0.68	-1.77
	(0.55)		(0.47)	(1.86)
High Trade	1.85		**-2.12**	**-2.91**
	(1.43)		(0.37)	(1.31)
Financial	**-4.75**		**-7.02**	**-6.10**
	(1.77)		(3.02)	(1.17)
ER_Vol: USD	**-0.55**	**-0.38**	0.37	-0.13
	(0.26)	(0.08)	(0.24)	(0.52)
Low Trade	0.00		0.00	0.37
	(1.00)		(0.01)	(0.35)
High Trade	-2.00		0.04	-0.48
	(3.03)		(0.14)	(0.44)
Financial	**-2.11**		**-0.10**	**-0.64**
	(0.44)		(0.01)	(0.26)

(*) Results are from the following regressions: $\hat{\beta}_{2it} = \lambda_0 + \lambda_1 \hat{\gamma}_{2it} + \nu_t$
$\hat{\beta}_{3it} = \lambda_0 + \lambda_1 \hat{\gamma}_{2it} + \nu_t$ where $\hat{\beta}_{2i}, \hat{\beta}_{3i}$ and $\hat{\gamma}_{2i}$ are estimated using equations (2) and (3) for each year.
Coefficients that are significant at the 5 percent level are in bold font.
US Dollar is used as the exchange rate.
Sector classification is determined based on
NBER–United Nations Trade (1962-2000) data
Sector classification for Israel is not included due to insufficient data.

Table 9. Third Stage Regressions
(using the US Dollar, JPY, Euro, GBP, Trade Weighted Exchange Rates)

	Chile	Israel	Korea	Turkey
ER: EMAX	**-0.71**	**-1.30**	**-8.85**	**-7.20**
	(0.33)	(0.29)	(3.63)	(1.16)
Low Trade	0.00		0.00	0.00
	(0.64)		(0.24)	(0.27)
High Trade	**-1.35**		**-2.10**	**-0.60**
	(.37)		(0.18)	(0.24)
Financial	**-1.60**		**-12.30**	**-10.00**
	(0.13)		(0.38)	(0.28)
ER_Vol: EMAX	-0.32	**-0.67**	**-0.39**	**-0.27**
	(0.43)	(0.03)	(0.16)	(0.12)
Low Trade	0.00		0.00	0.00
	(0.12)		(0.01)	(0.14)
High Trade	-0.47		0.00	0.00
	(0.27)		(0.01)	(0.09)
Financial	**-0.41**		**-0.68**	**-0.40**
	(0.16)		(0.07)	(0.07)

(*) Results are from the following regressions: $\hat{\beta}_{2it} = \lambda_0 + \lambda_1 \hat{\gamma}_{2it} + \nu_t$ where $\hat{\beta}_{2i}, \hat{\beta}_{3i}$ and $\hat{\gamma}_{2i}$ are estimated using equations (2) and (3) for each year.

Coefficients that are significant at the 5 percent level are in bold font.

For each firm a exchange rate that produces the largest exposure coefficient is used in the calculations for that firm (EMAX).

Sector classification is determined based on NBER–United Nations Trade (1962-2000) data

Sector classification for Israel is not included due to insufficient data.

Table 10. Third Stage Regressions using the SVAR-GARCH model output

	Chile	Korea	Turkey
ER: EMAX	**-0.45**	**-7.18**	**-0.36**
	(0.02)	(0.15)	(0.05)
Low Trade	**0.49**	0.01	0.01
	(0.02)	(0.11)	(0.04)
High Trade	**-19.31**	**-43.87**	0.02
	(0.01)	(0.20)	(0.03)
Financial	**-25.35**	**-127.23**	**-25.78**
	(0.01)	(0.22)	(0.05)
ER_Vol: EMAX	**-0.87**	**-3.41**	**-1.14**
	(0.04)	(0.37)	(0.05)
Low Trade	**-0.06**	0.00	0.09
	(0.02)	(0.13)	(0.02)
High Trade	**-1.00**	**-2.18**	**-15.34**
	(0.03)	(0.21)	(0.03)
Financial	**-22.46**	**-61.89**	**-16.08**
	(0.02)	(0.41)	(0.03)

(*) Results are from the following regressions: $\hat{\beta}_{2it} = \lambda_0 + \lambda_1 \hat{\gamma}_{2it} + \nu_t$. $\hat{\gamma}_{2i}$ is estimated using equation (3). $\hat{\beta}_{2i}, \hat{\beta}_{3i}$ are estimated using variance decompositions from the SVAR with the following casual ordering $\left[\hat{\sigma}^{er} \;\; R_m \;\; ER \;\; R_i\right]$ for each year.

