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VOLATILITY SPILLOVERS BETWEEN EQUITY AND CURRENCY MARKETS: EVIDENCE FROM MAJOR LATIN AMERICAN COUNTRIES*

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This paper investigates the nature of volatility spillovers between stock returns and a number of exchange rates in six Latin American countries and one European economy in the 1998-2006 period. We divide our sample into sub periods, prior to and after the introduction of the Euro and we apply the EGARCH methodology to model volatility. Our results show that the volatility of stock returns affects the volatility of exchange rates; however, we do not find evidence of volatility transmission in the opposite direction.

JEL: F37, G15

Keywords: Stock Returns, Exchange Rates, Integration, Volatility spillovers, EGARCH modelling.

1. INTRODUCTION

The aim of this paper is to investigate the extent of volatility spillovers between stock returns and exchange rate changes for six Latin American financial markets namely, Argentina, Brazil, Chile, Colombia, Mexico, and Venezuela and one European financial market, Spain, and a number of exchange rates. Our objective is to identify whether the volatility spillovers between stock markets and exchange rates vary across currencies, and to investigate how this has been affected by the introduction of the Euro.

Being aware that the existing literature has focused its attention in the analysis of the impact of the American Dollar in Latin American stock markets, we consider of importance to analyse the impact of the Euro in these markets. Therefore, the Spanish market was selected to be added to the sample countries,

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due to the fact that Spain is one of the European countries that have important investments in Latin America.

Several theoretical models have found empirical evidence that the exchange rate between two currencies is affected by stock price changes in the respective countries; for example, Zapatero (1995) shows that in fully integrated financial markets, there is an explicit linkage between the volatility of stock prices and the volatility of the exchange rate. More recently, Yang and Doong (2002) note that given the rapid integration and deregulation of international financial markets in recent years, exchange rates have become more sensitive to stock market innovations.

A number of studies have investigated the extent of volatility spillovers between stock markets and exchange rates (see for example, Yang and Doong, 2004; Kanas, 2000, 2002). However no study to date has specifically investigated volatility spillovers between stock markets and exchange rates in Latin America, or examined how these spillovers have been affected by the introduction of the Euro. In addition to this, there is a lack of evidence generally on the effect of exchange rates other than the domestic currency on stock returns; existing research has focused exclusively on spillovers between the domestic currency and the stock market countries. Our motivation for including a number of currencies is that despite the apparent symmetry in bilateral exchange rates, currencies are not symmetric, and some have greater economic importance than others (Wang and Yang, 2006). This base currency effect is similar to the volatility feedback effect in equity markets and is likely to be stronger in some currencies than in others. Therefore, we address the gap in the literature in this area by conducting an in depth analysis of the relationship between these two variables, with the objective of also adding to the general literature in this area investigating spillovers between stock markets and exchange rates.

The layout of this paper is as follows. Section 2 sets out the theoretical and empirical evidence on the nature of linkages between stock markets and exchange rates. In Section 3 we describe the methodology we use to assess the nature of volatility spillovers between the stock and foreign exchange markets and we discuss our data. Section 4 present empirical results and Section 5 concludes the analysis.

2. INTERLINKAGES BETWEEN STOCK MARKETS AND CURRENCY MARKETS: PREVIOUS EVIDENCE

A number of theoretical models have focused on the link between stock markets and currency markets. The asset market approach to exchange rate determination (Branson, 1983; Frankel, 1983) posits that causality will run from stock prices to exchange rate changes as expectations of financial asset price movements affect the dynamics of exchange rates. Smith (1992) derives an estimable equation for the exchange rate where the stock price is included as an explanatory variable.

In contrast, the goods market approach suggests causality runs in the opposite direction, from exchange rates to stock prices (Mundell, 1963, 1964; Dornbusch and Fisher, 1980). In these models, movements in exchange rates affect the international competitiveness of firms, which affects real income and output and eventually stock prices.

Much of the available empirical evidence on the linkages between stock markets and exchange rates has concentrated on the first moments¹. Yang and Doong (2004) note that there is a dearth of empirical evidence that concentrates on the linkages between the second moments of the distribution of the variables. A number of studies however have examined the extent to which volatility from one stock market spills over into other stock markets or between different assets². Kanas (2000) was one of the first studies which analysed volatility spillovers from stock returns to exchange rate changes in the USA, the UK, Japan, Germany, France and Canada. He found evidence of spillovers from stock returns to exchange rate changes for all countries except Germany, suggesting that the asset approach to exchange rate determination is valid when formulated in terms of the second moments of the exchange rate distribution for the countries included in his analysis. Volatility spillovers from exchange rate changes to stock returns were insignificant for all countries.

Assoé (2001) investigates the dynamic interrelationship between exchange rate changes and stock market performance in eleven emerging markets and five developed markets, using a trivariate Exponential-GARCH model. His results indicate that shocks in foreign exchange markets significantly increase volatility in emerging stock markets. He also found evidence of asymmetric volatility spillover from FX markets to stock markets for some of the countries that were included in his analysis. The asymmetric nature of volatility transmission suggest that investors in these markets react more to adverse innovations in foreign exchange markets than to positive shocks.

Yang and Doong (2004) explored the nature of the mean and volatility transmission mechanism between stock and foreign exchange markets for the G-7 countries. The results point to significant volatility spillovers and an asymmetric effect from the stock market to the foreign exchange market for France, Italy, Japan and the US, suggesting integration between stock and foreign exchange markets in these countries. Kanas (2000) and Yang and Doong (2004) concentrate exclusively on the domestic currency and do not investigate the extent of spillovers from other currencies to the domestic stock market. Wu (2005) examines volatility spillovers between stock prices and exchange rates for Japan, South Korea, Indonesia, Philippines, Singapore, Thailand and Taiwan for the period 1997-2000, splitting the sample into crises and recovery periods. He found a bi-directional relationship between the volatility of stock returns and exchange rate

¹ See for example Nieh and Lee (2001), Yau and Nieh (2006) for recent evidence on this topic.

² See also for example, Nelson (1991), Koutmos and Booth (1995), Laopodis (1998).

changes during the recovery period in all countries except South Korea, as well as significant contemporaneous relationships between the two markets for most of the countries. Furthermore, he found volatility spillovers increased in the recovery period. Qayyum and Kemal (2006) examine volatility spillover between the stock market and the foreign exchange market in Pakistan, through a bivariate EGARCH model. Their results show that the behavior of both the stock exchange and the foreign exchange markets are interlinked. The returns of one market are affected by the volatility of the other market. In particular the returns of the stock market are sensitive to the returns as well as the volatility of foreign exchange markets. They found evidence of strong relationship between the volatility of foreign exchange market and the volatility of returns in stock market. Leeves (2007) analyse the conditional volatility in stock returns in Indonesia over the period covered by the Asian crisis. He used three asymmetric models of conditional volatility (GJR, NGARCH and AGARCH); he found evidence of significant asymmetric impacts from conditional volatility shocks, with negative shocks causing greater volatility than positive shocks, during the Asian crisis.

Engle (1982) recognised that, in certain series, there are periods in which volatility was high and others in which it was low. He saw this volatility clustering as a time-varying conditional variance. He developed and applied ARCH modeling which dispenses with such an assumption. Afterwards, Bollerslev (1986) formulated the GARCH model, by allowing the variance of a series to be decomposed into unconditional and time conditional components. These models are capable of identifying periods of relative tranquility and volatility. Through the use of GARCH(p,q) models many analyses have provided evidence of the success of these techniques in the analysis of financial markets spillover effects. The reason for using this particular technique is derived from the characteristics of our series. The characteristics of the stock returns and of the exchange rates returns show that all the series are highly leptokurtic (non-normal series), a feature that has been commonly recognised in the analysis of these kinds of time series. The literature brings evidence that the ARCH family models have been proved successful in analyzing volatility effects in these series, indicating that a GARCH (EGARCH) analysis will be the most efficient way to study these financial markets. As the time series of the exchange rates returns and stock markets returns follow the typical distributions that allow the use of GARCH techniques we decided to implement the EGARCH modeling in our analysis; this asymmetric model allows negative shocks to behave differently from positive shocks. The main advantage of an EGARCH model is that it overcomes the problem of the standard ARCH/GARCH models where symmetry is imposed on the conditional variance.

We add to the existing literature in this area by providing up to date evidence on this issue for six developing markets and provide new evidence on the extent to which volatility spillovers vary between different currencies and the domestic stock market in each country.

3. DATA AND METHODOLOGY

Our analysis focuses on the period 1 January 1998 to 31 December 2006³ which we split into three sub samples in order to provide greater detail and a better understanding of volatility spillovers between stock returns and exchange rates. Thus our first sub sample analyses 1998, the period prior to the introduction of the Euro. As we are interested in examining whether the first years of the introduction of the Euro affected the relationship between our variables, we split our sample into two sub periods as follows; 1999-01 covers the period when exchange rates were fixed against the Euro but the currency was not physically introduced, and 2002-06 covers the period when the Euro was physically introduced into circulation. The reason to split the sample into three sub periods is justify by the objective of analysing the effect of the Spanish currency and stock market in the Latin American markets. We want to see if before the introduction of the Euro there was any effect of the Spanish currency in the Latin American markets, if the answer was yes, what happens after the introduction of the Euro, being the expectations that the Euro could be diluting the effect that the Spanish currency could be generating in the Latin American economies, in the case that the results verified the existence of any effect of the Spanish stock market or currency before the introduction of the Euro.

The data set consists of daily closing values for the stock market indices in each country as follows: Argentina (Merval), Brazil (Bovespa), Chile (IGPA Gen), Colombia (CSE Index), Mexico (IPC), Venezuela (IBC), Spain (IBEX 35). We have daily closing values for the exchange rates of each country against the Euro, UK pound sterling, Japanese Yen and the US dolar, plus the exchange rates of each country versus the six Latin American exchange rates. We include these exchange rates to examine whether volatility spillovers are stronger from certain currencies during the sample period.

The original data set was subject to some modifications, all holidays and other closing days were removed from the sample in order to avoid inconsistencies with the data set and also in order to avoid problems in the modelling estimation. Data was taken from DataStream and the Federal Reserve Statistic Release, giving a total of 2176 observations for each series. Following Kanas (2000) we use continuously compounded stock returns and exchange rate changes calculated as the first differences of the natural log. That is, S= Stock Prices; $S_t = \ln(P_t^s) - \ln(P_{t-1}^s)$ and E = Exchange Rates; $E_t = \ln(P_t^e) - \ln(P_{t-1}^e)$.

As an initial step we provide descriptive statistics for stock returns and exchange rates, in order to summarise the statistical characteristics of our sample (see Table A1 to A3 in the Appendix). We then proceed and perform a stationarity test on each of the relevant variables that are included in our analysis to ensure that the results from the analysis are not spurious. We apply the Dickey Fuller

³ In the case of Colombia, we are unable to present results before 2002 as DataStream only provided data for the CSE Index after July 2001.

(DF) test or Augmented Dickey-Fuller test (ADF) procedure if serial correlation is present. We also apply the Lagrange Multiplier (LMF) test, to ensure that a sufficient number of lags have been added in the ADF test to ensure that there is no serial correlation present and the results of the ADF test are valid. The LMF test is applied given that it is valid in the presence of lagged dependent variables as well as having the advantage of testing for first and higher orders of serial correlation. We estimate a Vector Autoregression (VAR) model in order to select the number of lags that would be appropriate to apply to our variables. We estimate the lag selection tests up to 20 lags. In terms of choosing between the various lag length selection criteria we follow Johansen *et al.* (2000) who suggest that when different information criteria suggest different lag lengths, it is common practice to prefer Hannan-Quinn (HQ) criteria. Again, we ensure that the lag length selected for the VAR model is free from serial correlation after performing by applying the LMF test to test for serial correlation up to the number of lags in the VAR model. We then proceed with our volatility analysis and apply a bivariate extension of the EGARCH (p, q) model in order to examine whether the volatility of stock returns affects and is affected by the volatility of exchange rate changes within each economy. The EGARCH specification (Nelson, 1991) is used in order to test whether the volatility spillover effects are asymmetric. For example, an asymmetric spillover from stock returns to exchange rate changes would suggest that the effect of “bad” stock market news on the exchange rate change is greater than the effect of “good” news. The model is specified as follows:

$$(1) \quad S_t = a_{s,0} + \sum_{i=1}^r a_{s,i} S_{t-i} + \sum_{i=1}^r a_{e,i} E_{t-i} + e_{S,t}$$

$$(2) \quad E_t = a_{E,0} + \sum_{i=1}^r a_{E,i} E_{t-i} + \sum_{i=1}^r a_{S,i} S_{t-i} + e_{E,t}$$

where $e_{S,t} / \Omega_{t-1} \approx N(0, \sigma_{S,t}^2)$ and $e_{E,t} / \Omega_{t-1} \approx N(0, \sigma_{E,t}^2)$

The conditional variances of stock returns and exchange rates changes are specified as follows:

$$(3) \quad \sigma_{S,t}^2 = \exp \left\{ c_{S,0} + \sum_{j=1}^{ps} b_{S,j} \log(\sigma_{S,t-j}^2) + \delta_{S,S} \left[\left(|z_{S,t-1}| - E|z_{S,t-1}| + \theta_{S,Sz_{S,T-1}} \right) + \delta_{S,E} \left[\left(|z_{E,t-1}| - E|z_{E,t-1}| + \theta_{S,Ez_{E,T-1}} \right) \right] \right] \right\}$$

$$(4) \quad \sigma_{E,t}^2 = \exp \left\{ c_{E,0} + \sum_{j=1}^{ps} b_{E,j} \log(\sigma_{E,t-j}^2) + \delta_{E,E} \left[\left(|z_{E,t-1}| - E|z_{E,t-1}| + \theta_{E,Ez_{E,T-1}} \right) + \delta_{E,S} \left[\left(|z_{S,t-1}| - E|z_{S,t-1}| + \theta_{E,Sz_{S,T-1}} \right) \right] \right] \right\}$$

$$\sigma_{S,E,T} = \rho_{S,E} \sigma_{S,t} \sigma_{E,t}$$

We summarize each of the relevant terms in equations (1)-(4) in Table 1.

