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The Puzzling Peso

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Abstract: In the past decade, some observers have noted an unusual aspect of the Mexican peso's behavior: During periods when the U.S. dollar has risen (fallen) against other major currencies such as the euro, the peso has risen (fallen) against the dollar. Very few other currencies display this behavior. In this paper, we attempt to explain the unusual pattern of the peso's correlation with the dollar by developing some general empirical models of exchange rate correlations. Based on a study of 29 currencies, we find that most of the cross-country variation in exchange rate correlations with the dollar and the euro can be explained by just a few variables. First, a country's currency is more likely to rise against the dollar as the dollar rises against the euro, the closer it is to the United States and the farther it is from the euro area. In this result, distance likely proxies for the role of economic integration in affecting exchange rate correlations. Second, and perhaps more surprisingly, a country's currency is more likely to exhibit this unusual pattern when its sovereign credit rating is more risky. This may reflect that currencies of riskier countries are less substitutable in investor portfolios than those of better-rated countries. All told, these factors well explain the peso's unusual behavior, as Mexico both is very close to the United States and has a lower credit rating than most industrial economies.

Keywords: Mexico, peso, dollar, exchange rates, interest rate differentials, inflation, output gap, output growth differentials

JEL classifications: F30, F31

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I. Introduction

The Mexican peso has been floating since shortly after the country's financial crisis at the end of 1994. Since then, some observers have noted an unusual aspect of the peso's behavior: During periods when the U.S. dollar has risen (fallen) against other major currencies such as the euro, the peso has risen (fallen) against the dollar.[1] This pattern implies that when the dollar rises (falls) against other major currencies, the peso rises (falls) against those other currencies by an even greater extent.

Chart 1 illustrates this behavior, plotting the level of the nominal peso/dollar exchange rate against the level of the dollar/euro rate during the period 1997 through mid-2008; the correlation between the two series is 0.56.[2] (The dollar/euro exchange rate is represented by the ECU, or European Currency Unit, for dates prior to the euro's inception in 1999; see Appendix for additional detail.) The relationship between the two exchange rates is also apparent in Chart 2, which plots monthly percentage changes; the correlation is 0.18.

Chart 3 puts the correlation between the levels of the peso/dollar and dollar/euro exchange rates in perspective, comparing it with correlations of other nominal exchange rates against the dollar with the dollar/euro rate. Chart 3 makes clear that the peso/dollar exchange rate's response to movements in dollar/euro is unusual. Of the 29 currencies shown, only 6 exhibit a positive correlation in levels; only the Argentine peso and the Venezuelan bolivar – which have not been market-determined in most of the sample period – have exhibited a higher correlation. Chart 4 presents similar information. It

[1] See Banco de Mexico (2003).
[2] Throughout this paper, we focus on the period from 1997 onwards in order to avoid complications associated with the aftermath of the Tequila crisis in 1995-96.

plots the response of different countries' exchange rates against the dollar to the dollar/euro exchange rate, estimated using OLS regressions; the diamond for each country is the coefficient on the dollar/euro exchange rate, while the vertical lines represent two-standard-error bands. The Mexican coefficient is clearly positive, significantly different from zero, and very precisely estimated, albeit lower than that of Turkey, Argentina and Venezuela. Chart 5 compares estimates of correlations with estimates of regression coefficients; it suggests that, for the most part, the regression coefficients and the ordinary correlations are providing similar information.

Evidence of the unusual behavior of the peso is reinforced by Chart 6, which presents correlations of *monthly percent changes* in nominal exchange rates against the dollar with changes in dollar/euro exchange rates. Of the 29 currencies shown, only four exhibit a positive correlation in percent changes, and the Mexican peso's is the highest. Chart 7 presents the analogous regression coefficients based on monthly percent changes in exchange rates. Mexico has the only coefficient that is significantly above zero. Chart 8 again confirms that regression coefficients and ordinary correlations provide similar information.

Because Mexico has long experienced inflation rates that have exceeded rates in the United States, focusing on nominal exchange rates could be misleading. Charts 9-14 replicate the analysis shown in previous charts, but based on bilateral *real* exchange rates—in which nominal exchange rates are deflated by relative CPIs—rather than *nominal* exchange rates. They confirm that the real peso/dollar exchange rate has exhibited an unusual positive correlation with the real dollar/euro rate. Using real rather than nominal exchange rates, the correlation between peso/dollar and dollar/euro is one

of the highest among the group shown for levels (chart 11), and the highest for percent changes (chart 13). In the analysis based on regression coefficients, the Mexican coefficient is the only one that is significantly greater than zero for percent changes.

Does the peso/dollar exchange rate respond in this unusual manner only to the dollar/euro rate, or does it respond to changes in the dollar's foreign exchange value more generally? The evidence is less robust but appears to support the latter hypothesis. Chart 15 plots correlations of movements in real bilateral exchange rates against the dollar with movements of the Federal Reserve's major currency index, a weighted average of the dollar's value against major industrial-country currencies. It shows that the peso/dollar exchange rate has the highest positive correlation with the dollar major currency index. Chart 16, based on regression analysis, has the peso/dollar rate showing only the third-largest positive response to changes in the dollar index; however, none of the positive coefficients (including Mexico's) is significantly different from zero.

Finally, the unusual correlation between peso/dollar and dollar/euro is not an artifact of outsized movements in these exchange rates during a select, limited time period. Chart 17 plots rolling 90-day correlations of daily levels of peso/dollar and dollar/euro, while Chart 18 plots correlations of daily percent changes in these exchange rates. The results indicate that, while the correlations are volatile and appear to have diminished in recent years, they were strongly positive on balance for long periods of time, and especially through 2003. To provide some perspective on this, Charts 19 and 20 present analogous calculations for the correlation between the Canadian dollar/U.S. dollar exchange rate and dollar/euro. This correlation has been negative for most of the past decade.