Coefficients that are significant at the 5 percent level are in bold font.

For each firm a exchange rate that produces the largest exposure coefficient is used in the calculations for that firm (EMAX).

Table 11. Third Stage Regressions, 3-Year Intervals

	Chile	Korea	Turkey
ER: EMAX	**-2.77**	**-17.77**	**-5.33**
	(0.02)	(0.64)	(1.12)
ER_Vol: EMAX	**-0.57**	**-2.47**	**-0.58**
	(0.07)	(0.74)	(0.17)

(*) Results are from the following regressions: $\hat{\beta}_{2it} = \lambda_0 + \lambda_1 \hat{\gamma}_{2it} + \nu_t$ where $\hat{\beta}_{2i}, \hat{\beta}_{3i}$ and $\hat{\gamma}_{2i}$ are estimated using equations (2) and (3), and three year intervals.

Coefficients that are significant at the 5 percent level are in bold font.

For each firm a exchange rate that produces the largest exposure coefficient is used in the calculations for that firm (EMAX).

Table 12. Third Stage Regressions, Including Size (Chile)

	% of Signicant Betas	% of Signicant Gammas	Effect of DMVt
ER: EMAX			
Small	19.56	24.37	-0.08
			(0.23)
Medium	37.39	44.56	**-0.51**
			(0.13)
Large	45.05	55.24	**-0.90**
			(0.24)
ER_Vol: EMAX			
Small	19.85		**-2.32**
			(0.67)
Medium	39.39		-0.67
			(0.39)
Large	47.86		-0.01
			(0.55)

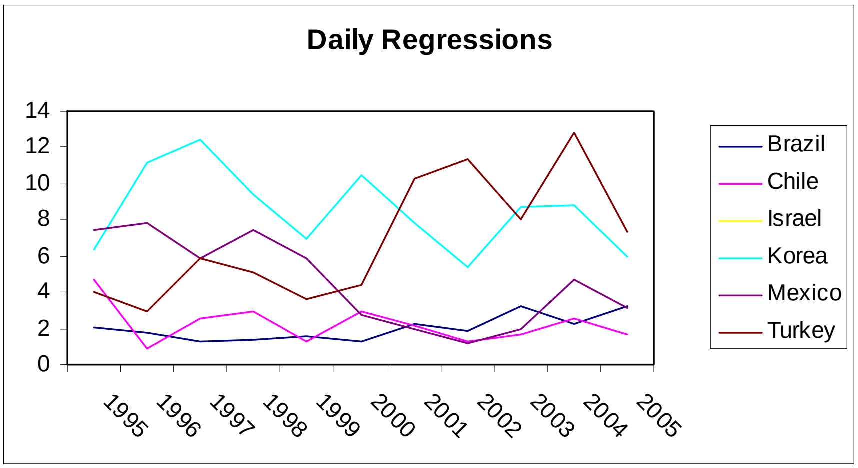
(*) Results are from the following regressions: $\hat{\beta}_{2it} = \lambda_0 + \lambda_1 \hat{\gamma}_{2it} + \nu_t$ where $\hat{\beta}_{2i}, \hat{\beta}_{3i}$ and $\hat{\gamma}_{2i}$ are estimated using equations (2) and (3) for each year.
Coefficients that are significant at the 5 percent level are in bold font.
For each firm a exchange rate that produces the largest exposure coefficient is used in the calculations for that firm (EMAX).
Size data from Chile was employed in estimation.
Firms are classified in to three equal size groups based on their total assets.

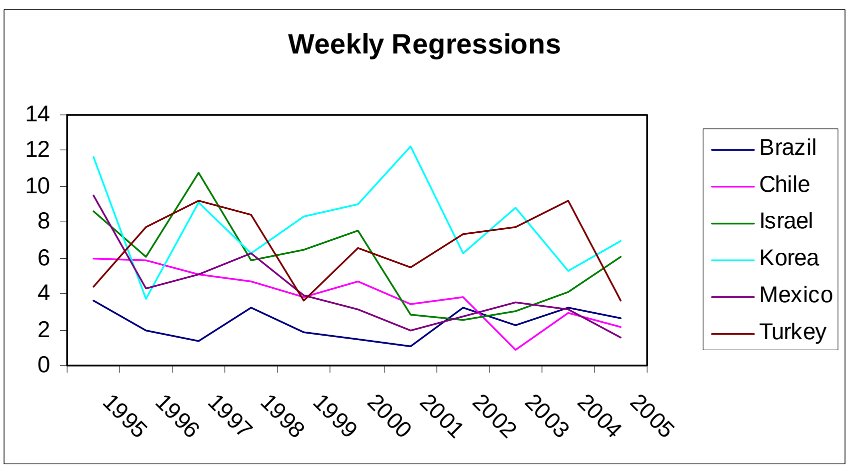
Table 13. Third Stage Regressions, Absolute Exposure