TABLE 1
DESCRIPTION OF PARAMETERS EQUATIONS (1)-(4)

	Stock Returns	Exchange Rate Returns
Stochastic error terms	$e_{S,t}$	$e_{E,t}$
Information set at time $t-1$	Ω_{t-1}	Ω_{t-1}
Conditional (time varying) variances	$\sigma_{S,t}^2$	$\sigma_{E,t}^2$
Standardised residuals assumed to be normally distributed with 0 mean and variances of $\sigma_{S,t}^2, \sigma_{E,t}^2$	$z_{S,t} = e_{S,t} / \sigma_{S,t}$ $e_{S,t} / \Omega_{t-1} \sim N(0, \sigma_{S,t}^2)$	$z_{E,t} = e_{E,t} / \sigma_{E,t}$ $e_{E,t} / \Omega_{t-1} \sim N(0, \sigma_{E,t}^2)$
Persistence of Volatility	$\sum_{j=1}^{ps} b_{S,j}$	$\sum_{j=1}^{pE} b_{E,j}$
ARCH effect where the parameters $\theta_{S,S}, \theta_{E,E}$ allow this effect to be asymmetric	$\left[z_{S,t} \left -E \left[z_{S,t} \right] + \theta_{S,S} z_{S,t} \right. \right]$	$\left[z_{E,t} \left -E \left[z_{E,t} \right] + \theta_{E,E} z_{E,t} \right. \right]$
Volatility Spillover	$\delta_{S,E} \left[z_{E,t-1} \left -E \left[z_{E,t-1} \right] + \theta_{S,E} z_{E,t-1} \right. \right]$	$\delta_{E,S} \left[z_{S,t-1} \left -E \left[z_{S,t-1} \right] + \theta_{E,S} z_{S,t-1} \right. \right]$
Measures of spillovers	$\delta_{S,E}$	$\delta_{E,S}$
Asymmetry of Spillovers(*)	$\theta_{S,E}$	$\theta_{E,S}$
Correlation Coefficient for Standardised Residuals	$\rho_{S,E}$	$\rho_{E,S}$

Note: $\theta_{S,E} < 0, \theta_{E,S} < 0$, implies that negative exchange rate shocks increase the volatility of stock returns more than positive shocks.

We specify the number of lags for the conditional mean equations (1) and (2) using the Hannan-Quinn (HQ) criterion; Griffin *et al.* (2005) Andersen *et al.* (2004) and Stulz *et al.* (2002) all note that the HQ criterion is preferable to the more commonly used Akaike's Information Criteria (AIC), as the latter tends to overparameterize the models⁴. Next we apply the likelihood ratio (LR) test to

⁴ For brevity here we do not report the number of lags selected for the conditional mean equations for stock prices and exchange rates for each period.

determine the lag truncation length, p . We perform separate LR test on the stock returns and exchange rate conditional variance equations (3) and (4) to determine the optimal lag length for the EGARCH specification of each equation. Hamilton (1994) defines the LR test as follows: $2[L(\hat{\theta}) - L(\tilde{\theta})] \approx \chi^2(m)$, where $L(\hat{\theta})$ denotes the value of the log likelihood function at the unrestricted estimate and $L(\tilde{\theta})$ denotes the value of the log likelihood functions of the restricted estimate. Bollerslev-Woolridge robust t -statistics are derived to take into account possible non-normality of the residuals. All results are generated using the EVIEWS statistical program.

4. EMPIRICAL RESULTS

4.1 Descriptive Statistics

Our analysis begins by providing descriptive statistics for stock returns and exchange rates, in order to summarise the statistical characteristics of our sample and these are set out in Tables A1 and A2 presented in Appendix. For the stock returns of each country for 1998 we found that the means are negative in all the cases, with the exception of the Spanish stock market, IBEX 35. During 1999-01 the performance of stock markets in the region generally improved with the sample means of stock returns positive for all countries with the exception of Argentina (Merval) and Spain (IBEX 35). For the 2002-06 period, the means of all the indices are positive and generally of a higher magnitude than for 1999-01 indicating further improved performance over this period. The standard deviations of the stock returns provide information about the volatility of the markets in each period. All stock markets exhibited higher volatility during 1998 prior to the introduction of the Euro; the standard deviation of stock returns in all markets declined during the 1999-01 period, and was lowest in all markets for 2002-06. The standard deviation for 1998 ranged from 1.15% (IGPA Gen) to 3.63% (Bovespa) while for 1999-01 was between 0.7% (IGPA Gen) and 2.56% (Merval) and between 0.6% (IGPA Gen) to 2.1% (Merval). Thus the volatility was lowest in the Chilean stock market in all periods and was generally highest in the Argentinian stock market, particularly in the aftermath of the introduction of the Euro. The skewness and kurtosis coefficients indicate that stock returns are leptokurtic relative to the normal distribution, which Caporale *et al.* (2002) note is a common finding for stock returns. The Jarque-Bera test also rejects the hypothesis that stock returns are normally distributed in all the cases.

The descriptive statistics for the exchange rate returns are presented for each country to capture the behavior of the exchange rates on an individual basis. Overall there is a considerable variation in the sign and magnitude of the means and standard deviations both over time, across countries and across the various bilateral exchange rates we included in the analysis.

For 1998, Mexico was the only country for which the means of the exchange rates were positive in all instances; for Venezuela they were positive against all the 'hard' currencies while in Chile the means were negative for all of the Latin American bilateral exchange rates. Although for Argentina, Brazil and Venezuela the means were negative against the Colombian and Mexican Pesos, they were positive against the Chilean Peso. For all other countries, we observe a mix of positive and negative means across the bilateral exchange rates reflecting both appreciation and depreciation of the various bilateral exchange rates during this period.

For the 1999-01 period, Brazil was the only country where the means of all exchange rate returns were positive while in the case of Chile they were all negative; both Mexico and Argentina exhibited negative mean returns across all bilateral exchange rates except the Euro and Chilean Peso, with the return also negative for Argentina against the Mexican Peso. Venezuela showed positive mean returns against all the 'hard' currencies in contrast to the Euro where they were negative; the Euro also showed positive mean returns against all the Latin American currencies during this period with the exception of the Argentinian Peso.

For the period since the Euro was introduced into circulation, all mean returns were positive for Argentina, and almost all positive for Venezuela; Chile and Mexico showed positive mean returns across all hard currencies excluding the Euro. In fact, all Latin American currencies showed positive mean returns against the Canadian \$, the Yen and the UK£. While Brazil had negative mean returns against all other Latin American exchange rates, for the rest of the exchange rates in other countries, no discernable patterns are evident and as for the earlier periods, we observe a mix of positive and negative means across the other bilateral exchange rates reflecting both appreciation and depreciation of the various bilateral exchange rates during this period.

With regard to the standard deviation of the exchange rates, for the period prior to the introduction of the Euro for all countries volatility was generally lowest against the US\$ and highest against the Yen, except for Argentina where volatility was highest against the US\$ and for the Peseta where volatility was highest against the Columbian Peso. For the 1999-01 period the again volatility for the Latin American bilateral exchange rates was generally lowest against the US\$ and highest against the Brazilian Real. For the Euro, the standard deviation of volatility was lowest against the UK£ and highest against the Brazilian Real. For the final period of analysis, again the standard deviation was lowest against the US\$ for most bilateral exchange rates and highest against the Argentinian Peso. The magnitude of the standard deviations were similar in the earlier two periods and showed a slight increase for the final period.

The skewness and kurtosis statistics for all countries and bilateral exchange rates in all periods indicate that the distribution of exchange rate returns in all the cases for all the countries are non-normal and the Jarque-Bera test also rejects the hypothesis of normally distributed returns for all periods for all exchange rates.

4.2 Unit Roots and Likelihood Tests

The results from the ADF tests are given in Table A3 (see Appendix). The values of the test statistics indicate that we can reject the null hypothesis of the existence of unit root in levels for all variables in all periods indicating that all series are $I(0)$ ⁵. Given that all variables are integrated of the same order, and also given that they are $I(0)$ processes we proceed directly to perform our volatility analysis using EGARCH (p, q) modelling.

In order to establish the correct lag length for the EGARCH model, we apply the Likelihood Ratio test⁶. For the stock return equation, we chose the EGARCH (1,1) model for Argentina for 1998, for Mexico and Venezuela for 1999-01 and for Columbia, Chile and Venezuela for 2000-02 across all bilateral exchange rates. For the other countries there was a mix of (1,1) and (2,1) models chosen for the different bilateral exchange rates. For the exchange rate equation, there was less consistency across countries and time periods in the selection of the EGARCH model with a mixture of (1,1) and (2,1) chosen for each country for each bilateral exchange rate.

The estimated parameters from the EGARCH estimation are set out in Tables 2 to 9, for the three periods of analysis (1998, 1999-01, and 2002-06). The p -values are given in parentheses beneath each coefficient estimate. Those coefficient estimates which are significant at 5% level are marked with an asterisk.

4.3 Volatility Persistence

Firstly, in relation to the coefficients on the volatility persistence term, the results vary depending on the country and the equation but we find that the majority of terms are significant for both the stock returns and exchange rate changes in all three periods (see Tables 2 to 4) this result is not surprising given that persistence is a feature of many financial markets data. An interesting feature of our results which reflects the inclusion of more than one bilateral exchange rate in our analysis is that the persistence of volatility varies across the different bilateral exchange rates. The results indicate that the introduction of the Euro did not generate any general effect on the persistence of the volatility of stock returns and exchange rates as it has not had a uniform impact across the financial markets in Latin American markets. Wu (2005) notes that a necessary condition for the volatility persistence terms to be stable is that the value of the estimated coefficients should be less than one; for our results, this applies in all cases for the three periods for the persistence terms for both stock returns and exchange rates where the magnitude of the coefficients are all less than one.

⁵ The LMF test results indicated that the ADF tests were free from serial correlation; for brevity we do not show the test results here.

⁶ Likelihood Ratio test and LMF results are available upon request.

TABLE 2
EGARCH RESULTS: VOLATILITY PERSISTENCE 1998

	A. Peso/B. Real	A. Peso/Ch. Peso	A. Peso/Co. Peso	A. Peso/M. Peso	A. Peso/Bolivar	A. Peso/CS	A. Peso/¥	A. Peso/\$	A. Peso/£	A. Peso/Pta
ARGENTINA										
Stock Returns	0.1180** (0.018)	0.0738*** (0.009)	0.1202** (0.019)	0.1921** (0.028)	0.1163** (0.029)	0.1296* (0.010)	0.1160** (0.014)	0.1202** (0.015)	0.1278** (0.030)	0.1193** (0.015)
Exchange Rates	0.6476* (0.008)	1.0905* (0.000)	0.6433* (0.000)	0.5174** (0.011)	0.4604* (0.000)	0.6236* (0.000)	0.0737 (0.616)	0.2025* (0.003)	0.4063** (0.040)	0.0760 (0.378)
BRAZIL										
Stock Returns	0.1795* (0.000)	-0.2339** (0.033)	0.1824* (0.000)	0.2071* (0.180)	0.1838* (0.000)	-0.1483 (0.001)	0.2026* (0.001)	0.1776* (0.001)	0.1875* (0.000)	0.1862* (0.000)
Exchange Rates	0.6007* (0.000)	0.9780* (0.001)	0.6573* (0.000)	0.4413* (0.011)	0.3898** (0.018)	0.2031* (0.004)	0.4367** (0.027)	0.3790* (0.000)	0.1170 (0.437)	0.1557 (0.194)
CHILE										
Stock Returns	0.4565* (0.003)	0.4658* (0.003)	0.5399* (0.000)	0.1879* (0.005)	0.4858* (0.002)	0.1974** (0.011)	0.5301* (0.000)	0.2140** (0.011)	0.5464* (0.000)	0.5285* (0.000)
Exchange Rates	0.8334* (0.003)	0.8061** (0.011)	0.2669 (0.214)	0.9325* (0.000)	0.5231** (0.020)	0.1073 (0.454)	0.3902*** (0.005)	0.8369* (0.003)	-0.1081** (0.027)	-0.4321** (0.011)
MEXICO										
Stock Returns	0.1751 (0.185)	0.1625 (0.2157)	0.0268 (0.857)	0.1592 (0.186)	0.0947 (0.447)	0.0481 (0.710)	0.1008** (0.046)	0.1712 (0.197)	0.2241* (0.004)	0.0051 (0.967)
Exchange Rates	0.4524* (0.002)	0.7116* (0.000)	0.3004 (0.845)	0.4602* (0.003)	0.3477** (0.019)	0.3213* (0.008)	0.4996* (0.001)	0.4315* (0.002)	0.5704* (0.000)	0.3344** (0.025)
VENEZUELA										
Stock Returns	0.3952* (0.000)	0.4218* (0.000)	0.3852* (0.000)	0.4574* (0.000)	0.7563* (0.000)	0.4410* (0.000)	0.4454* (0.000)	0.3982* (0.000)	0.4288* (0.000)	0.4392* (0.000)
Exchange Rates	0.2423 (0.266)	0.5317* (0.007)	0.5736* (0.007)	0.2797 (0.252)	0.3611** (0.017)	0.5350* (0.000)	0.6054* (0.000)	0.3386 (0.124)	0.4371* (0.000)	0.1456 (0.389)
SPAIN										
Stock Returns	0.1529* (0.007)	0.1555* (0.007)	0.1669* (0.007)	0.0106 (0.971)	0.1432** (0.015)	0.1519*** (0.090)	0.1399* (0.007)	0.1712* (0.007)	0.1545* (0.007)	0.1610* (0.007)
Exchange Rates	0.0383 (0.696)	0.1250 (0.250)	-0.1573* (0.000)	-0.9401*** (0.064)	0.2805*** (0.063)	0.1654 (0.301)	0.0994 (0.280)	0.2775 (0.128)	0.0243 (0.805)	0.0226 (0.901)

* 1% significant value, **5% significant value, ***10% significant value, p-values are indicated in brackets. A. Peso: Argentinian Peso, B. Real: Brazilian Real, Ch. Peso: Chilean Peso, Co. Peso: Colombian Peso, M. Peso: Mexican Peso, Bolivar: Venezuelan Bolivar, CS: Canadian Dollar, ¥: Japanese Yen, \$: US Dollar, £: British Pound, Pta: Spanish Peseta.