Charts 21 through 26 address some of the other exchange rates against the dollar that also exhibit high correlations with the dollar/euro exchange rate. As may be seen, notwithstanding their apparent high correlation in levels, the rolling correlations of daily percent changes for the Venezuelan bolivar, Russian ruble, and Argentine peso provide little evidence of systematic reactions to the dollar/euro exchange rate.

What accounts for the unusual positive correlation of the Mexican peso with the dollar's value against other major currencies such as the euro? The factor that comes most readily to mind is Mexico's proximity to, and thus close integration with, the United States. The United States is the major market for Mexican manufactures, and the manufacturing sector is playing an increasingly important role in overall Mexican economic activity. Possibly, the types of shocks that boost U.S. output, interest rates, and exchange rates relative to the euro area—for example, a shock to U.S. investment spending—might boost Mexican output, interest rates, and exchange rates to an even greater extent. Even so, this cannot be the whole story. Canada is also next door to and highly integrated with the United States, and yet the exchange rate of the Canadian dollar against the U.S. dollar exhibits the more normal negative correlation with the dollar/euro rate.

In the remainder of this paper, we attempt to explain the unusual pattern of the peso's correlation with the dollar. Section II briefly addresses a body of related research. Section III lays out the standard uncovered interest parity relationship between exchange rates and interest rate differentials, and assesses whether correlations among bilateral interest rate differentials can explain correlations among bilateral exchange rates. Section IV drills down a bit further, examining the explanatory power of the factors underlying

correlations in interest rate differentials: output and inflation. Section V examines the possible role of a range of measures of trade and financial integration. Section VI concludes.

II. Previous related research

We are not aware of any previous analyses of the unusual behavior of the peso/dollar exchange rate. However, this topic is similar in various respects to an issue that attracted some attention in previous decades: the response of European exchange rates to movements in the deutschemark/dollar rate. (See Frankel, 1985, Giavazzi and Giovannini, 1989, and Galati, 1999.) In particular, it was observed that appreciations of the mark against the dollar tended to be associated with increases in the other European currencies' value against the dollar as well, albeit generally to a less extent; this was described as the "dollar-mark axis" or "dollar-mark polarity". Galati (1999) found that this pattern could be explained by participation in the ERM, the close trade links between the European countries, and a measure of portfolio bias in international investments.

Unlike in the case of the "dollar-mark axis", however, the focus of this paper is not to explain why a group of currencies move together with respect to other currencies, but to explain why one particular currency—the peso—moves by an outsized amount when its "anchor currency"—the dollar—moves against other major currencies. In this sense, the peso's relation to the dollar is similar to the Swiss franc's relation to the mark in the pre-EMU period; alone among the European currencies, when the mark appreciated against the dollar, the Swiss franc tended to appreciate against the mark. Giavazzi and Giovannini (1989) and Galati (1999) suggest this pattern may have owed to portfolio shifts: a high share of the portfolios of international investors may have been

allocated to Switzerland, so that shifts in portfolio allocations that tended to boost the mark against the dollar may have boosted the Swiss franc even more.

It is difficult to believe this portfolio allocation story, by itself, explains the puzzling behavior of the peso/ dollar exchange rate, however. Unlike the case of the deutschemark and the Swiss franc, the dollar and the peso likely offer very different attributes to investors and are placed by them in distinct baskets. The dollar is the world's preeminent reserve currency and offers maximum liquidity and safety; as we will discuss further below, the peso is more likely to be grouped by investors with other emerging market currencies.

The research that comes closest to bearing on the unusual behavior of the Mexican peso is Fratzscher (2008). This paper evaluates the impact of shocks to U.S. monetary policy and economic performances on the values of different currencies. It finds that shocks tending to lower the value of the dollar (for example, a higher-than-expected employment report) tend to lower the dollar most against the euro and Swiss franc and least against emerging market countries. But most interesting for our purposes is that such shocks would actually *boost* the value of the dollar against a few currencies: in ascending order, Hong Kong, Argentina, Venezuela, Chile, and most of all, *Mexico*! Thus, the pattern of correlations we have documented corresponds closely to the pattern of response to shocks documented in Fratzscher (2008).

III. Exploiting the uncovered interest parity relationship

Equation (1) presents the standard uncovered interest parity (UIP) relationship:

$$i_t^{\,p} = i_t^{\,\$} + e_{t+1}^{\,p/\$} - e_t^{\,p/\$} + \varepsilon_t \qquad (1)$$

$i_t^{\,p}$: peso interest rate

$i_t^{\$}$: dollar interest rate

$e_t^{p/\$}$: log exchange rate, pesos per dollar

Re-arranging terms, the current exchange rate can be expressed as a function of the interest rate differential and the expected future exchange rate:

$$e_t^{p/\$} = i_t^{\$} - i_t^{p} + e_{t+1}^{p/\$} + \varepsilon_t \qquad (2)$$

If the future exchange rate is expected to revert to some constant equilibrium rate $\overline{e^{p/\$}}$, then the exchange rate essentially becomes a function of the interest rate differential alone:

$$e_t^{p/\$} = i_t^{\$} - i_t^{p} + \overline{e^{p/\$}} + \varepsilon_t \qquad (3)$$

It then follows that the correlation of the peso/dollar exchange rate with the dollar/euro exchange rate will reflect the correlation of the peso/dollar interest rate differential with the dollar/euro interest rate differential:[3]

$$corr(e_t^{p/\$}, e_t^{\$/eu}) = corr(i_t^{\$} - i_t^{p}, i_t^{eu} - i_t^{\$}) \qquad (4)$$

To what extent do correlations in bilateral interest rate differentials match up with correlations in bilateral exchange rates, and does this relationship help explain the positive correlation between peso/dollar and dollar/euro? Chart 27 presents a scatterplot where each point represents correlations for a single country, computed using monthly data for the period 1997 through mid-2008. The x-axis plots the correlation between that country's interest rate differential with the United States (for Mexico, $i_t^{\$} - i_t^{p}$) and the

[3] This assumes that expected future values of the peso/dollar and dollar/euro exchange rates remain constant, and that the error terms in the UIP equations for peso/dollar and dollar/euro are uncorrelated.