	Chile	Korea	Turkey
ER: EMAX	**-0.91**	**-6.84**	**-5.57**
	(0.01)	(0.05)	(0.22)
ER_Vol: EMAX	**-1.52**	**-3.11**	**-2.33**
	(0.01)	(0.04)	(0.02)

(*) Results are from the following regressions: $\hat{\beta}_{2it} = \lambda_0 + \lambda_1 \hat{\gamma}_{2it} + \nu_t$ where $\hat{\beta}_{2i}, \hat{\beta}_{3i}$ and $\hat{\gamma}_{2i}$ are estimated using equations (5) and (3) for each year.
Coefficients that are significant at the 5 percent level are in bold font.
For each firm a exchange rate that produces the largest exposure coefficient is used in the calculations for that firm (EMAX).

Figure 1. Percentage of Firms by year.

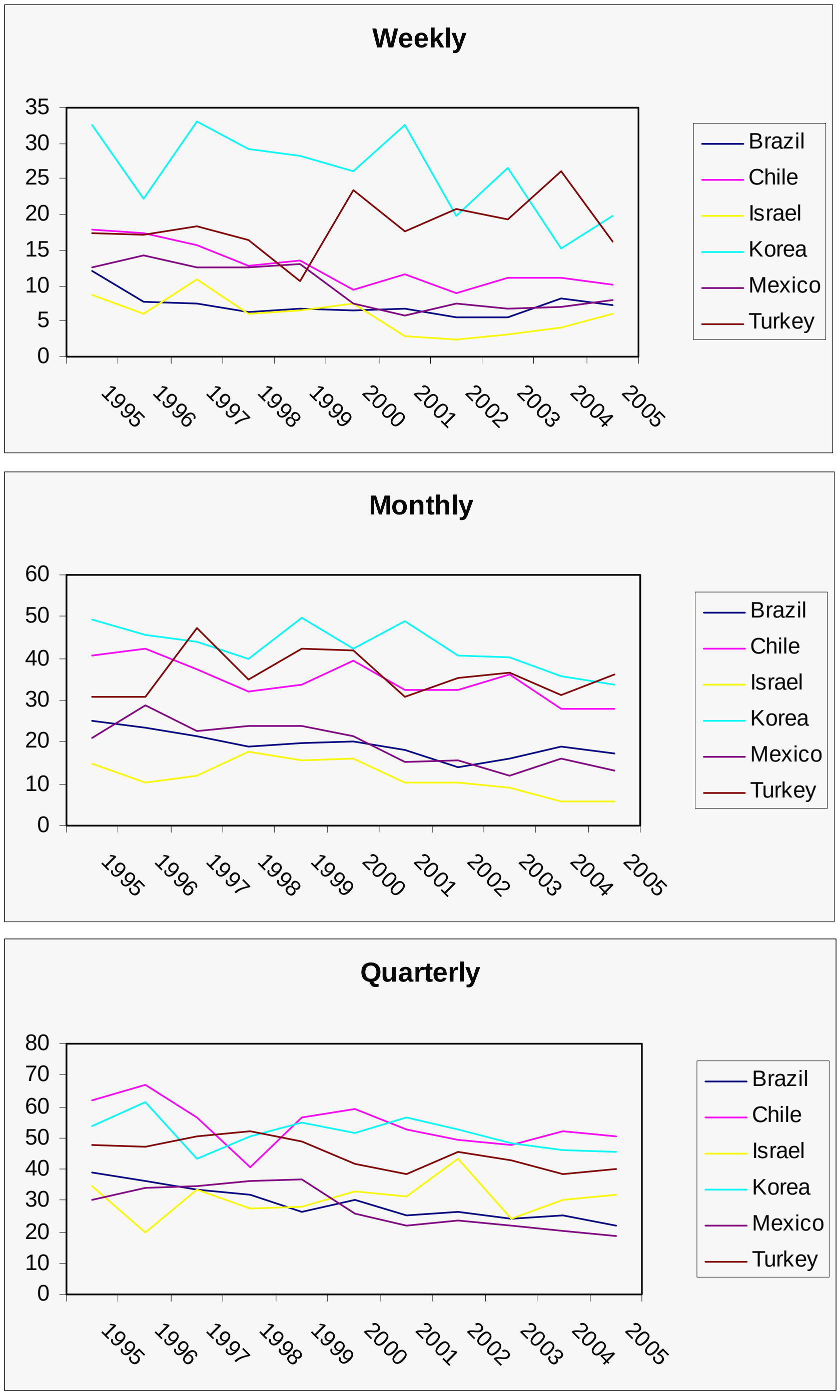




(*) Percentage of firms with significant exchange rate coefficients in the following Regression: $R_{it} - R_{ft} = \beta_{0i} + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i}\Delta ER_t + e_t$

Daily and weekly return horizons are used to estimate β_{2i}.

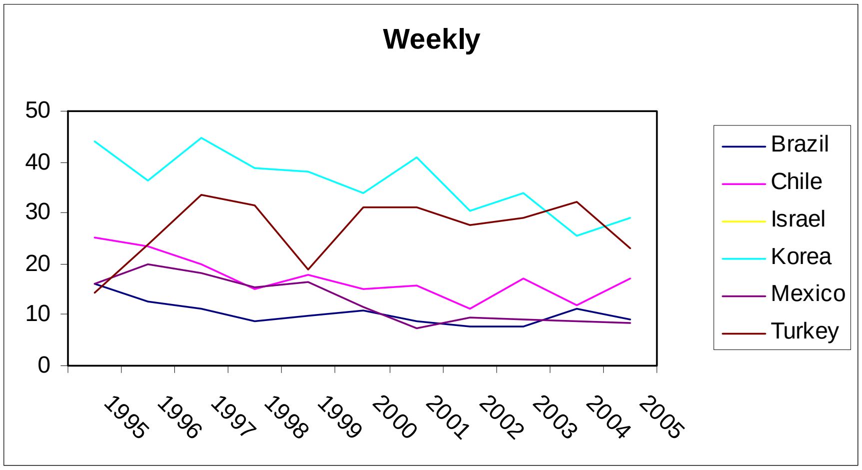