TABLE 3
EGARCH RESULTS: VOLATILITY PERSISTENCE 1999-2001

	A. Peso/B. Real	A. Peso/Ch. Peso	A. Peso/Co. Peso	A. Peso/M. Peso	A. Peso/Bolivar	A. Peso/CS	A. Peso/¥	A. Peso/\$	A. Peso/£	A. Peso/€
ARGENTINA										
Stock Returns	0.2312** (0.012)	0.2029* (0.000)	0.2065* (0.000)	-0.0035 (0.871)	0.1947* (0.000)	0.1864* (0.000)	0.1895* (0.000)	0.1941* (0.000)	0.1983* (0.000)	0.1989* (0.000)
Exchange Rates	0.1498 (0.001)	0.3307 (0.000)	0.3272 (0.005)	0.2041 (0.283)	0.5339 (0.002)	0.0687 (0.067)	0.0476 (0.074)	0.5916 (0.000)	0.0806 (0.357)	0.0508 (0.625)
BRAZIL										
Stock Returns	0.2384*** (0.067)	0.2073 (0.101)	0.2744** (0.050)	0.1800* (0.002)	0.2283*** (0.065)	0.2294*** (0.060)	0.2299*** (0.084)	0.2326*** (0.069)	0.2140*** (0.072)	0.2388** (0.047)
Exchange Rates	0.1490* (0.000)	0.2078* (0.005)	0.2883* (0.000)	0.3588*** (0.053)	0.1582* (0.000)	0.2382* (0.000)	0.1460* (0.000)	0.1709* (0.000)	0.0681** (0.024)	0.0571*** (0.051)
CHILE										
Stock Returns	0.4975* (0.000)	0.4933* (0.000)	0.4240* (0.000)	0.4618* (0.000)	0.4988* (0.060)	0.4878* (0.000)	0.5264* (0.000)	0.5018* (0.000)	0.5040* (0.000)	0.4135* (0.000)
Exchange Rates	0.3191* (0.001)	0.1990* (0.006)	0.3200* (0.000)	0.1251*** (0.075)	0.3800* (0.000)	0.2864*** (0.092)	0.2242 (0.370)	0.3660* (0.004)	0.2985* (0.005)	0.3074** (0.031)
MEXICO										
Stock Returns	0.0829*** (0.058)	0.0965* (0.008)	0.0945** (0.013)	0.1000** (0.013)	0.0812*** (0.060)	0.0955** (0.014)	0.0876** (0.023)	0.0776*** (0.0855)	0.0922** (0.019)	0.0365 (0.657)
Exchange Rates	0.2733 (0.189)	0.3437*** (0.063)	0.2161* (0.001)	0.3392** (0.022)	0.1407 (0.576)	-0.0024 (0.985)	0.0144 (0.697)	0.2475*** (0.099)	0.1725 (0.108)	0.0863* (0.001)
VENEZUELA										
Stock Returns	0.1532* (0.001)	0.1575* (0.000)	0.1465* (0.002)	0.1486* (0.001)	0.1500* (0.003)	0.1548* (0.002)	0.1465* (0.001)	0.1483* (0.001)	0.1588* (0.002)	0.1470* (0.001)
Exchange Rates	0.5208* (0.004)	0.1620 (0.138)	0.3901* (0.000)	0.3593** (0.007)	0.0951 (0.770)	-0.0113 (0.919)	0.0276 (0.156)	0.5999* (0.000)	0.0576 (0.242)	-0.0148 (0.877)
SPAIN										
Stock Returns	0.1204* (0.000)	0.1186* (0.000)	0.1130* (0.001)	0.1213* (0.001)	0.1235* (0.000)	0.1239* (0.000)	0.1179* (0.000)	0.0032 (0.976)	0.1209* (0.000)	0.1268* (0.000)
Exchange Rates	-0.0070 (0.942)	0.2007*** (0.070)	0.3763*** (0.015)	0.1263** (0.047)	0.0414 (0.668)	0.0221 (0.804)	-0.0203 (0.631)	0.2581* (0.001)	-0.0979 (0.230)	0.1395** (0.011)

* 1% significant value, ** 5% significant value, *** 10% significant value, p-values are indicated in brackets. A. Peso: Argentinian Peso, B. Real: Brazilian Real, Ch. Peso: Chilean Peso, Co. Peso: Colombian Peso, M. Peso: Mexican Peso, Bolivar: Venezuelan Bolivar, CS: Canadian Dollar, ¥: Japanese Yen, \$: US Dollar, £: British Pound, €: Spanish Peseta.

TABLE 4
EGARCH RESULTS: VOLATILITY PERSISTENCE 2002-2006

	A. Peso/B. Real	A. Peso/Ch. Peso	A. Peso/Co. Peso	A. Peso/M. Peso	A. Peso/Bolivar	A. Peso/C\$	A. Peso/¥	A. Peso/\$	A. Peso/£	A. Peso/€
ARGENTINA										
Stock Returns	0.0646 (0.504)	0.2003* (0.002)	0.2058* (0.001)	0.0424 (0.689)	0.2206* (0.001)	0.1957* (0.000)	0.1990* (0.000)	0.1982* (0.000)	0.2058* (0.001)	0.2104* (0.001)
Exchange Rates	0.2729* (0.001)	0.3816* (0.001)	0.2881* (0.001)	1.703* (0.470)	0.1770 (0.000)	1.0973* (0.000)	0.0660* (0.000)	0.4477* (0.000)	0.9273* (0.000)	0.9467* (0.000)
BRAZIL										
Stock Returns	-0.1031 (0.170)	0.0857* (0.008)	-0.1199 (0.161)	-0.0861 (0.293)	-0.1088 (0.007)	0.0845* (0.000)	-0.1116 (0.168)	0.1054* (0.001)	-0.1079 (0.004)	0.0872* (0.004)
Exchange Rates	0.1445* (0.000)	0.2806* (0.000)	0.2675* (0.000)	0.1876* (0.000)	0.6537* (0.000)	0.2712* (0.000)	0.1897* (0.000)	0.2888* (0.000)	0.1882* (0.000)	0.1986* (0.000)
CHILE										
Stock Returns	0.1578** (0.030)	0.1602* (0.008)	0.1581** (0.022)	0.1643** (0.014)	0.1652* (0.007)	0.1502** (0.024)	0.1562** (0.030)	0.1593** (0.023)	0.1735* (0.006)	0.1507** (0.026)
Exchange Rates	0.3830** (0.036)	0.3236* (0.000)	0.3987* (0.000)	0.3255** (0.020)	0.2765* (0.000)	0.3620* (0.001)	0.3184** (0.030)	0.3810* (0.007)	0.3535* (0.008)	0.3530* (0.002)
COLOMBIA										
Stock Returns	0.3842* (0.000)	0.3805* (0.000)	0.3746* (0.000)	0.3837* (0.000)	0.3826* (0.000)	0.3832* (0.000)	0.3851* (0.000)	0.3848* (0.000)	0.3815* (0.000)	0.3750* (0.000)
Exchange Rates	0.2577** (0.035)	0.2765* (0.000)	0.3829* (0.000)	0.2072* (0.000)	0.0807 (0.373)	0.1704* (0.001)	0.0962** (0.012)	0.3400* (0.000)	0.1103* (0.007)	-0.0590 (-0.403)
MEXICO										
Stock Returns	0.1050* (0.002)	0.1064* (0.001)	0.1066* (0.000)	0.1069* (0.002)	0.1020* (0.000)	0.1069* (0.002)	0.1090* (0.002)	0.1128* (0.001)	0.1106* (0.001)	0.1011* (0.002)
Exchange Rates	0.3161* (0.000)	0.1912* (0.000)	0.3166** (0.014)	0.2136* (0.000)	-0.2842 (0.293)	0.0267*** (0.070)	0.0469** (0.032)	0.1106* (0.002)	0.0096 (0.503)	0.0577* (0.069)
VENEZUELA										
Stock Returns	0.2401* (0.006)	0.2645* (0.001)	0.2274* (0.008)	0.3096* (0.000)	0.3580* (0.000)	0.3147* (0.000)	0.2875* (0.000)	0.2655*** (0.051)	0.3115* (0.000)	0.2526* (0.001)
Exchange Rates	0.6627* (0.000)	0.4720* (0.000)	0.2565* (0.000)	-0.1562 (0.351)	-0.3189 (0.150)	-0.2236 (0.264)	-0.2259 (0.183)	0.2340 (0.130)	-0.2789*** (0.085)	-0.1218 (0.375)
SPAIN										
Stock Returns	0.1468* (0.000)	0.1466* (0.000)	0.1582* (0.000)	0.1526* (0.000)	0.1474* (0.000)	0.1420* (0.000)	0.1430* (0.000)	0.1460* (0.000)	0.1525* (0.000)	0.1477* (0.000)
Exchange Rates	0.6286* (0.000)	0.2351* (0.000)	0.4991* (0.000)	0.1288* (0.001)	0.0787* (0.003)	0.6264* (0.000)	0.0349 (-0.486)	0.0616** (0.017)	0.0602* (0.001)	0.0231 (0.113)

* 1% significant value, **5% significant value, ***10% significant value, p-values are indicated in brackets. A. Peso: Argentinian Peso, B. Real: Brazilian Real, Ch. Peso: Chilean Peso, Co. Peso: Colombian Peso, M. Peso: Mexican Peso, Bolivar: Venezuelan Bolivar, C\$: Canadian Dollar, ¥: Japanese Yen, \$: US Dollar, £: British Pound, €: Spanish Peseta.

4.4 Volatility Spillovers

In terms of the coefficients for the volatility spillovers, there is some degree of variation across countries, over time and for the various bilateral exchange rates included in the analysis (see Tables 5 to 7). Dealing first with spillovers from stock markets to exchange rates, for Brazil and Mexico, we found significant spillovers in all three time periods to all bilateral exchange rates at 10% level, with most significant at 1% level. Similarly for Spain, all spillover coefficients were significant for all bilateral exchange rates general at 1% level, with the exception of the Mexican Peso in the 1998 period which was insignificant. For the other countries, there are fewer consistences both over time and across the bilateral exchange rates in terms of spillovers from the stock market. In Argentina, for the 1998 period, all coefficients are significant for all bilateral exchange rates at least at 10% level, but this situation changes for the 1999-01 and 2002-06 periods where we found significant spillovers from the stock market only to the Brazilian Real and Mexican Peso. For Chile, while there were significant spillovers at least at 5% level from the stock market only to all Latin American exchange rates excluding the Mexican Peso in 1998, these spillovers were absent in the 1999-01 and 2002-06 periods. In contrast, for Venezuela there were no significant spillovers from the stock market to any currency in the 1998 period, spillovers were significant to all currencies for 1999-01, and then only for the Argentinian Peso, Brazilian Real and Chilean Peso for the 2002-06 period. Volatility spillovers were absent from the stock market to all currencies for Colombia for 2002-06.

Significant coefficients are indicative of integration between stock markets and exchange rate markets as well as indicating that the volatility of stock returns was a determinant of the volatility of the exchange rate and that information contained in stock prices impacted on the behavior of exchange rates in these markets. The lack of consistency over time and across countries and bilateral exchange rates indicates that the degree of integration of stock and money markets varies depending on the currency, is not constant over time, as well as demonstrates that there is some potential for diversification between stock markets and currency markets in these countries.