U.S. interest rate differential with the euro area ($i_t^{eu} - i_t^{\$}$). The y-axis plots the correlation between that country's exchange rate against the dollar (for Mexico, $e_t^{p/\$}$) and the dollar/euro exchange rate ($e_t^{\$/eu}$). All interest rates are money market rates.[4] For the euro area, we use the interbank rate, which is available for the entire sample period.

The scatter plot reveals the expected positive relationship between the two sets of correlations: the correlation of the interest rate differential between a given country and the United States with the interest rate differential between the U.S. and the euro area is positively associated with the correlation between that country's exchange rate against the dollar with the dollar/euro exchange rate. The slope of the regression line is 0.48, and it is significant at the 5 percent level. Note that Mexico is the only country whose correlations of interest rate differentials and exchange rates both exceed zero by a substantial margin. It appears that when U.S. interest rates rise relative to euro rates, Mexican interest rates rise relative to dollar rates—this may explain at least part of the positive response of peso/dollar exchange rates to dollar/euro exchange rates.

Chart 28 repeats this exercise, but with correlations involving 12-month changes in interest rate differentials and in exchange rates. The slope of the regression line is 0.59, and it is again significant at the 5 percent level. Mexico exhibits one of the highest correlations of exchange rates. Although no country had a positive correlation of changes in interest rate differentials, Mexico's correlation is one of the highest in the sample.

So far, we have referred to nominal variables in our summary of UIP and in our correlation analysis. However, the assumption that the future expected exchange rate is constant makes more sense if the analysis is re-cast in terms of real exchange rates rather

[4] Except for Chile, Hungary, and Israel, for which we use the discount rate.

than nominal rates. Starting with the nominal UIP equation (1), above, it is straightforward to derive a version of equation (3) that expresses the current real exchange rate as a function of the real interest rate differential and a constant equilibrium real exchange rate:

$$rer_t^{p/\$} = r_t^{\$} - r_t^{p} + \overline{rer^{p/\$}} + \varepsilon_t \qquad (5)$$

r_t^{p} : real peso interest rate = $i_t^{p} - (p_{t+1}^{p} - p_t^{p})$

p_t^{p} : Mexican price level

$r_t^{\$}$: real dollar interest rate = $i_t^{\$} - (p_{t+1}^{\$} - p_t^{\$})$

$p_t^{\$}$: U.S. price level

$rer_t^{p/\$}$: log real exchange rate, pesos per dollar = $e_t^{\$/eu} + p_t^{\$} - p_t^{p}$

Based on equation (5), Charts 29 and 30 repeat the analysis shown in Charts 27 and 28, but showing correlations between *real* interest rate differentials and *real* exchange rates. As shown in Chart 29, the relationship between correlations of *levels* of real interest rate differentials and correlations of *levels* of real exchange rates is not significant and explains very little of the variation across currencies. However, the relationship among correlations based on *12-month changes*, shown in Chart 30, is again statistically significant; the slope of the regression line is .60 with a t-statistic of 2.7.[5]

Even so, Mexico is a substantial outlier: Whereas the correlation of its real exchange rate movements against the dollar with dollar movements against the euro (the

[5] We should note that the uncovered interest parity relationship described in equation (1) is an equilibrium condition, and it does not indicate whether causality runs from interest rate differentials to exchange rates or vice-versa. Accordingly, it is possible that the relationships shown in Charts 27-30 actually depict the impact of exchange rate correlations on interest rate correlations. We do not place a lot of weight on this "reverse causality" scenario, however, and it leaves unresolved what led to the pattern of exchange rate correlations in the first place.

y-axis) is the highest in the sample, the correlation of Mexico-U.S. real interest rate differentials with U.S.-euro differentials (the x-axis) is negative and unremarkable. This may reflect that our calculations of *ex post* real interest rates are poor proxies for the *ex ante* real interest rates that influence exchange rate movements. Alternatively, other factors besides interest rate differentials may be influencing exchange rates.

IV. Drilling down below interest rate differentials

In this section, we drill down a little deeper to assess what factors may explain the pattern of correlations of interest-rate differentials that, in turn, appear to influence the pattern of exchange rate correlations. We start by assuming that interest rates in a given country j are set accordingly to the Taylor-rule type relation shown in equation (6) below:

$$i_t^j = \overline{i^j} + \beta(\pi_t^j - \overline{\pi^j}) + \delta(y^j{}_t - \overline{y^j{}_t}) + \eta^j{}_t \qquad (6)$$

$\overline{i^j}$: equilibrium nominal interest rate = $\overline{r^j} + \overline{\pi^j}$

$\overline{r^j}$: equilibrium real interest rate

π_t^j : inflation rate = $p_t^j - p_{t-1}^j$

$\overline{\pi^j}$: target inflation rate

y_t^j : log real output

$\overline{y_t^j}$: log real potential output

Define the inflation and output gaps:

$$\pi gap_t^j = \pi_t^j - \overline{\pi^j}$$

$$ygap_t^j = y_t^j - \overline{y_t^j}$$

Accordingly, the interest rate differential between Mexico and the United States, for example, is expressed as:[6]

$$i_t^{\,p} - i_t^{\,\$} = \overline{i^{\,p}} - \overline{i^{\,\$}} + \beta(\pi gap_t^{\,p} - \pi gap_t^{\,\$}) + \delta(ygap^{p}{}_t - ygap^{\$}{}_t) + \eta^{p}{}_t - \eta^{\$}{}_t \qquad (7)$$

With the interest rate differential between the United States and the euro area expressed similarly, it is apparent that the correlation between the Mexico/U.S. and U.S./euro area interest rate differentials—that is, $corr(i_t^{\,p} - i_t^{\,\$}, i_t^{\,\$} - i_t^{\,eu})$ --will depend on the correlations and cross correlations between inflation gap differentials—e.g., correlations of $(\pi gap_t^{\,p} - \pi gap_t^{\,\$})$ with $(\pi gap_t^{\,\$} - \pi gap_t^{\,eu})$—and output gap differentials—e.g., correlations of $(ygap^{p}{}_t - ygap^{\$}{}_t)$ with $(ygap^{\$}{}_t - ygap^{eu}{}_t)$.