Figure 2. Percentage of Firms by year. Overlapping Observations.

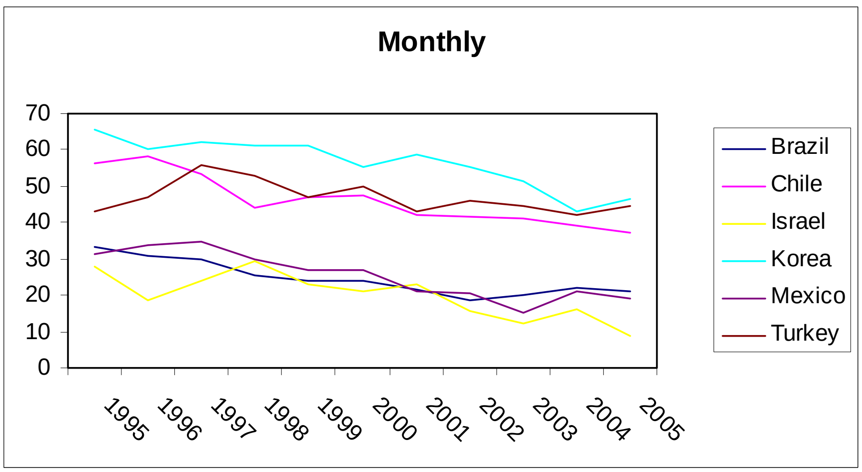


(*) Percentage of firms with significant exchange rate coefficients in the following Regression: $R_{it} - R_{ft} = \beta_{0i} + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i}\Delta ER_t + e_t$

Weekly, monthly and quarterly return horizons are used with daily, weekly, and monthly overlapping observations respectively to estimate β_{2i}.

Figure 3: Including Exchange Rate Volatility, Overlapping Observations





(*) Percentage of firms with either significant exchange rate or exchange rate volatility coefficients in the following regression:

$$R_{it} - R_{ft} = \beta_{0i} + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i}\Delta ER_t + \beta_{3i}\sigma_t^{er} + e_t$$

Weekly return horizon with daily overlapping observations and monthly return horizons with weekly overlapping observations are used to estimate β_{2i} and β_{3i}.