In terms of volatility spillovers from exchange rates to stock markets, the results are less significant and consistent across countries and over time than the spillovers from stock markets to exchange rates. Dealing first with the volatility spillovers from the Latin American bilateral exchange rates to stock markets, we found that for Argentina and Brazil there were no significant spillovers at 5% level neither 1998 or 2002-06 with significant spillovers only from the Mexican Peso to the Argentinian stock market and from the Colombian Peso and Bolivar to the Brazilian stock market in the 1999-01 period. For Mexico, again there were no significant spillovers in the 1998 period but volatility spillovers from the Chilean Peso in 1999-01, and the Real in 2002-06, to the Mexican stock market. In the case of Chile, significant spillovers were found from the Colombian Peso in 1998 and from the Mexican Peso in 1999-01 but significant spillovers from all of the Latin American bilateral exchange rates were completely absent for the

TABLE 5
EGARCH RESULTS: VOLATILITY SPILLOVERS 1998

	A.Peso/B.Real	A.Peso/Ch.Peso	A.Peso/Co.Peso	A.Peso/M.Peso	A.Peso/Bolivar	A.Peso/CS	A.Peso/¥	A.Peso/\$	A.Peso/£	A.Peso/Pta
ARGENTINE										
Stock Returns	-0.1198* (0.006)	-0.1227* (0.004)	-0.1215* (0.005)	-0.0808*** (0.094)	-0.1239* (0.005)	-0.1325* (0.001)	-0.1171* (0.009)	-0.1193** (0.012)	-0.1212** (0.011)	-0.1228* (0.004)
Exchange Rates	-0.2939 (0.212)	-0.0373 (0.685)	-0.0601 (0.667)	-0.1235 (0.197)	0.1950** (0.055)	-0.2365*** (0.089)	0.2383** (0.015)	-0.0494 (0.440)	0.194*** (0.067)	0.2119** (0.012)
BRAZIL										
Stock Returns	-0.2004* (0.000)	-0.2124* (0.000)	-0.1974* (0.000)	-0.1909* (0.000)	-0.1970* (0.000)	-0.2100* (0.000)	-0.1968* (0.000)	-0.1970* (0.000)	-0.1985* (0.000)	-0.1949* (0.000)
Exchange Rates	0.2357*** (0.099)	0.0136 (0.876)	-0.0421 (0.808)	-0.0927 (0.403)	0.1681 (0.114)	-0.0399 (0.519)	0.2383** (0.039)	0.1328 (0.211)	0.1817*** (0.096)	0.2487** (0.010)
CHILE										
Stock Returns	-0.0677* (0.001)	-0.0626* (0.006)	-0.0644* (0.006)	-0.0364 (0.227)	-0.0558** (0.027)	-0.0401 (0.222)	-0.0498*** (0.060)	-0.0389 (0.255)	-0.0451 (0.128)	-0.0504*** (0.064)
Exchange Rates	-0.1696*** (0.061)	-0.0998 (0.256)	0.2164** (0.022)	-0.1882 (0.131)	-0.0426 (0.718)	0.1071 (0.225)	0.1795 (0.115)	-0.1385 (0.116)	0.0581 (0.106)	0.0716** (0.040)
MEXICO										
Stock Returns	-0.0945** (0.021)	-0.0957** (0.018)	-0.1190* (0.005)	-0.0920** (0.032)	-0.1065* (0.008)	-0.1112* (0.004)	-0.1164* (0.005)	-0.0944** (0.020)	-0.1159* (0.010)	-0.1010** (0.023)
Exchange Rates	0.1833 (0.250)	0.1207 (0.176)	0.0924 (0.516)	0.0174 (0.885)	0.1314 (0.381)	0.0656 (0.353)	0.1540** (0.045)	0.1721 (0.260)	-0.0601 (0.201)	0.0878 (0.316)
VENEZUELA										
Stock Returns	0.0127 (0.855)	-0.0029 (0.968)	0.0028 (0.968)	-0.0445 (0.513)	-0.1057 (0.386)	-0.0318 (0.639)	-0.0299 (0.662)	0.0155 (0.833)	-0.0266 (0.700)	-0.0301 (0.662)
Exchange Rates	-0.3142** (0.020)	-0.5089* (0.004)	0.0332 (0.797)	0.0815 (0.381)	-0.1339 (0.376)	0.1544 (0.124)	0.3037** (0.016)	-0.2828** (0.038)	0.0721 (0.133)	0.3733* (0.001)
SPAIN										
Stock Returns	-0.1133* (0.008)	-0.1127* (0.007)	-0.1069* (0.008)	0.0097 (0.967)	-0.1086* (0.006)	-0.1129* (0.007)	-0.1301* (0.016)	-0.1003** (0.016)	-0.1130* (0.008)	-0.1083* (0.008)
Exchange Rates	-0.1344*** (0.094)	-0.1915** (0.020)	-0.0844*** (0.039)	0.6922** (0.025)	-0.0656 (0.491)	0.3478* (0.002)	-0.0981 (0.207)	0.2074*** (0.052)	-0.1494*** (0.058)	-0.2178** (0.012)

* 1% significant value, **5% significant value, ***10% significant value, p-values are indicated in brackets. A.Peso: Argentinian Peso, B.Real: Brazilian Real, Ch.Peso: Chilean Peso, Co.Peso: Colombian Peso, M. Peso: Mexican Peso, Bolivar: Venezuelan Bolivar, CS: Canadian Dollar, ¥: Japanese Yen, \$: US Dollar, £: British Pound, Pta: Spanish Peseta.

TABLE 6
EGARCH RESULTS: VOLATILITY SPILLOVERS 1999-2001

	A. Peso/B. Real	A. Peso/Ch. Peso	A. Peso/Co. Peso	A. Peso/M. Peso	A. Peso/Bolivar	A. Peso/CS	A. Peso/¥	A. Peso/£	A. Peso/€
ARGENTINA									
Stock Returns	-0.0918* (0.000)	-0.0649 (0.202)	-0.0720 (0.157)	-0.0606* (0.000)	-0.0676 (0.180)	-0.0691 (0.160)	-0.0673 (0.178)	-0.0679 (0.177)	-0.0682 (0.179)
Exchange Rates	-0.0400 (0.196)	-0.0375 (0.704)	-0.0168 (0.822)	-0.2451** (0.047)	-0.1437 (0.235)	-0.0212 (0.363)	0.0371 (0.104)	-0.0320** (0.016)	-0.0915 (0.210)
BRAZIL									
Stock Returns	Real/A. Peso -0.0576** (0.027)	Real/Ch. Peso -0.0607** (0.021)	Real/Co. Peso -0.0633* (0.004)	Real/M. Peso -0.1352** (0.022)	Real/Bolivar -0.0574** (0.028)	Real/CS -0.0560** (0.031)	Real/¥ -0.0517*** (0.077)	Real/£ -0.0537** (0.012)	Real/€ -0.0560*** (0.005)
Exchange Rates	0.0477 (0.118)	0.0307 (0.496)	-0.0121 (0.781)	0.0080 (0.797)	0.0502*** (0.066)	0.0667*** (0.073)	0.0370*** (0.083)	0.0661* (0.000)	0.0593* (0.001)
CHILE									
Stock Returns	Ch. Peso/A. Peso -0.0001 (0.996)	Ch. Peso/Real -0.0054 (0.804)	Ch. Peso/Co. Peso -0.0271 (0.609)	Ch. Peso/M. Peso 0.0118 (0.271)	Ch. Peso/Bolivar 0.0098 (0.541)	Ch. Peso/CS 0.0004 (0.984)	Ch. Peso/¥ -0.0071 (0.744)	Ch. Peso/£ -0.0062 (0.780)	Ch. Peso/€ -0.0062 (0.654)
Exchange Rates	0.0320 (0.756)	-0.0402 (0.330)	-0.0744 (0.156)	-0.2074* (0.000)	0.0332 (0.709)	-0.0257 (0.811)	0.0091 (0.431)	-0.0068 (0.872)	-0.0479 (0.561)
MEXICO									
Stock Returns	M. Peso/A. Peso -0.0723** (0.011)	M. Peso/Real -0.0708* (0.005)	M. Peso/Ch. Peso -0.0754* (0.004)	M. Peso/Co. Peso -0.0774* (0.006)	M. Peso/Bolivar -0.0705* (0.009)	M. Peso/CS -0.0793* (0.007)	M. Peso/¥ -0.0637** (0.013)	M. Peso/£ -0.0742*** (0.064)	M. Peso/€ -0.0792* (0.005)
Exchange Rates	0.2262*** (0.074)	-0.0118 (0.689)	0.2128* (0.000)	0.0455 (0.585)	0.1831*** (0.095)	0.2099* (0.005)	0.0573*** (0.072)	0.1945* (0.000)	-0.0549 (0.434)
VENEZUELA									
Stock Returns	Bolivar/A. Peso 0.1042** (0.045)	Bolivar/Real 0.1018*** (0.052)	Bolivar/Ch. Peso 0.1072** (0.043)	Bolivar/Co. Peso 0.1057** (0.041)	Bolivar/M. Peso 0.1277** (0.044)	Bolivar/CS 0.1076** (0.041)	Bolivar/¥ 0.1065** (0.030)	Bolivar/£ 0.1083*** (0.051)	Bolivar/€ 0.1048** (0.037)
Exchange Rates	0.1527 (0.236)	-0.0496** (0.048)	-0.0500 (0.663)	0.0005 (0.995)	-0.1903** (0.024)	-0.0250* (0.000)	0.0284 (0.145)	0.1386*** (0.218)	-0.1158 (0.116)
SPAIN									
Stock Returns	€/A. Peso -0.1010* (0.000)	€/Real -0.0956* (0.000)	€/Ch. Peso -0.1039* (0.000)	€/Co. Peso -0.0938* (0.003)	€/Bolivar -0.0982* (0.000)	€/Bolivar -0.1002* (0.000)	€/CS -0.0986* (0.000)	€/£ -0.1007* (0.000)	€/€ -0.0978* (0.000)
Exchange Rates	-0.0240 (0.716)	0.0665* (0.000)	0.0176 (0.850)	0.0900** (0.021)	0.0893 (0.147)	-0.0216 (0.642)	-0.0144 (0.633)	0.0133 (0.785)	-0.0650*** (0.070)

* 1% significant value, ** 5% significant value, *** 10% significant value, p-values are indicated in brackets. A. Peso: Argentinian Peso, B. Real: Brazilian Real, Ch. Peso: Chilean Peso, Co. Peso: Colombian Peso, M. Peso: Mexican Peso, Bolivar: Venezuelan Bolivar, ¥: Japanese Yen, \$: US Dollar, £: British Pound, Pta: Spanish Peseta.

TABLE 7
EGARCH RESULTS: VOLATILITY SPILLOVERS 2002-2006

	A. Peso/B. Real	A. Peso/Ch. Peso	A. Peso/Co. Peso	A. Peso/M. Peso	A. Peso/Bolivar	A. Peso/CS	A. Peso/¥	A. Peso/\$	A. Peso/£	A. Peso/€
ARGENTINA										
Stock Returns	-0.0474*** (0.074)	-0.0266 (0.402)	-0.0304 (0.280)	-0.0469*** (0.079)	-0.0266 (0.389)	-0.0363 (0.183)	-0.0334 (0.224)	-0.0333 (0.278)	-0.0308 (0.278)	-0.0275 (0.334)
Exchange Rates	-0.0217 (0.450)	-0.0425 (0.131)	-0.0193 (0.434)	-0.0164 (0.497)	0.2450*** (0.08)	0.0170 (0.405)	-0.0107 (0.599)	-0.0042 (0.879)	0.0204* (0.000)	0.0049 (0.853)
BRAZIL										
Stock Returns	-0.0881* (0.000)	-0.0616* (0.002)	-0.0742* (0.000)	-0.0822* (0.000)	-0.0916* (0.000)	-0.0512* (0.010)	-0.0858* (0.000)	-0.0515*** (0.012)	-0.0809* (0.000)	-0.0584* (0.003)
Exchange Rates	0.0168 (0.587)	0.0572 (0.158)	0.0413*** (0.09)	0.0607*** (0.065)	0.5731* (0.000)	0.0433 (0.129)	0.0486*** (0.013)	0.0614** (0.026)	0.0503** (0.041)	0.0404 (0.139)
CHILE										
Stock Returns	-0.0237 (0.364)	-0.0264 (0.343)	-0.0223 (0.385)	-0.0242 (0.349)	-0.0205 (0.424)	-0.0240 (0.370)	-0.0241 (0.336)	-0.0229 (0.380)	-0.0266 (0.299)	-0.0221 (0.384)
Exchange Rates	0.0405 (0.171)	-0.0692*** (0.059)	0.0309 (0.538)	-0.0225 (0.717)	-0.1126 (0.158)	0.0488*** (0.092)	0.0638* (0.000)	0.0469 (0.581)	0.0239 (0.537)	0.0089 (0.989)
COLOMBIA										
Stock Returns	-0.0203 (0.543)	-0.0200 (0.552)	-0.0228 (0.504)	-0.0196 (0.561)	-0.0201 (0.545)	-0.0197 (0.557)	-0.0199 (0.552)	-0.0189 (0.57)	-0.0181 (0.587)	-0.0222 (0.505)
Exchange Rates	0.0171 (0.467)	-0.0486** (0.044)	-0.0243 (0.690)	0.0065 (0.809)	0.2585* (0.000)	0.0125 (0.644)	0.0292 (0.262)	-0.0052 (0.887)	0.0288 (0.101)	-0.0054 (0.824)
MEXICO										
Stock Returns	-0.1778* (0.000)	-0.1683* (0.000)	-0.1844* (0.000)	-0.1774* (0.000)	-0.1797* (0.000)	-0.1751* (0.000)	-0.1772* (0.000)	-0.1761* (0.000)	-0.1796* (0.000)	-0.1792* (0.000)
Exchange Rates	0.0152 (0.420)	-0.0621** (0.049)	0.0269 (0.689)	-0.0064 (0.813)	-0.1577*** (0.088)	0.0463* (0.000)	0.0066 (0.686)	-0.1796** (0.035)	0.0300* (0.003)	-0.0480* (0.001)
VENEZUELA										
Stock Returns	0.1430*** (0.065)	0.1771** (0.035)	0.1516*** (0.051)	0.1158 (0.176)	0.1174 (0.162)	0.1162 (0.194)	0.1300 (0.129)	0.1315 (0.149)	0.1246 (0.163)	0.1584** (0.044)
Exchange Rates	-0.0656 (0.691)	-0.4502* (0.000)	0.1105 (0.184)	-0.0142 (0.734)	0.1637** (0.047)	0.0122 (0.848)	0.2634** (0.014)	-0.4810* (0.000)	0.2151* (0.004)	0.0270 (0.672)
SPAIN										
Stock Returns	-0.0868* (0.000)	-0.0879* (0.000)	-0.0870* (0.001)	-0.0799* (0.000)	-0.0876* (0.000)	-0.0820* (0.000)	-0.0914* (0.000)	-0.0920* (0.000)	-0.0737* (0.001)	-0.0929* (0.000)
Exchange Rates	-0.0100 (0.867)	0.0415 (0.118)	-0.0547 (0.503)	-0.0111 (0.597)	-0.0412** (0.012)	0.3375** (0.020)	-0.1051* (0.003)	-0.0111 (0.619)	0.0152 (0.215)	0.0168 (0.158)

* 1% significant value, **5% significant value, ***10% significant value, p-values are indicated in brackets. A. Peso: Argentinian Peso, B. Real: Brazilian Real, Ch. Peso: Chilean Peso, Co. Peso: Colombian Peso, M. Peso: Mexican Peso, Bolivar: Venezuelan Bolivar, CS: Canadian Dollar, ¥: Japanese Yen, \$: US Dollar, £: British Pound, €: Spanish Peseta.