Previous research supports the view that arguments in the Taylor-rule relation influence exchange rates. Clarida and Waldman (2007) show that positive inflation surprises tend to lead a country's currency to appreciate, and especially so for countries with explicit inflation targets. See also Mark (2005), Engel and West (2006), and Molodtsova and Papell (2008), among others.

To what extent can correlations in inflation gap differentials and output gap differentials empirically explain the cross-country pattern of correlations in interest rate differentials and, ultimately, exchange rates? To answer this question, we depart from the bivariate scatterplot approach utilized above and instead estimate multivariate regressions.

IV.1 Explaining patterns of correlations of interest rate differentials

[6] We assume for simplicity that the coefficients on the inflation and output gap terms are the same across countries. This is almost certainly a substantial simplification.

Table 1 presents the results of estimates of equations explaining correlations of interest rate differentials as a function of correlations of output gap differentials and correlations of inflation gap differentials. Output gaps are calculated as the percent difference between industrial production (IP) and a trend measure of IP calculated using an HP filter; we denote them IPgap. Inflation gaps (πgap) are calculated analogously, as 12-month CPI inflation minus an HP filter of inflation.[7] The data are analyzed in 12-month changes, indicated by Δ. Accordingly, correlations of 12-month changes in interest rate differentials for a given country X – Corr[$\Delta(i^{\$} - i^{X})$, $\Delta\,(i^{eu} - i^{\$})$] – are related to correlations of changes in IPgap differentials—Corr[$\Delta(IPgap^{\$} - IPgap^{X})$, $\Delta\,(IPgap^{eu} - IPgap^{\$})$]–and correlations of changes in inflation gap differentials—Corr[$\Delta(\pi gap^{\$} - \pi gap^{X})$, $\Delta\,(\pi gap^{eu} - \pi gap^{\$})$]. The data are also analyzed in both nominal and real terms.

Two results are worth highlighting. First, correlations of inflation gap differentials are significant and robust explainers of correlations in interest rate differentials. This means that if increases in a country's inflation gap relative to that of the United States are associated with increases in the U.S. inflation gap relative to that of the euro area, it is more likely that increases in a country's interest rate relative to the U.S. rate will be associated with increases in the U.S. interest rate relative to the euro area rate.

Second, and conversely, looking at columns (1) and (3), there appears to be no relationship between correlations in IPgap differentials and correlations in interest rate differentials. It is possible that the output gaps are being mis-measured, or that they are not the best measure of economic slack. To explore this possibility, we estimated another

[7] For the United States, core CPI inflation, which excludes prices of food and energy, is used instead of total CPI inflation.

set of regressions, using correlations of the differentials in 12-month percent changes in IP rather than correlations of the differentials in IP gaps. Because these equations are estimated in 12-month changes, with the 12-month percent change in IP denoted Δip, the explanatory variable becomes $Corr[\Delta(\Delta ip^{\$} - \Delta ip^{X}), \Delta (\Delta ip^{eu} - \Delta ip^{\$})]$.[8] However, as indicated in columns (2) and (4), this did not materially change the results.

How much of the cross-country pattern in correlations of interest rate differentials is explained by the output and inflation correlations? Chart 31 plots the fitted values from the regression in equation (2) in Table 1—based on changes in nominal interest rates—against their actual values; Chart 32 presents plots the fitted and actual values from equation (4), based on changes in real interest rates. The solid lines represent points where the fitted value equals actual; the dashed lines represent the fitted values plus/minus twice the standard error of the regression, a measure of the confidence interval. As can be seen in these charts, this simple regression does a relatively poor job of fitting the nominal interest rate correlations, albeit a somewhat better job of fitting the real interest rate correlations.

IV.2 Explaining patterns of correlations of exchange rates

Table 2 presents estimation results for equations explaining exchange rate correlations as a function of correlations of IP gap differentials, inflation gap differentials, and interest rate differentials. If output and inflation affected exchange rates exclusively through their effect on interest rates, of course, we would expect them to have little measured effect, once interest rates were added to the equation. The estimation

[8] To provide an example, consider the 2002.07 observation for Mexico. To compute the first argument in the correlation, Mexican IP growth between 2001.07 and 2002.07 is subtracted from U.S. IP growth over the same period. From this calculation is then subtracted the difference between U.S. and Mexico IP growth during the preceding year, of 2000.07 to 2001.07. The analogous computations are then made for the second argument of the correlation, the change in IP growth differential between U.S. and euro area.

results, however, suggest otherwise. Although the coefficients on correlations of IP gap differentials remain insignificantly different from zero, the coefficients on correlations of IP *growth* differentials are significantly different from zero. In contrast, the coefficients on correlations of inflation gaps differentials, and especially interest rate differentials, are not consistently significant, particularly in the regressions using real exchange rate changes. Accordingly, correlations of output growth emerge as the single most consistent influence on patterns of exchange rate correlations, and this influence appears to go beyond their effects on interest rates.[9]

How well do the set of output, inflation, and interest rate correlations explain the cross-country pattern of exchange rate correlations? Chart 33 plots the fitted values from equation (3) in Table 2—based on changes in nominal exchange rates—against their actual values; Chart 34 presents plots the fitted and actual values from equation (6), based on changes in real exchange rates. These models correctly predict Mexico to have the highest exchange rate correlations, both in nominal and real terms, although the predicted values of these correlations are below zero. Moving to the other side of the rankings, the model successfully predicts close-to-negative-one correlations for several European currencies. However, the fit of these models is obviously poor, as evidenced by the wide dispersion of actual correlations for given levels of fitted values.

[9] This is not implausible, as exchange rates ultimately should be influenced by expected rates of return, and output growth may be a more robust indicator of such returns than short-term interest rates alone. Additionally, the uncovered interest parity relationship may be more applicable to long rates than the short rates used in our research (mainly reflecting data availability). To the extent that output and inflation affect long rates as well as short rates, they may influence exchange rates even if short rates are held constant.