Appendix A:

Table A.1. Contents of Derivatives Market Volume Data

	Range (Daily)	Source	Content
Chile	01/2002-07/2007	Central Bank (Banco Central de Chile): Statistical Database	Forward Operations Amount (peso/dollar). >42 days, 31-42 days, <7 days. Millions of US Dollars
Israel	06/2000-06/2006	Central Bank (BOI): Trade turnover in the NIS Foreign Currency Market	Buy + Sell. Foreign financial institutions, other customers, domestic interbank swap contracts. Millions of USD.
Korea	01/2004-10/2007	Korea Exchange (KRX): Futures and Options	USD, JPY, EURO call + put options and futures trading volume
Turkey	10/2002-10/2006	Central Bank (TCMB): Volume of Foreign Exchange Transactions of Banks Against Turkish Lira.	Total volume of swap and forward foreign exchange transactions with domestic dustomers, offices and branches abroad, corporations and customers abroad, within the domestic interbank market. Millions of USD

Table A.2. Including ER Volatility, Percent. of Firms with Sig. ER Exposure (95-05)

	Brazil	Chile	Korea	Mexico	Turkey
Weekly	5.9	8.1	22.0	5.5	19.8
Monthly	5.7	7.7	19.3	12.2	14.3
Quarterly	7.2	12.8	18.6	12.6	9.5

(*) The numbers represent the percentage of firms that have a significant β_2 coefficient at the 5% level in the following regression: $R_{it} - R_{ft} = \beta_{0i} + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i}\Delta ER_t + \beta_{3i}\sigma_t^{er} + e_t$. Rows correspond to the different horizons used. Local Currency/US Dollar exchange rate is used in the estimation.

Table A.3. Weekly Regressions, Percentage of Firms with Significant ER Exposure

	Brazil	Chile	Israel	Korea	Mexico	Turkey
1995	12.0	17.9	8.6	32.6	12.6	17.3
1996	7.8	17.4	6.1	22.2	14.2	17.2
1997	7.5	15.7	10.8	33.0	12.6	18.3
1998	6.2	12.8	5.9	29.3	12.6	16.5
1999	6.7	13.6	6.5	28.3	13.0	10.6
2000	6.6	9.4	7.5	26.0	7.5	23.4
2001	6.7	11.5	2.9	32.5	5.9	17.6
2002	5.4	8.9	2.5	19.9	7.5	20.9
2003	5.6	11.1	3.0	26.6	6.7	19.4
2004	8.2	11.1	4.1	15.3	7.1	26.0
2005	7.3	10.2	6.1	19.9	7.9	16.1

(*) The numbers represent the percentage of firms that have a significant β_2 coefficient at the 5% level for each in the following regression: $R_{it} - R_{ft} = \beta_{0i} + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i}\Delta ER_t + e_t$. Weekly return horizon and US Dollar exchange rates are used in estimation.

Table A.4. Monthly Regressions, Percentage of Firms with Significant ER Exposure

	Brazil	Chile	Israel	Korea	Mexico	Turkey
1995	25.2	40.9	14.9	49.4	20.9	30.8
1996	23.6	42.1	10.4	45.8	28.7	30.8
1997	21.5	37.4	11.8	43.9	22.4	47.3
1998	19.0	31.9	17.7	39.7	24.0	34.8
1999	19.5	33.6	15.6	49.9	24.0	42.1
2000	20.3	39.6	16.1	42.2	21.3	41.8
2001	18.0	32.3	10.2	48.8	15.4	30.8
2002	13.8	32.3	10.4	40.6	15.7	35.2
2003	16.1	36.2	9.0	40.1	11.8	36.6
2004	19.0	28.1	5.6	35.6	16.1	31.1
2005	17.3	28.1	5.7	33.9	13.0	36.3

(*) The numbers represent the percentage of firms that have a significant β_2 coefficient at the 5% level for each in the following regression: $R_{it} - R_{ft} = \beta_{0i} + \beta_{1i}\left(R_{mt} - R_{ft}\right) + \beta_{2i}\Delta ER_t + e_t$. Monthly return horizon and US Dollar exchange rates are used in estimation.

Table A.5. Cointegration Test (Ri Rm and Rf)

	Daily	Weekly	Monthly	Quarterly	6 Months	Annual
Argentina	100.0	100.0	100.0	81.3	58.3	59.4
Chile	100.0	100.0	100.0	100.0	81.4	32.0
Czech	100.0	100.0	100.0	82.8	63.2	50.7
Mexico	100.0	100.0	100.0	99.8	97.9	37.9
Turkey	100.0	100.0	100.0	94.6	80.0	67.3

(*) Percentage of firms for each Johanson's test rejects cointegration of R_i, R_m, and R_f variables at the 5 percent level.