2002-06 period. There were significant spillovers for Venezuela in all three periods, but there were some differences across the three periods with the Argentinian Peso and Real significant in 1998, the Chilean Peso and Bolivar significant for 1999-01 and the Real significant for the 2002-06 period. For Colombia during 2002-06 significant volatility spillovers were found from the Real to Bolivar to the Colombian stock exchange for this period. The most significant spillovers for Spain were found from the Real and the Chilean and Colombian Pesos in 1998, from the Chilean and Mexican Pesos for 1999-01 and from the Mexican Peso and Bolivar for 2002-06. Thus collectively the results from the estimated coefficients of the volatility spillovers from the Latin American exchange rates to the stock market examined indicate that the existence of spillovers are dynamic in nature and not constant over time with no significant result common to all three periods. Furthermore, the lack of consistency across countries indicates that the impact of volatility spillovers from any single Latin American currency is not uniform across different stock markets.

Dealing now with the volatility spillovers from the 'harder' currencies, there appears to be some similarities in the impact on the Latin American stock markets. For 1998 there were significant volatility spillovers from the domestic currencies against the Yen for Argentina, Brazil, Venezuela and Mexico, with the Peseta also significant for Argentina in this period. For Chile, volatility spillovers to the stock market were significant from the Chilean Peso against the US\$ while for Spain, spillovers from the C\$ and US\$ were significant.

In the period since the introduction of the Euro, for Argentina, Brazil and Mexico significant spillovers were observed from the domestic currencies against the £ the stock market in both the 1999-01 and 2002-06 periods with significant spillovers also from the C\$ and US\$ for Mexico. These were the only significant spillovers common to both periods after the Euro was introduced; for all other significant coefficients, results differ for the 1999-01 and 2002-06 periods. For example, there were no significant spillovers for Chile or Spain for 1999-01 but for 2002-06 spillovers from the £ was significant for Chile and the C\$ significant for Spain. Similarly, significant spillovers were found from the € to the Brazilian stock market only for 1999-01, from the € to the Mexican stock market only for 2002-06, from the C\$ to the Venezuelan stock market only in 1999-01 while for 2002-06, spillovers were significant from the Yen, US\$ and £ to the Venezuelan stock market.

The presence of significant volatility spillover coefficients indicates that volatility of the relevant bilateral exchange rates was a determinant of the volatility of the stock markets and that information contained in exchange rates impacted on the behavior of stock markets in these countries. Overall, volatility spillovers are much more prevalent from the various stock markets to the various bilateral exchange rates than is the case for the volatility spillovers from the various bilateral exchange rates to the stock markets in the countries examined. The lack of significant spillovers from exchange rate changes to stock returns found here

for some countries across a number of bilateral exchange rates is consistent with results from Jorion (1990) as well as with Yang and Doong (2005). Jorion (1990) explained the lack of spillovers as possibly due to positive exchange rate volatility on stock returns for some firms offsetting negative exchange rate volatility on stock returns for other firms to give an insignificant or weak effect overall. In addition to this, the use of instruments to hedge exchange rate risk, may reduce the impact of exchange rate volatility on stock markets; Grant and Marshall, 1997, and Bodnar *et al.* (1995) both note that the use of hedging instruments to ameliorate exchange rate risk is pervasive amongst larger companies which are the main components of national stock market indices.

The more widespread presence of significant spillovers from the Peseta to stock markets in the pre Euro period than from the Euro in the post Euro period is indicative of wider use of hedging by firms listed on the stock markets in these countries after the introduction of the Euro; it may be that the Euro's status as a global currency resulted in increased hedging than was the case for the Peseta in order to insulate against the volatility of the Euro which firms listed on these stock markets would not have been exposed to the same extent as for the Peseta.

Considering the results from the volatility spillovers from the stock market to exchange rates and from exchange rates to stock markets together, we are able to highlight a number of instances where the spillovers are bidirectional in nature between the two markets. For 1998, we found significant bidirectional spillovers between the Yen and the Peseta, and the stock markets of Argentina and Brazil, as well as for the Colombian Peso and the Chilean stock market and the Yen and the Mexican stock market, as well as for the Real, Chilean peso, Bolivar and £ for the Spanish stock market. For 1999-01 spillovers were significant in both directions between the Mexican Peso and the Argentinian stock market, for the Chilean Peso and the Mexican stock market, the Mexican Peso and C\$ and the Venezuelan stock market, and for the Real and Colombian Peso and the Real and the Spanish stock market. In the more recent 2002-2006 period, there were significant bidirectional volatility spillovers for the Bolivar, Yen and the US\$ and the Brazilian stock market, the Real, £ and € and the Mexican stock market, the Real and the Venezuelan stock market, and the Mexican Peso, Bolivar and C\$ and the stock market. These results show that there were no significant bidirectional relationships that were common to all three periods. However, we found that for the £ and the Brazilian stock market, and for the C\$ and the US\$ and the Mexican stock market were common to both post Euro periods; the result for Mexico is not surprising given the geographical proximity of Mexico to the US and Canada and also taking into account that his countries relationship will be strongly influence by the North American Free Trade Agreement (NAFTA). The significant spillovers in both directions can be taken as evidence of a high degree of integration between stock and money markets in these instances, and the degree of level of integration appears to be currency specific rather than a general feature of financial markets in these countries.

4.5 Asymmetric Spillovers

For the asymmetric spillover effects from stock returns to exchange rates (see tables 8 to 10) we found that the coefficients are significant in almost all cases for all periods, with the following exceptions; for the asymmetric spillover effects from exchange rates to stock returns during 1998 the coefficients for the Argentina Peso/¥, the Brazilian Real/Pta, the Venezuelan Bolivar/C\$ and Bolivar/Pta, and finally for the Spanish Pta/Real, Pta/Colombian Peso and Pta/Bolivar. During 1999-01 the coefficients are significant with the following exceptions: for Argentina in the case of Argentina/€, for Venezuela in the case of Bolivar/€ and for Spain in the case of €/Argentina Peso, €/Chilean Peso and €/Bolivar. Thus the general significance of most of the asymmetry coefficients justifies the use of the EGARCH model to capture this asymmetry in the impact of good and bad news. The existence of insignificant coefficients indicates that the spillover effects in these instances are symmetric, that is that positive and negative shocks have the same impact on volatility.

4.6 Diagnostic Tests

The models are estimated using the BHHH (Berndt-Hall-Hall-Hausman) method with robust standard errors. The Jarque-Bera test indicates that we reject the hypothesis that the residuals are normally distributed, hence justifying the use of the Bollerslev-Woolridge robust t-statistics⁷. The Ljung-Box statistics for all three periods for all countries indicate that there are no residual linear or non linear dependencies. There are some exceptions where the coefficient was not significant but the problem was corrected after introducing more lags into the test. Finally to check the validity of the assumption of constant correlation adopted in the estimation of the bivariate models (Kanas, 2000), the LB statistics for the cross products of the standardised residuals from the stock returns equation and from the exchange rate equation are calculated and these statistics indicated that the assumption of constant correlation over time can be accepted.

5. CONCLUSIONS

Relationships between equity returns and exchange rates are of particular interest for academics and practitioners due to the fact that these two variables play a crucial role in portfolio and risk management. Equity returns and exchange rate movements may be used to hedge portfolios against currency movements and risk

⁷ As Bollerslev and Wooldrige (1992) note, statistical inferences based on the t-student distribution, when the residuals are non-normal will lead to misleading interpretation of the results, as the standard errors will be biased. For brevity we have not included the tables with the ddiagnostic test results but they are available upon request.

TABLE 8
EGARCH RESULTS: ASYMMETRIC SPILLOVERS 1998

	A. Peso/B. Real	A. Peso/Ch. Peso	A. Peso/Co. Peso	A. Peso/M. Peso	A. Peso/Bolivar	A. Peso/CS	A. Peso/¥	A. Peso/£	A. Peso/Pta
ARGENTINA									
Stock Returns	0.9774* (0.000)	0.9853* (0.000)	0.9765* (0.000)	0.9793* (0.000)	0.9754* (0.000)	0.9775* (0.000)	0.9778* (0.000)	0.9746* (0.000)	0.9774* (0.000)
Exchange Rates	0.9721* (0.000)	0.9274* (0.000)	0.9707* (0.000)	0.9536* (0.000)	0.7274* (0.000)	0.9013* (0.000)	-0.2404 (0.4884)	0.8163* (0.000)	0.7305* (0.000)
BRAZIL									
Stock Returns	0.9590* (0.000)	0.9577* (0.000)	0.9577* (0.000)	0.9581* (0.000)	0.9581* (0.000)	0.9534* (0.000)	0.9590* (0.000)	0.9568* (0.000)	0.9568* (0.000)
Exchange Rates	0.9080* (0.000)	0.9461* (0.000)	0.9698* (0.000)	0.9584* (0.000)	0.7348* (0.000)	0.9871* (0.000)	0.7365* (0.000)	-0.1031 (0.800)	0.5212*** (0.078)
CHILE									
Stock Returns	1.0025* (0.000)	1.0016* (0.000)	1.0021* (0.000)	0.9909* (0.000)	0.9994* (0.000)	0.9849* (0.000)	0.9969* (0.000)	0.9941* (0.000)	0.9970* (0.000)
Exchange Rates	0.9662* (0.000)	0.9592* (0.000)	0.8808* (0.000)	0.9385* (0.000)	0.9006* (0.000)	0.9303* (0.000)	0.7863* (0.000)	0.9278* (0.000)	0.9557* (0.000)
MEXICO									
Stock Returns	0.9838* (0.000)	0.9844* (0.000)	0.9880* (0.000)	0.9740* (0.000)	0.9848* (0.000)	0.9818* (0.000)	0.9787* (0.000)	0.9796* (0.000)	0.9817* (0.000)
Exchange Rates	0.9496* (0.000)	0.9575* (0.000)	0.9576* (0.000)	0.9557* (0.000)	0.9656* (0.000)	0.9608* (0.000)	0.8739* (0.000)	0.9806* (0.000)	0.9496* (0.000)
VENEZUELA									
Stock Returns	0.9025* (0.000)	0.8882* (0.000)	0.8960* (0.000)	0.8921* (0.000)	0.4907* (0.000)	0.8999* (0.000)	0.8841* (0.000)	0.9088* (0.000)	0.8829* (0.000)
Exchange Rates	0.5408* (0.003)	-0.3285* (0.002)	0.8993* (0.000)	1.0131* (0.000)	0.9640* (0.000)	0.0443 (0.889)	0.4920* (0.000)	0.5897* (0.000)	0.2228 (0.189)
SPAIN									
Stock Returns	0.9559* (0.000)	0.9563* (0.000)	0.9559* (0.000)	0.0100 (0.000)	0.9508* (0.000)	0.9557* (0.000)	0.9550* (0.000)	0.9561* (0.000)	0.9578* (0.000)
Exchange Rates	0.7592* (0.000)	0.6592 (0.100)	0.9536* (0.000)	0.0055 (0.986)	0.9536* (0.000)	0.2028 (0.412)	0.8677* (0.000)	0.7289* (0.001)	0.7933* (0.000)

* 1% significant value, ** 5% significant value, *** 10% significant value, p-values are indicated in brackets. A. Peso: Argentinian Peso, B. Real: Brazilian Real, Ch. Peso: Chilean Peso, Co. Peso: Colombian Peso, M. Peso: Mexican Peso, Bolivar: Venezuelan Bolivar, CS: Canadian Dollar, ¥: Japanese Yen, \$: US Dollar, £: British Pound, Pta: Spanish Peseta.