V. Other Factors Influencing the Pattern of Exchange Rate Correlations

The evidence summarized in Charts 33 and 34 suggests that, although correlations of output, inflation, and interest rates explain some of the country-country pattern of exchange rate correlations, much of this pattern remains unexplained. In this section, we assess a broad set of additional factors that might help further explain why the correlation of a country's exchange rate against the dollar with the dollar/euro rate might be high or low. Following on work by Fratzscher (2008), we focus on the extent to which a country is integrated with the United States through either trade or finance, along with more general measures of financial integration and maturity. Accordingly, we consider the effect of the following measures:

1. Log of Distance from the United States, and Log of Distance from the euro area (specifically, Germany): Measured as the Great Circle log distance between country centers .

2. Trade Share: Measured as the sum of a country's bilateral imports and exports with the United States divided by the country's GDP.

3. Stock Return Correlation: Measured as the correlation of monthly log changes in a country's stock market index vis-à-vis the S&P 500 index.

4. U.S. Portfolio Integration: Measured as the sum of a country's claims on and liabilities to the United States divided by the country's GDP.

5. International Financial Integration: Measured as the sum of a country's total external assets and liabilities divided by the country's GDP.

6. International Financial Size: Measured as the sum of a country's total external assets and liabilities in absolute dollar terms.

7. Credit Rating: Based on Moody's and S&P sovereign credit ratings and converted to a numerical system, with the safest rating indicated by 1 and the riskiest rating indicated by 27.

Tables 3 and 4 present estimates of regressions in which measures of the correlation of a country's exchange rate against the dollar with the dollar/euro rate are

related to (1) the output, inflation, and interest rate correlations discussed in the previous section, and (2) the additional factors described above. In Table 3, the dependent variable is the correlation of 12-month changes in nominal exchange rates; in Table 4, the dependent variable is based on correlations of changes in real exchange rates. Columns (2) through (8) include the additional factors separately, while Column (9) includes them jointly. Column (10) represents a reduced version of Column (9), where we progressively remove explanatory variables with the smallest t-statistics. Because the distance variables may be well-correlated with other measures of integration between countries, the equation shown in Column (11) represents the outcome of the same exercise, but with the distance variables removed at the outset.

All told, a number of variables are robustly significant determinants of exchange rate correlations. These include, first, the distance variables. The closer a country is to the United States, the higher is its exchange rate correlation—that is, the greater the likelihood that its currency will rise against the dollar when the dollar rises against the euro. Conversely, the closer a country is to the euro area, the lower (more negative) its exchange rate correlation. We interpret these distance variables as proxies for the degree of economic integration between a country and the United States/euro area, and, in fact, they appear to be rather good proxies. Other measures of economic integration—the correlation of IP growth differentials, the correlation of inflation gap differentials, the correlation of interest rate differentials, and the trade share—are only sporadically significant in the regressions, and mainly when the distance variables are not included.

The second robustly significant variable in the regressions shown in Tables 3 and 4 is the credit rating. The coefficient on the credit rating variable is positive and

significantly different from zero in all regressions, suggesting that currencies of riskier countries are more likely to rise against the dollar when the dollar rises against the euro. Generally speaking, less developed countries have lower credit ratings. However, the coefficient on credit rating remains positive and significant even after including the country's per capita income as a control variable. Accordingly, it appears to be a country's perceived riskiness that is affecting the exchange rate correlations rather than its level of development *per se*. It is not clear what accounts for this result. One possibility is that the credit rating variable serves to distinguish the currencies of major financial centers—which may be most substitutable in global investor portfolios—from the currencies of other countries. Accordingly, when a shock renders U.S. investments more attractive, investors may shift their portfolios more out of other low-risk currencies (generally in industrial economies) than out of higher-risk currencies (generally in emerging market economies). Another possibility is that, given the centrality of the United States in the world economy, shocks which boost the U.S. economy and the dollar relative to the euro area are regarded by the market as favorable for reduction of risk around the world.

Finally, measures of a country's financial integration do not appear to have much effect, one way or the other, on exchange rate correlations. The coefficients on Stock Return Correlation, International Financial Integration, and U.S. Portfolio Integration are all insignificantly different from zero, while that on International Financial Size is usually insignificant as well. Perhaps the economies in our sample all have financial systems that are sufficiently linked to world capital markets that variations in integration among them have little bearing on the responsiveness of their currencies to economic conditions.

How much of the cross-country pattern of exchange rate correlations is explained by the augmented models shown in Tables 3 and 4? We replicate the exercise described in Section IV, focusing on the regressions shown in Column (10), which combine high explanatory power with parsimonious specifications. Chart 35 plots the fitted values from Table 3—based on changes in nominal exchange rates—against their actual values; Chart 36 presents plots of the fitted and actual values from Table 4, based on changes in real exchange rates. The charts suggest that the factors considered explain much of the pattern of exchange rate correlations. In particular, Mexico's high exchange rate correlations, both in nominal and real terms, are well-predicted by the models.

Of the explanatory variables in the models, which of them account most for Mexico's unusually high correlation? To address this question, we decompose the fitted values for each country's exchange rate correlation into the respective contributions of the explanatory variables—in practice, this means multiplying the explanatory variables by their coefficients. For ease of interpretation, we combine the constant with the contributions of the two distance variables. Chart 37 presents the estimated contributions the explanatory variables to the nominal exchange rate correlations, while Chart 38 presents the analogous calculations for the real exchange rate correlations. The dashed black lines indicate the fitted values themselves, while the solid grey lines indicate the actual value of the exchange rate correlations.

Focusing on Chart 38, which has fewer variables and is easier to interpret, it is apparent that distance to the United States and the euro area accounts for most of the variation in predicted and actual exchange rate correlations. For Mexico, the combination of the constant and the two distance variables makes a small positive

contribution to the exchange rate correlation, whereas for countries close to the euro area, the contribution is large and negative. Accordingly, to the extent that distance proxies for economic integration, Chart 38 lends support to our initial hypothesis that the peso's unusual behavior reflects Mexico's close economic relationship with the United States.