TABLE 9
EGARCH RESULTS: ASYMMETRIC SPILLOVERS 1999-2001

	A. Peso/B. Real	A. Peso/Ch. Peso	A. Peso/Co. Peso	A. Peso/M. Peso	A. Peso/Bolivar	A. Peso/CS	A. Peso/¥	A. Peso/\$	A. Peso/£	A. Peso/€
ARGENTINA										
Stock Returns	0.976* (0.00)	0.9429* (0.00)	0.9425* (0.00)	1.008* (0.00)	0.9423* (0.00)	0.9517* (0.00)	0.9451* (0.00)	0.9419* (0.00)	0.9430* (0.00)	0.9407* (0.00)
Exchange Rates	0.9900* (0.00)	0.9640* (0.00)	0.6667* (0.00)	0.6661* (0.00)	0.9527* (0.00)	0.9823* (0.00)	0.9790* (0.00)	0.9356* (0.00)	0.9447* (0.00)	0.5654 (0.281)
BRAZIL										
Stock Returns	0.9695* (0.00)	0.9690* (0.00)	0.9667* (0.00)	0.9143* (0.00)	0.9698* (0.00)	0.9677* (0.00)	0.9665* (0.00)	0.9696* (0.00)	0.9692* (0.00)	0.9672* (0.00)
Exchange Rates	0.9863* (0.00)	0.9743* (0.00)	0.9753* (0.00)	0.9901* (0.00)	0.9862* (0.00)	0.9783* (0.00)	0.9823* (0.00)	0.9851* (0.00)	0.9812* (0.00)	0.9784* (0.00)
CHILE										
Stock Returns	0.9725* (0.00)	0.9657* (0.00)	0.7714* (0.00)	0.9938* (0.00)	0.9888* (0.00)	0.9740* (0.00)	0.9670* (0.00)	0.9760* (0.00)	0.9678* (0.00)	0.7712* (0.00)
Exchange Rates	0.9515* (0.00)	0.9751* (0.00)	0.7870* (0.00)	0.8310* (0.00)	0.9263* (0.00)	0.6013* (0.00)	0.9843* (0.00)	0.7161* (0.00)	-0.6735* (0.00)	0.6662* (0.00)
MEXICO										
Stock Returns	0.9309* (0.00)	0.9514* (0.00)	0.9389* (0.00)	0.9378* (0.00)	0.9350* (0.00)	0.9335* (0.00)	0.9447* (0.00)	0.9301* (0.00)	0.9388* (0.00)	0.9351* (0.00)
Exchange Rates	0.6965* (0.00)	0.9902* (0.00)	0.7753* (0.00)	0.8276* (0.00)	0.7429* (0.00)	0.4723* (0.00)	0.9581* (0.00)	0.7312* (0.00)	0.6319* (0.00)	-0.3415*** (0.096)
VENEZUELA										
Stock Returns	0.9364* (0.00)	0.9354* (0.00)	0.9333* (0.00)	0.9371* (0.00)	0.9131* (0.00)	0.9346* (0.00)	0.9388* (0.00)	0.9356* (0.00)	0.9338* (0.00)	0.9378* (0.00)
Exchange Rates	0.9521* (0.00)	0.9898* (0.00)	0.9833* (0.00)	0.9675* (0.00)	0.7416* (0.00)	0.9871* (0.00)	0.9833* (0.00)	0.9362* (0.00)	-0.8267* (0.00)	0.4357 (0.361)
SPAIN										
Stock Returns	0.9647* (0.00)	0.9664* (0.00)	0.9637* (0.00)	0.9606* (0.00)	0.9627* (0.00)	0.9652* (0.00)	0.9653* (0.00)	0.9601* (0.00)	0.9651* (0.00)	0.9617* (0.00)
Exchange Rates	0.0672 (0.979)	0.9796* (0.00)	0.4898** (0.011)	0.8359* (0.00)	0.4465* (0.007)	0.5670 (0.581)	-0.9410* (0.00)	0.6346* (0.00)	-0.8240* (0.001)	0.8902* (0.00)

* 1% significant value, **5% significant value, ***10% significant value, p-values are indicated in brackets. A. Peso: Argentinian Peso, B. Real: Brazilian Real, Ch. Peso: Chilean Peso, Co. Peso: Colombian Peso, M. Peso: Mexican Peso, Bolivar: Venezuelan Bolivar, CS: Canadian Dollar, ¥: Japanese Yen, \$: US Dollar, £: British Pound, €: Spanish Peseta.

TABLE 10
EGARCH RESULTS: ASYMMETRIC SPILLOVERS 2002-2006

	A.Peso/B/Real	A.Peso/Ch/Real	A.Peso/Co.Peso	A.Peso/M.Peso	A.Peso/Bolivar	A.Peso/C\$	A.Peso/¥	A.Peso/\$	A.Peso/£	A.Peso/€
ARGENTINA										
Stock Returns	0.9615* (0.000)	0.9568* (0.000)	0.9609* (0.000)	0.9622* (0.000)	0.9590* (0.000)	0.9628* (0.000)	0.9623* (0.000)	0.9621* (0.000)	0.9609* (0.000)	0.9603* (0.000)
Exchange Rates	0.9968* (0.000)	0.9961* (0.000)	0.9966* (0.000)	-0.9930* (0.000)	0.9971* (0.000)	-0.9204* (0.000)	0.9964* (0.000)	0.9966* (0.000)	-0.9169* (0.000)	-0.9119* (0.000)
BRAZIL										
Stock Returns	0.9486* (0.000)	0.9647* (0.000)	0.9585* (0.000)	0.9504* (0.000)	0.9472* (0.000)	0.9685* (0.010)	0.9474* (0.000)	0.9678** (0.012)	0.9505* (0.000)	0.9667* (0.003)
Exchange Rates	0.9970* (0.000)	0.9083* (0.000)	0.9739* (0.000)	0.9795* (0.000)	0.7564* (0.000)	0.9541* (0.000)	0.9790* (0.000)	0.9722* (0.000)	0.9704* (0.000)	0.9546* (0.000)
CHILE										
Stock Returns	0.9398* (0.000)	0.9377* (0.000)	0.9408* (0.000)	0.9453* (0.000)	0.9454* (0.000)	0.9378* (0.000)	0.9411* (0.000)	0.9409* (0.000)	0.9408* (0.000)	0.9431* (0.000)
Exchange Rates	0.9957* (0.000)	0.8765* (0.000)	0.9639* (0.000)	0.8148* (0.000)	0.9823* (0.000)	0.9900* (0.000)	0.9988* (0.000)	0.9862* (0.000)	0.9819* (0.000)	0.9798* (0.000)
COLOMBIA										
Stock Returns	0.9259* (0.000)	0.9258* (0.000)	0.9234* (0.000)	0.9266* (0.000)	0.9261* (0.000)	0.9251* (0.000)	0.9261* (0.000)	0.9270* (0.000)	0.9277* (0.000)	0.9276* (0.000)
Exchange Rates	0.9981* (0.000)	0.9679* (0.000)	0.8267* (0.000)	0.9654* (0.000)	0.9925* (0.000)	0.9469* (0.000)	0.9450* (0.000)	0.9645* (0.000)	0.9617* (0.000)	0.9415* (0.000)
MEXICO										
Stock Returns	0.9223* (0.000)	0.9290* (0.000)	0.9215* (0.000)	0.9179* (0.000)	0.9225* (0.000)	0.9217* (0.000)	0.9187* (0.000)	0.9201* (0.000)	0.9184* (0.000)	0.9245* (0.000)
Exchange Rates	0.9969* (0.000)	0.9796* (0.000)	0.8004* (0.000)	0.9631* (0.000)	0.9505* (0.000)	0.9916* (0.000)	0.9929* (0.000)	0.9184* (0.000)	0.9844* (0.000)	0.9946* (0.000)
VENEZUELA										
Stock Returns	0.7804* (0.000)	0.7702* (0.000)	0.7679* (0.000)	0.8350* (0.000)	0.8534* (0.000)	0.8272* (0.000)	0.8058* (0.000)	0.8095* (0.000)	0.8091* (0.000)	0.7835* (0.000)
Exchange Rates	-0.8867* (0.000)	0.7246* (0.000)	0.9810* (0.000)	0.9496* (0.000)	0.9624* (0.000)	0.9858* (0.000)	0.9337* (0.000)	0.9807* (0.000)	0.9643* (0.000)	0.9772* (0.000)
SPAIN										
Stock Returns	0.9772* (0.000)	0.9992* (0.000)	0.9765* (0.000)	0.9764* (0.000)	0.9772* (0.000)	0.9775* (0.000)	0.9764* (0.000)	0.9763* (0.000)	0.9769* (0.000)	0.9764* (0.000)
Exchange Rates	-0.9028* (0.000)	0.9478* (0.000)	0.7988* (0.000)	0.9622* (0.000)	0.9850* (0.000)	-0.5760* (0.000)	-0.6516* (0.000)	0.9853* (0.000)	0.9921* (0.000)	0.9999* (0.000)

* 1% significant value, **5% significant value, ***10% significant value, p-values are indicated in brackets. A.Peso: Argentinian Peso, B.Real: Brazilian Real, Ch.Peso: Chilean Peso, Co.Peso: Colombian Peso, M.Peso: Mexican Peso, Bolivar: Venezuelan Bolivar, C\$: Canadian Dollar, ¥: Japanese Yen, \$: US Dollar, £: British Pound, €: Spanish Peseta.

management has to take into consideration the linkages between these to markets in order to design appropriate strategies.

This paper set out to examine the volatility linkages between stock returns and exchange rates in six Latin American countries and one European country. While there is a significant body of evidence which investigates the relationship between the first moments of exchange rates and stock returns, the evidence on volatility linkages between the two markets is scarce and has generally been confined to investigation of the relationship for stock returns and a single exchange rate. Our analysis was thus broader in scope than existing research in that we included a number of bilateral exchange rates in our analysis which permitted us to examine whether volatility spillovers exist to the same extent across exchange rates. In addition to this, no research to date has explicitly focused on the impact of the introduction of the Euro on volatility spillovers between these financial markets. The Spanish market and currency was introduced in the study due to the fact, that Spain is a country that has important investments in Latin America, therefore, it was considered of importance to analyse the impact of the Peseta in the Latin American markets and what happen after the introduction of the Euro. In order to address these gaps in the literature, we examined three main periods, covering the time period before the introduction of the Euro, immediately after the introduction of the Euro when the currency was not yet in circulation, and finally the period covering when the currency was physically introduced.

Our results overall show that the volatility of stock prices affects the volatility of exchange rates in a much more widespread way than the volatility of exchange rates affects the volatility of stock prices. The lack of significant spillovers in these markets indicates that there is potential for diversification between stock markets and currency markets in certain instances. We also highlighted a number of instances where the spillovers are bidirectional in nature between the two markets, although there were no significant bidirectional relationships that were common to all three periods. The more widespread presence of significant spillovers from the Peseta to stock markets in the pre Euro period than from the Euro in the post Euro period could reflect wider use of hedging by firms listed on the stock markets in these countries after the introduction of the Euro; it may be that the Euro's status as a global currency resulted in increased hedging than was the case for the Peseta in order to insulate against the volatility of the Euro which firms listed on these stock markets would not have been exposed to the same extent as for the Peseta.

Our results are consistent with those of Kanas (2000) and Yang and Doong (2004) who both found evidence of volatility spillovers from stock returns to exchange rates. However our results differ on the evidence of spillovers in the opposite direction from exchange rates to stock markets; these studies found no significant spillovers while we found that although volatility spillovers are much less prevalent from the various bilateral exchange rates to the stock markets in the countries examined, as well as less consistent across countries and over time than the spillovers from stock markets to exchange rates, they nonetheless are present in certain instances. From the point of view of policy, linkages between the two

markets indicate that policymakers should take into account the impact of any exchange rate policy on stock markets, and viceversa. It is well known that stability in stock markets is important to guarantee foreign direct investment, which generates a positive impact in the growing and stability of a country economy.

The difference between our results and existing studies on volatility spillovers between exchange rates and stock markets likely reflects the larger number of bilateral exchange rates included in our analysis. Thus further research along these lines is required in order to establish more comprehensively the true nature of spillovers from exchange rates to equity markets which should provide valuable information on the possibilities for diversifying holdings of stocks and currencies in investment portfolios, as well as the potential for hedging amongst these assets. Also, the effect of the US\$ in the Latin American economies and in particular the effects of the NAFTA agreements is an area for future research that indeed will provide valuable information for these economies.

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APPENDIX

TABLE A1
DESCRIPTIVE STATISTICS STOCK RETURNS

Stock Indices*	Mean	SD	Skewness	Kurtosis	JB
1998					
Merval	-0.001908	0.0288	-0.5002	6.4864	132
Bovespa	-0.001854	0.0363	0.0441	7.2298	180
IGPA Gen	-0.00122	0.0115	0.3701	4.8870	41
CSE Index	n/a	n/a	n/a	n/a	n/a
IPC	-0.001021	0.0222	0.6056	9.8558	487
IBC	-0.002466	0.0336	1.1081	11.4543	767
IBEX 35	0.001075	0.0197	-0.3973	5.6594	77
1999-2001					
Merval	-0.000544	0.0256	0.4044	7.6183	663
Bovespa	0.000893	0.0249	1.9831	29.4984	21656
IGPA Gen	0.000556	0.0070	-0.0579	5.3085	161
CSE Index	n/a	n/a	n/a	n/a	n/a
IPC	0.000592	0.0191	0.0137	4.3738	57
IBC	0.000456	0.0180	1.0025	10.4508	1798
IBEX 35	-0.000325	0.0151	-0.2076	4.1193	43
2002-2006					
Merval	0.001501	0.0206	-0.1443	6.7135	699
Bovespa	0.000941	0.0174	-0.2239	3.7560	39
IGPA Gen	0.000684	0.0056	0.1899	6.6485	677
CSE Index	0.00191	0.0154	-0.0937	17.0443	10086
IPC	0.000995	0.0120	-0.0056	5.3720	283
IBC	0.001685	0.0148	1.8533	23.9751	22836
IBEX 35	0.000427	0.0122	0.0238	6.5292	638

*Stock Indices: Argentina (Merval), Brazil (Bovespa), Chile (IGPA Gen), Colombia (CSE Index), Mexico (IPC), Venezuela (IBC), Spain (IBEX 35), SD: standard deviation, JB: Jarque Bera test for normality.