Yet, Canada is almost equally close to the United States in both geographical and economic terms, but it exhibits a negative exchange rate correlation. Chart 38 highlights several factors that differentiate Canada from Mexico. First, although Canada's IP is relatively well correlated with U.S. IP, the correlation of the Canada/U.S. IP-growth differential with the U.S./euro area IP-growth differential is negative (-.55), whereas that of Mexico is positive (.21).[10] Second, Canada has a much safer credit rating than Mexico. Accordingly, investors may view Canadian dollars as more substitutable for U.S. dollars in their portfolio (compared with pesos and dollars), or they may view U.S. shocks as having different implications for risk in Canada compared with in Mexico. Finally, Canada's exchange rate correlation is lower than the model prediction, whereas Mexico's is higher, introducing a third, unexplained factor distinguishing the two countries.

VI. Concluding Remarks

This paper is, to our knowledge, the first attempt to systematically document and account for a puzzling feature of the Mexican peso: when the dollar rises (falls) against the euro, the peso tends to rise (fall) against the dollar. We have found strong evidence that this behavior is very unusual. The correlation between changes in the peso/dollar and dollar/euro exchange rates during 1997-2008 has been among the highest of a broad

[10] The correlation of the 12-month rate of IP growth in Canada and the United States is .70, compared with .88 for Mexico and the United States.

set of currencies, whether measured in nominal or real terms, and is one of only a few currency correlations to exceed zero.

What explains the peso's unusual behavior? Our starting hypothesis was that the Mexican economy is unusually reliant upon the U.S. economy. Accordingly, shocks that boost U.S. demand relative to euro-area demand will tend to boost Mexican demand even more. Therefore, even as the shocks to U.S. output raise U.S. interest rates relative to euro rates—and thus boost the dollar against the euro—they raise Mexican interest rates relative to U.S. rates—and thus boost the peso against the dollar.

To evaluate this hypothesis, we focused on explaining the cross-country variation in exchange rate correlations. We first estimated a number of simple regression models based on the uncovered interest parity (UIP) condition, which links exchange rates to interest rates, and the Taylor rule, which links interest rates to output and inflation. We showed that correlations of interest rate differentials are significantly related to patterns of exchange rate correlations: countries whose interest rates rise relative to U.S. rates when U.S. rates rise relative to euro rates are also likely to have currencies that rise against the dollar when the dollar rises against the euro. We showed, as well, that across the countries in our sample, correlations of differentials in output growth and inflation are systematically related to correlations in exchange rates.

Even so, the models we estimated based on the UIP condition and the Taylor rule did not explain a great deal of the cross-country variation in exchange rate correlations, nor did they consistently account for Mexico's unusually high and positive correlation. Accordingly, we departed from the simple UIP/Taylor-rule framework and tested the explanatory power of a number of additional variables intended to proxy for countries'

economic and financial integration with the United States, the euro area, and the broader global financial system. We found that just a few variables consistently and significantly explained most of the cross-country variation in exchange rate correlations.

First, most of the variation in exchange rate correlations appears to be explained by two variables representing a country's distance from the United States and the euro area, respectively. The closer a country is to the United States, and the farther from the euro area, the more likely a country's currency will rise against the dollar when the dollar rises against the euro. Clearly, distance represents a proxy for a range of economic and financial ties that are too diverse to be captured by just a few economic or financial statistics. Another measure of economic integration, the correlation of a country's industrial production with that of the United States and the euro area, was found to be a significant influence on exchange rate correlations in many, but not all, of the models we estimated.

Second, a country's sovereign credit rating is a robust, statistically significant influence on a country's exchange rate correlation. The safer the credit rating, the more likely that a country's currency will fall against the dollar when the dollar rises against the euro. Our preferred interpretation for this effect is that in the portfolios of international investors, the dollar and the currencies of other highly rated countries are most substitutable with each other. Accordingly, when some shock enhances the attractiveness of U.S. assets, investors are more likely to shift out of the euro and other highly-rated currencies (mainly of industrial countries) than out of lower-rated currencies (mainly of emerging markets).

Our estimated models based on these variables correctly predict Mexico to have a positive correlation of its currency against the dollar with the dollar/euro exchange rate, and among the highest in the sample. This mainly reflects Mexico's proximity to the United States, which has led to considerable integration and, presumably, has led Mexico's economic and financial prospects to be highly dependent upon U.S. economic and financial prospects. Of course, Canada is geographically close to, and economically integrated with, the United States as well. But Canada has a much safer credit rating than does Mexico, and this offsets much of the effect on its exchange rate correlation conferred by its geographical proximity. Finally, given our estimated results, it is no surprise that the currencies of the euro area's neighbors—given their proximity to the euro area and relatively favorable credit ratings—tend to move alongside the euro when the euro moves against the dollar.

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Data Appendix

Industrial Production

Seasonally adjusted industrial production.

Source: Haver Analytics for Argentina, Chile, Colombia, India, Indonesia, Russia, Taiwan, and Venezuela; CEIC for Thailand; IFS line 66..b/c for Brazil, Canada, Czech Republic, Denmark, Hungary, Israel, Japan, Korea, Mexico, Norway, Poland, Sweden, Turkey, United Kingdom, and United States. IFS line 66ey (Manufacturing production, not seasonally adjusted) was manually seasonally adjusted for Pakistan and South Africa. Missing Pakistan data is filled by Manufacturing Production series in EMERGEPR of Haver Analytics.

Interest Rates

Nominal short-term interest rate.

Source: IFS line 60b (Money Market Rate). For Chile, Hungary, India, Norway, and Sweden, IFS line 60 (Discount Rate) was used. For Israel, IFS line 60c (Treasury Bill Rate) was used. For Argentina, IFS line 60l (Deposit Rate) was used.

Inflation

12-month percent change in seasonally adjusted consumer price index.

Source: Haver Analytics; CEIC for China, Hong Kong, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand. IFS line 64 for Pakistan, Peru, and South Africa. Seasonally adjustments were done manually when unavailable.

Exchange Rates

Nominal bilateral exchange rate with the United States (end of period).

Source: IFS line ae. Before January 1999, the EU uses United States line ea (the $/ECU rate).

Equity Prices

Major stock market index.

Source: Bloomberg.

GDP

Gross Domestic Product in current USD.

Source: IFS line 99b(.c).

Trade Levels

Imports and Exports to the United States in current USD.

Source: IMF Direction of Trade Statistics.

Trade Share

Sum of imports and exports to the United States as a percent of GDP

Distance to the United States
Great Circle distance to the United States based on longitude and latitude given by CIA Factbook.
Source: Andrew Rose's Webpage.

International Investment Position
Assets and liabilities in USD.
Source: IFS line 79aad and 79lad.

Portfolio Claims
Portfolio investment from the Coordinated Portfolio Investment Survey.
Source: IMF.

Credit Ratings
Average of S&P and Moody's ratings over the sample period.
Source: Bloomberg.

Real Interest Rate
Calculated by subtracting 12-month inflation rate from the nominal interest rate.

Real Exchange Rate
Calculated by scaling nominal exchange rate changes by US and local inflation.

Interest Rate Differential
Calculated by subtracting local interest rate from the US rate.

Inflation Gap
Calculated by subtracting inflation from an HP-filtered trend of inflation.

Industrial Production Gap
Calculated as the percent deviation of industrial production from an HP-filtered trend measure of industrial production.

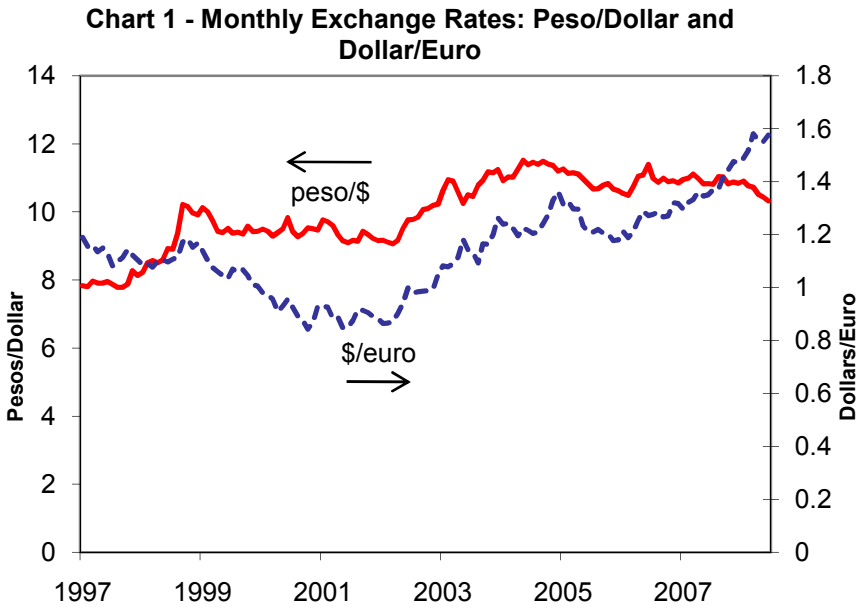


Chart 1 - Monthly Exchange Rates: Peso/Dollar and Dollar/Euro
Pesos/Dollar
Dollars/Euro
peso/$
$/euro
14
12
10
8
6
4
2
0
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1997
1999
2001
2003
2005
2007

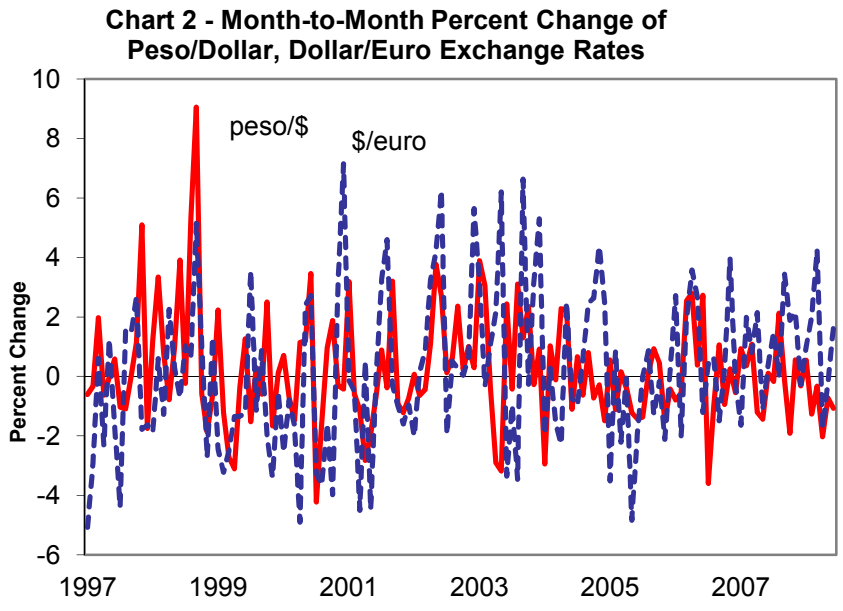


Chart 2 - Month-to-Month Percent Change of Peso/Dollar, Dollar/Euro Exchange Rates
Percent Change
peso/$
$/euro
10
8
6
4
2
0
-2
-4
-6
1997
1999
2001
2003
2005
2007