TABLE A2
DESCRIPTIVE STATISTICS FOR EXCHANGE RATES

		1988				
		Mean*	SD	Skewness	Kurtosis	JB
ARGENTINA	Argentine Peso/Brazilian Real	-0.33	0.1%	0.00	33.84	9548
	Argentine Peso/Chilean Peso	0.29	0.4%	1.54	15.31	1618
	Argentine Peso/Colombian Peso	-0.68	0.7%	-1.54	26.76	5766
	Argentine Peso/Mexican Peso	-0.88	1.0%	-0.50	9.12	387
	Argentine Peso/Venezuelan Bolivar	-0.47	0.2%	1.56	18.47	2500
	Argentine Peso/Canadian Dollar	-0.33	0.1%	0.70	12.17	864
	Argentine Peso/Japanese Yen	0.11	0.5%	0.63	4.36	34
	Argentine Peso/US Dollar	-0.34	0.4%	0.19	5.45	62
	Argentine Peso/UK Pound	0.64	1.1%	0.95	6.27	144
	Argentine Peso/Peseta	0.33	0.6%	0.22	4.80	35
BRAZIL	Brazilian Real/Argentine Peso	0.33	0.1%	-0.70	12.17	864
	Brazilian Real/Chilean Peso	0.62	0.4%	1.55	15.05	1555
	Brazilian Real/Colombian Peso	-0.35	0.7%	-1.66	26.81	5805
	Brazilian Real/Mexican Peso	-0.56	1.0%	-0.46	9.05	377
	Brazilian Real/Venezuelan Bolivar	-0.14	0.2%	1.73	18.95	2675
	Brazilian Real/Canadian Dollar	-0.01	0.4%	0.15	5.45	61
	Brazilian Real/Japanese Yen	0.97	1.1%	0.92	6.06	128
	Brazilian Real/US Dollar	0.33	0.1%	-1.05	10.44	601
	Brazilian Real/UK Pound	0.43	0.5%	0.75	4.65	50
	Brazilian Real/Peseta	0.66	0.6%	0.24	4.83	36
CHILE	Chilean Peso/Argentine Peso	-0.29	0.4%	-1.54	15.31	1618
	Chilean Peso/Brazilian Real	-0.62	0.4%	-1.55	15.05	1555
	Chilean Peso/Colombian Peso	-0.97	0.8%	-1.62	19.19	2737
	Chilean Peso/Mexican Peso	-1.18	1.2%	-0.35	7.02	168
	Chilean Peso/Venezuelan Bolivar	-0.76	0.5%	-1.15	11.42	765
	Chilean Peso/Canadian Dollar	-0.64	0.6%	-0.58	6.54	139
	Chilean Peso/Japanese Yen	0.35	1.2%	0.75	5.97	111
	Chilean Peso/US Dollar	-0.29	0.4%	-1.61	16.24	1863
	Chilean Peso/UK Pound	-0.19	0.6%	-0.34	8.49	307
	Chilean Peso/Peseta	0.04	0.7%	-0.42	4.85	41
COLOMBIA	Colombian Peso/Argentine Peso	-	-	-	-	-
	Colombian Peso/Brazilian Real	-	-	-	-	-
	Colombian Peso/Chilean Peso	-	-	-	-	-
	Colombian Peso/Mexican Peso	-	-	-	-	-
	Colombian Peso/Venezuelan Bolivar	-	-	-	-	-
	Colombian Peso/Canadian Dollar	-	-	-	-	-
	Colombian Peso/Japanese Yen	-	-	-	-	-
	Colombian Peso/US Dollar	-	-	-	-	-
	Colombian Peso/UK Pound	-	-	-	-	-
Colombian Peso/Euro	-	-	-	-	-	
MEXICO	Mexican Peso/Argentine Peso	0.88	1.0%	0.50	9.12	387
	Mexican Peso/Brazilian Real	0.56	1.0%	0.46	9.05	377
	Mexican Peso/Chilean Peso	1.18	1.2%	0.35	7.02	168
	Mexican Peso/Colombian Peso	0.21	1.2%	0.07	7.10	169
	Mexican Peso/Venezuelan Bolivar	0.42	1.0%	0.45	8.69	333
	Mexican Peso/Canadian Dollar	0.54	1.0%	0.17	6.95	158
	Mexican Peso/Japanese Yen	1.52	1.5%	0.41	5.39	64
	Mexican Peso/US Dollar	0.88	1.0%	0.51	9.14	389
	Mexican Peso/UK Pound	0.99	1.1%	0.68	7.92	262
	Mexican Peso/Peseta	1.21	1.2%	0.47	6.97	168
VENEZUELA	Venezuelan Bolivar/Argentine Peso	0.47	0.2%	-1.56	18.47	2500
	Venezuelan Bolivar/Brazilian Real	0.14	0.2%	-1.73	18.95	2675
	Venezuelan Bolivar/Chilean Peso	0.76	0.5%	1.15	11.42	765
	Venezuelan Bolivar/Colombian Peso	-0.21	0.8%	-1.36	22.40	3854
	Venezuelan Bolivar/Mexican Peso	-0.42	1.0%	-0.45	8.69	333
	Venezuelan Bolivar/Canadian Dollar	0.12	0.5%	-0.15	5.14	47
	Venezuelan Bolivar/Japanese Yen	1.10	1.1%	0.95	6.04	129
	Venezuelan Bolivar/US Dollar	0.47	0.2%	-1.77	20.31	3136
	Venezuelan Bolivar/UK Pound	0.57	0.5%	0.71	4.91	57
	Venezuelan Bolivar/Peseta	0.80	0.6%	0.27	5.05	45
SPAIN	Peseta/Argentine Peso	-0.33	0.6%	-0.22	4.80	35
	Peseta/Brazilian Real	-0.66	0.6%	-0.24	4.83	36
	Peseta/Chilean Peso	-0.04	0.7%	0.42	4.85	41
	Peseta/Colombian Peso	4.15	6.4%	15.43	239.00	568860
	Peseta/Mexican Peso	-1.21	1.2%	-0.47	6.97	168
	Peseta/Venezuelan Bolivar	0.80	0.6%	0.27	5.05	45
	Peseta/Canadian Dollar	-0.67	0.7%	-0.31	3.78	10
	Peseta/Japanese Yen	0.31	1.1%	0.72	4.94	59
	Peseta/US Dollar	-0.33	0.6%	-0.23	4.91	39
	Peseta/UK Pound	-0.23	0.7%	0.28	4.99	43

Note: (*) The daily mean corresponds to this value multiplied by 10^{-3} . SD: standard deviation, JB: Jarque Bera test for normality. (***) Peseta is replaced for Euro since 2000.

1999-2001					2002-2006				
Mean	SD	Skewness	Kurtosis	JB	Mean	SD	Skewness	Kurtosis	JB
-0.91	1.2%	-1.44	21.05	10078	0.99	2.1%	4.65	72.45	247328
0.47	0.6%	0.25	24.25	13633	0.77	2.1%	5.20	85.90	351657
-0.55	0.5%	-0.17	14.61	4071	0.95	2.0%	6.08	102.73	508427
0.09	0.6%	0.35	14.61	4084	0.79	2.0%	6.47	112.57	613196
-0.43	0.2%	-0.22	13.91	3599	0.07	2.6%	1.92	77.20	278127
-0.07	0.4%	0.13	4.40	61	1.19	2.0%	6.14	108.58	569157
-0.23	0.7%	0.01	5.44	180	1.01	2.0%	5.97	102.05	501453
0.00	0.1%	0.76	29.20	20773	0.93	1.9%	6.75	119.67	694902
-0.19	0.5%	0.20	3.61	16	1.18	2.0%	6.07	104.61	527552
0.39	0.7%	-0.10	4.40	60	0.61	2.0%	6.02	100.65	487654
0.91	1.2%	1.44	21.05	10078	-0.99	2.1%	-4.65	72.39	246710
1.37	1.5%	1.15	13.61	3559	-0.22	1.4%	-0.09	8.21	1367
0.35	1.3%	1.32	16.58	5774	-0.04	1.1%	-0.27	11.26	3451
0.99	1.3%	1.88	28.27	19690	-0.21	1.0%	-0.54	12.44	4543
0.48	1.2%	1.36	20.80	9776	-0.92	1.8%	-2.32	53.04	127116
0.84	1.2%	1.20	18.89	7792	0.21	1.1%	-0.19	10.76	3035
0.67	1.4%	0.97	9.84	1525	0.03	1.1%	-0.12	9.81	2340
0.90	1.2%	1.47	21.34	10402	-0.06	1.0%	-0.23	13.23	5243
0.72	1.3%	1.12	17.53	6517	0.19	1.1%	-0.30	10.09	2551
1.30	1.4%	1.05	15.32	4710	-0.37	1.2%	0.01	9.20	1934
-0.47	0.6%	-0.25	24.25	13633	-0.78	2.1%	-5.19	85.83	350780
-1.37	1.5%	-1.15	13.61	3559	0.22	1.4%	0.09	8.21	1367
-1.02	0.8%	-0.10	9.47	1264	0.18	0.9%	0.02	16.23	8804
-0.38	0.9%	0.10	9.88	1427	0.01	1.0%	0.18	10.66	2956
-0.90	0.6%	-0.26	25.97	15928	-0.70	1.7%	-2.25	51.05	117222
-0.54	0.7%	-0.09	14.20	3782	0.42	1.0%	0.07	13.29	5327
-0.70	0.9%	0.05	8.92	1058	0.24	1.0%	0.27	11.25	3440
-0.47	0.6%	-0.21	26.60	16801	0.16	0.8%	0.22	26.63	28103
-0.65	0.8%	-0.26	9.35	1223	0.41	1.0%	0.21	15.38	7722
-0.07	0.9%	0.05	7.98	749	-0.16	0.9%	-0.30	15.61	8025
-	-	-	-	-	-	-	-6.21	107.14	562322
-	-	-	-	-	-	-	0.34	11.23	3483
-	-	-	-	-	-	-	-0.02	16.49	9307
-	-	-	-	-	-	-	-0.17	6.24	544
-	-	-	-	-	-	-	-2.61	75.40	269407
-	-	-	-	-	-	-	-0.07	5.01	207
-	-	-	-	-	-	-	0.28	5.42	314
-	-	-	-	-	-	-	0.25	9.63	2259
-	-	-	-	-	-	-	-0.05	4.95	194
-	-	-	-	-	-	-	0.20	4.21	83
-0.09	0.6%	-0.35	14.61	4084	-0.79	2.0%	-6.47	112.48	611741
-0.99	1.3%	-1.88	28.27	19690	0.21	1.0%	0.54	12.44	4543
0.38	0.9%	-0.10	9.88	1427	-0.01	1.0%	-0.18	10.66	2956
-0.64	0.8%	-0.15	11.30	2081	0.17	0.7%	0.18	6.18	516
-0.51	0.6%	-0.46	15.09	4438	-0.72	1.6%	-3.02	72.91	247853
-0.16	0.7%	-0.43	11.94	2434	0.41	0.7%	0.27	4.10	75
-0.32	1.0%	0.17	6.36	344	0.23	0.8%	0.43	3.96	83
-0.09	0.6%	-0.35	15.97	5090	0.15	0.5%	0.45	4.46	149
-0.27	0.8%	0.17	8.52	922	0.40	0.7%	0.24	4.21	86
0.31	0.9%	-0.05	6.02	275	-0.17	0.8%	0.32	4.02	73
0.43	0.2%	0.22	13.93	3615	-0.07	2.6%	-1.92	77.14	277428
-0.48	1.2%	-1.36	20.82	9821	0.92	1.8%	2.32	53.04	127116
0.89	0.6%	0.26	25.89	15839	0.70	1.7%	2.25	51.05	117222
-0.13	0.5%	-0.16	14.86	4252	0.88	1.6%	2.85	71.10	235036
0.52	0.6%	0.46	15.09	4443	0.72	1.6%	3.02	72.91	247853
0.36	0.4%	0.12	3.80	21	1.13	1.6%	2.85	70.18	228793
0.21	0.7%	0.12	5.41	177	0.95	1.6%	2.63	62.90	181992
0.42	0.1%	1.65	19.94	8994	0.86	1.5%	3.43	86.23	351062
0.24	0.5%	0.17	3.66	17	1.11	1.6%	3.02	71.48	237897
0.83	0.7%	-0.09	4.38	58	1.11	1.6%	3.02	71.48	237897
-0.38	0.7%	0.26	4.00	39	-0.61	2.0%	-6.17	104.70	537439
1.27	1.4%	0.91	15.01	4500	-0.37	1.2%	-0.10	9.18	1959
0.08	0.9%	-0.03	7.96	751	0.15	0.9%	0.21	15.51	8024
0.93	0.8%	-0.07	4.03	33	-0.33	0.7%	0.22	3.97	58
0.29	0.8%	-0.21	5.34	172	-0.16	0.8%	0.25	4.15	81
0.80	0.7%	-0.26	3.91	34	0.54	1.6%	2.77	72.05	245718
-0.56	0.7%	0.20	3.60	16	0.40	0.7%	-0.13	3.10	4
-0.18	0.9%	0.11	3.94	29	0.26	0.6%	-0.35	4.46	126
-0.38	0.7%	0.27	4.00	39	0.31	0.6%	-0.10	3.46	13
-0.20	0.6%	0.24	4.35	63	0.08	0.4%	0.13	4.15	68

TABLE A3
AUGMENTED DICKEY-FULLER TEST

	1998	1999-2001	2002-2006	1% CV*	5% CV**	10% CV***
<i>Stock Returns</i>						
Merval	-14.60*(0)	-24.70*(0)	-10.66*(14)	-3.45	-2.87	-2.57
Bovespa	-16.05*(0)	-20.20*(1)	-25.14*(1)	-3.45	-2.87	-2.57
IGPA Gen	-3.46*(10)	-18.64*(0)	-8.47*(12)	-3.45	-2.87	-2.57
CSE Index	n/a	n/a	-8.03*(12)	-3.45	-2.87	-2.57
IPC	-14.86*(0)	-22.83*(0)	-32.55*(0)	-3.45	-2.87	-2.57
IBC	-11.00*(1)	-22.91*(0)	-20.54*(1)	-3.45	-2.87	-2.57
IBEX 35	-14.25*(0)	-26.71*(0)	-8.47*(17)	-3.45	-2.87	-2.57
<i>Exchange Rates</i>						
ARGENTINA						
Argentine Peso/ Brazilian Real	-7.01*(15)	-9.52*(14)	-7.23*(22)	-3.45	-2.87	-2.57
Argentine Peso/ Chilean Peso	-14.40*(0)	-10.50*(4)	-8.45*(22)	-3.45	-2.87	-2.57
Argentine Peso/Colombian Peso	-12.53*(1)	-26.64*(0)	-7.84*(22)	-3.45	-2.87	-2.57
Argentine Peso/Mexican Peso	-18.03*(0)	-20.76*(1)	-7.97*(22)	-3.45	-2.87	-2.57
Argentine Peso/Venezuelan Bolivar	-8.55*(1)	-19.52*(2)	-9.11*(22)	-3.45	-2.87	-2.57
Argentine Peso/ Canadian Dollar	-14.05*(1)	-12.48*(5)	-8.18*(22)	-3.45	-2.87	-2.57
Argentine Peso/Japanese Yen	-11.68*(1)	-16.89*(2)	-7.78*(22)	-3.45	-2.87	-2.57
Argentine Peso/US Dollar	-15.32*(0)	-8.89*(25)	-8.19*(22)	-3.45	-2.87	-2.57
Argentine Peso/UK Pound	-13.55*(0)	-27.69*(0)	-7.77*(22)	-3.45	-2.87	-2.57
Argentine Peso/Peseta	-15.51*(0)	n/a	n/a	-3.45	-2.87	-2.57
Argentine Peso/Euro	n/a	-26.97*(0)	-6.49*(25)	-3.45	-2.87	-2.57
BRAZIL						
Brazilian Real/Argentine Peso	-14.05*(1)	-9.52*(14)	-7.23*(22)	-3.45	-2.87	-2.57
Brazilian Real/Chilean Peso	-14.14*(0)	-8.25*(14)	-19.32*(2)	-3.45	-2.87	-2.57
Brazilian Real/ Colombian Peso	-12.53*(1)	-9.22*(13)	-8.51*(15)	-3.45	-2.87	-2.57
Brazilian Real/Mexican Peso	-18.03*(0)	-8.90*(14)	-14.29*(6)	-3.45	-2.87	-2.57
Brazilian Real/Venezuelan Bolivar	-8.43*(1)	-9.28*(14)	-11.22*(7)	-3.45	-2.87	-2.57
Brazilian Real/Canadian Dollar	-14.99*(0)	-9.45*(14)	-8.00*(15)	-3.45	-2.87	-2.57
Brazilian Real/Japanese Yen	-13.49*(0)	-24.53*(0)	-19.06*(2)	-3.45	-2.87	-2.57
Brazilian Real/US Dollar	-12.76*(1)	-9.51*(14)	-7.53*(15)	-3.45	-2.87	-2.57
Brazilian Real/UK Pound	-11.84*(1)	-16.07*(1)	-16.07*(3)	-3.45	-2.87	-2.57
Brazilian Real/Peseta	-15.49*(0)	n/a	n/a	-3.45	-2.87	-2.57
Brazilian Real/Euro	n/a	-21.81*(0)	-24.81*(1)	-3.45	-2.87	-2.57
CHILE						
Chilean Peso/Argentine Peso	-14.40*(0)	-10.50*(4)	-8.44*(22)	-3.45	-2.87	-2.57
Chilean Peso/Brazilian Real	-14.14*(0)	-8.25*(14)	-19.32*(2)	-3.45	-2.87	-2.57
Chilean Peso/Colombian Peso	-12.17*(1)	-25.78*(0)	-11.54*(6)	-3.45	-2.87	-2.57
Chilean Peso/Mexican Peso	-16.17*(0)	-20.44*(1)	-27.21*(1)	-3.45	-2.87	-2.57
Chilean Peso/Venezuelan Bolivar	-9.21*(1)	-10.76*(4)	-7.90*(19)	-3.45	-2.87	-2.57
Chilean Peso/Canadian Dollar	-15.39*(0)	-10.57*(6)	-28.51*(1)	-3.45	-2.87	-2.57
Chilean Peso/Japanese Yen	-13.26*(0)	-30.10*(0)	-28.14*(1)	-3.45	-2.87	-2.57
Chilean Peso/US Dollar	-14.09*(0)	-10.61*(4)	-30.01*(1)	-3.45	-2.87	-2.57
Chilean Peso/UK Pound	-11.55*(2)	-28.69*(0)	-26.82*(1)	-3.45	-2.87	-2.57
Chilean Peso/Peseta	-15.43*(0)	n/a	n/a	-3.45	-2.87	-2.57
Chilean Peso/Euro	n/a	-15.09*(2)	-27.76*(1)	-3.45	-2.87	-2.57

Note: * Indicates significant at 1% level. The numbers of lags used in the Dickey-Fuller test are indicated in brackets.

TABLE A3 (continued)
AUGMENTED DICKEY-FULLER TEST

	1998	1999–2001	2002–2006	1% CV*	5% CV**	10% CV***
COLOMBIA						
Colombian Peso/Argentine Peso	n/a	n/a	-8.72*(19)	-3.45	-2.87	-2.57
Colombian Peso/Brazilian Real	n/a	n/a	-8.76*(15)	-3.45	-2.87	-2.57
Colombian Peso/Chilean Peso	n/a	n/a	-11.74*(6)	-3.45	-2.87	-2.57
Colombian Peso/Mexican Peso	n/a	n/a	-19.57*(3)	-3.45	-2.87	-2.57
Colombian Peso/Venezuelan Bolivar	n/a	n/a	-11.47*(6)	-3.45	-2.87	-2.57
Colombian Peso/Canadian Dollar	n/a	n/a	-8.28*(13)	-3.45	-2.87	-2.57
Colombian Peso/Japanese Yen	n/a	n/a	-34.63*(0)	-3.45	-2.87	-2.57
Colombian Peso/US Dollar	n/a	n/a	-24.13*(1)	-3.45	-2.87	-2.57
Colombian Peso/UK Pound	n/a	n/a	-31.74*(0)	-3.45	-2.87	-2.57
Colombian Peso/Euro	n/a	n/a	-34.11*(0)	-3.45	-2.87	-2.57
MEXICO						
Mexican Peso/Argentine Peso	-18.03*(0)	-26.63*(0)	-7.97*(22)	-3.45	-2.87	-2.57
Mexican Peso/Brazilian Real	-18.03*(0)	-23.16*(0)	-32.54*(0)	-3.45	-2.87	-2.57
Mexican Peso/Chilean Peso	-16.17*(0)	-26.10*(0)	-37.32*(0)	-3.45	-2.87	-2.57
Mexican Peso/Colombian Peso	-13.01*(1)	-27.15*(0)	-34.83*(0)	-3.45	-2.87	-2.57
Mexican Peso/Venezuelan Bolivar	-18.29*(0)	-25.96*(0)	-13.41*(4)	-3.45	-2.87	-2.57
Mexican Peso/Canadian Dollar	-7.22*(5)	-21.04*(1)	-36.02*(0)	-3.45	-2.87	-2.57
Mexican Peso/Japanese Yen	-16.12*(0)	-25.82*(0)	-35.62*(0)	-3.45	-2.87	-2.57
Mexican Peso/US Dollar	-17.96*(0)	-25.87*(0)	-36.82*(0)	-3.45	-2.87	-2.57
Mexican Peso/UK Pound	-17.36*(0)	-25.64*(0)	-36.56*(0)	-3.45	-2.87	-2.57
Mexican Peso/Peseta	-6.50*(5)	-27.03*(0)	-36.76*(0)	-3.45	-2.87	-2.57
MEXICO						
VENEZUELA						
Venezuelan Bolivar/Argentine Peso	-8.55*(1)	-19.48*(2)	-9.10*(22)	-3.45	-2.87	-2.57
Venezuelan Bolivar/Brazilian Real	-8.43*(1)	-9.09*(14)	-11.22*(7)	-3.45	-2.87	-2.57
Venezuelan Bolivar/Chilean Peso	-9.21*(1)	-10.11*(6)	-7.90*(19)	-3.45	-2.87	-2.57
Venezuelan Bolivar/Colombian Peso	-12.09*(1)	-4.95*(19)	-13.42*(4)	-3.45	-2.87	-2.57
Venezuelan Bolivar/Mexican Peso	-18.29*(0)	-20.95*(1)	-10.08*(12)	-3.45	-2.87	-2.57
Venezuelan Bolivar/Canadian Dollar	-14.64*(0)	-20.20*(1)	-10.02*(12)	-3.45	-2.87	-2.57
Venezuelan Bolivar/Japanese Yen	-13.88*(0)	-27.60*(0)	-12.69*(4)	-3.45	-2.87	-2.57
Venezuelan Bolivar/US Dollar	-8.25*(1)	-6.42*(10)	-10.06*(12)	-3.45	-2.87	-2.57
Venezuelan Bolivar/UK Pound	-13.91*(0)	-26.48*(0)	-9.97*(11)	-3.45	-2.87	-2.57
Venezuelan Bolivar/Peseta	-15.59*(0)	n/a	n/a	-3.45	-2.87	-2.57
Venezuelan Bolivar/Euro	n/a	-25.98*(0)	-9.22*(13)	-3.45	-2.87	-2.57
SPAIN						
Peseta/Argentine Peso	-15.51*(0)	n/a	n/a	-3.45	-2.87	-2.57
Peseta/Brazilian Real	-15.49*(0)	n/a	n/a	-3.45	-2.87	-2.57
Peseta/Chilean Peso	-15.43*(0)	n/a	n/a	-3.45	-2.87	-2.57
Peseta/Colombian Peso	-15.49*(0)	n/a	n/a	-3.45	-2.87	-2.57
Peseta/Mexican Peso	-17.86*(0)	n/a	n/a	-3.45	-2.87	-2.57
Peseta/Venezuelan Bolivar	-15.59*(0)	n/a	n/a	-3.45	-2.87	-2.57
Peseta/Canadian Dollar	-15.01*(0)	n/a	n/a	-3.45	-2.87	-2.57
Peseta/Japanese Yen	-15.01*(0)	n/a	n/a	-3.45	-2.87	-2.57
Peseta/US Dollar	-15.44*(0)	n/a	n/a	-3.45	-2.87	-2.57
Peseta/UK Pound	-13.35*(1)	n/a	n/a	-3.45	-2.87	-2.57
Euro/Argentine Peso	n/a	-26.10*(0)	-8.80*(18)	-3.45	-2.87	-2.57
Euro/Brazilian Real	n/a	-22.16*(0)	-25.18*(1)	-3.45	-2.87	-2.57
Euro/Chilean Peso	n/a	-28.14*(0)	-28.13*(1)	-3.45	-2.87	-2.57
Euro/Colombian Peso	n/a	-24.82*(0)	-23.50*(1)	-3.45	-2.87	-2.57
Euro/Mexican Peso	n/a	-26.02*(0)	-37.32*(0)	-3.45	-2.87	-2.57
Euro/Venezuelan Bolivar	n/a	-25.32*(0)	-9.74*(11)	-3.45	-2.87	-2.57
Euro/Canadian Dollar	n/a	-25.42*(0)	-34.07*(0)	-3.45	-2.87	-2.57
Euro/Japanese Yen	n/a	-26.57*(0)	-33.57*(0)	-3.45	-2.87	-2.57
Euro/US Dollar	n/a	-25.63*(0)	-36.70*(0)	-3.45	-2.87	-2.57
Euro/UK Pound	n/a	-20.67*(1)	-33.82*(0)	-3.45	-2.87	-2.57

Note: * Indicates significant at 1% level. Numbers of lags indicated in brackets.