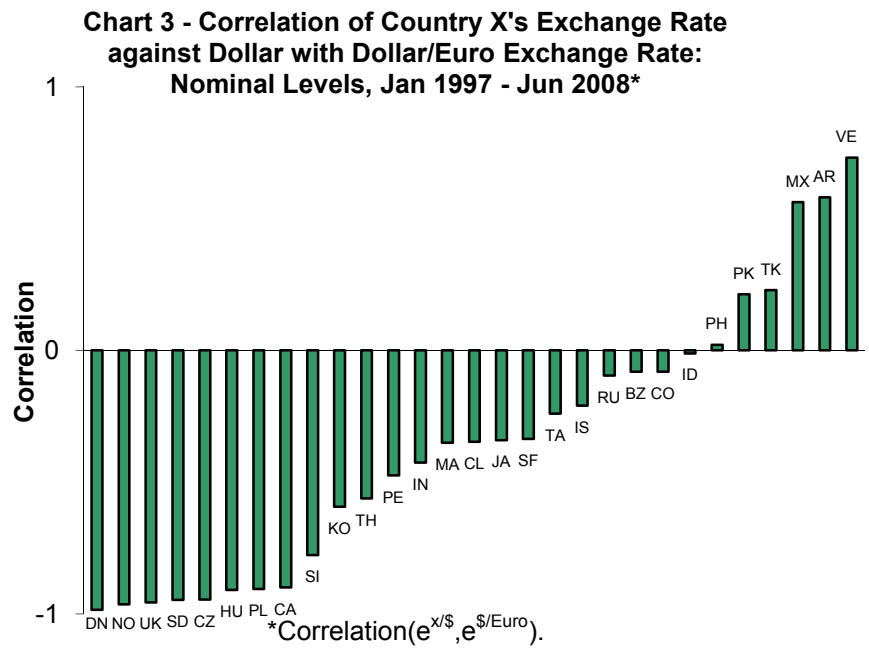


Chart 3 - Correlation of Country X's Exchange Rate against Dollar with Dollar/Euro Exchange Rate: Nominal Levels, Jan 1997 - Jun 2008*
Correlation
1
0
-1
DN NO UK SD CZ HU PL CA SI KO TH PE IN MA CL JA SF TA IS RU BZ CO ID PH PK TK MX AR VE
*Correlation(e^x/$,e^$/Euro).

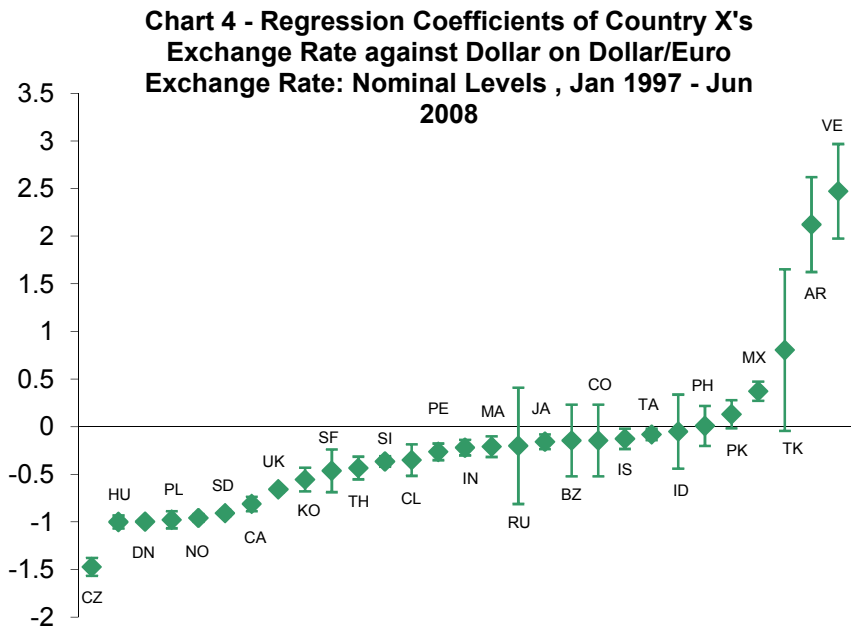


Chart 4 - Regression Coefficients of Country X's Exchange Rate against Dollar on Dollar/Euro Exchange Rate: Nominal Levels , Jan 1997 - Jun 2008
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
CZ HU DN PL NO SD CA UK KO SF TH SI CL PE IN MA RU JA BZ CO IS TA ID PH PK MX TK AR VE

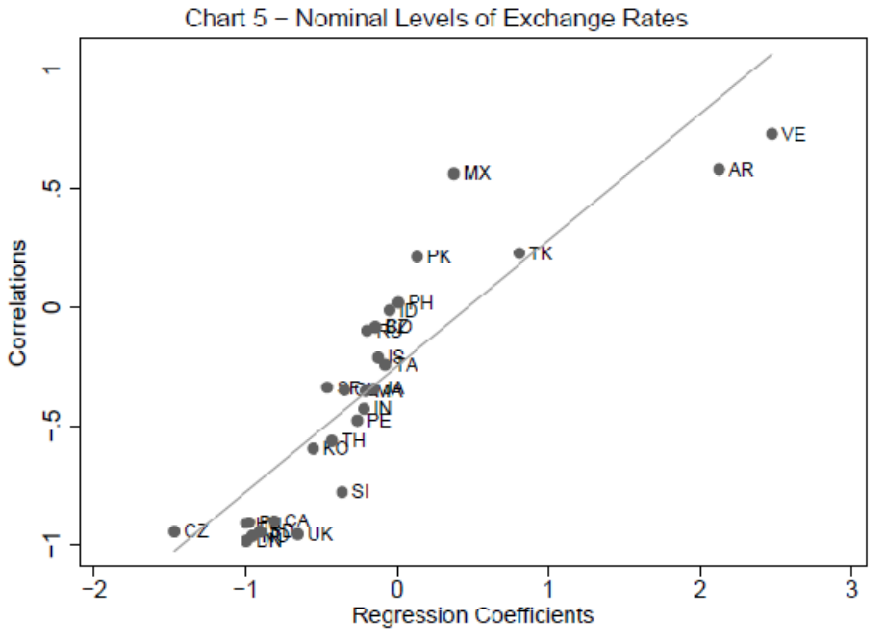


Chart 5 – Nominal Levels of Exchange Rates
Correlations
Regression Coefficients
VE
MX
AR
PK
TK
PH
ID
IS
TA
IN
PE
TH
KO
SI
CZ
CA
UK

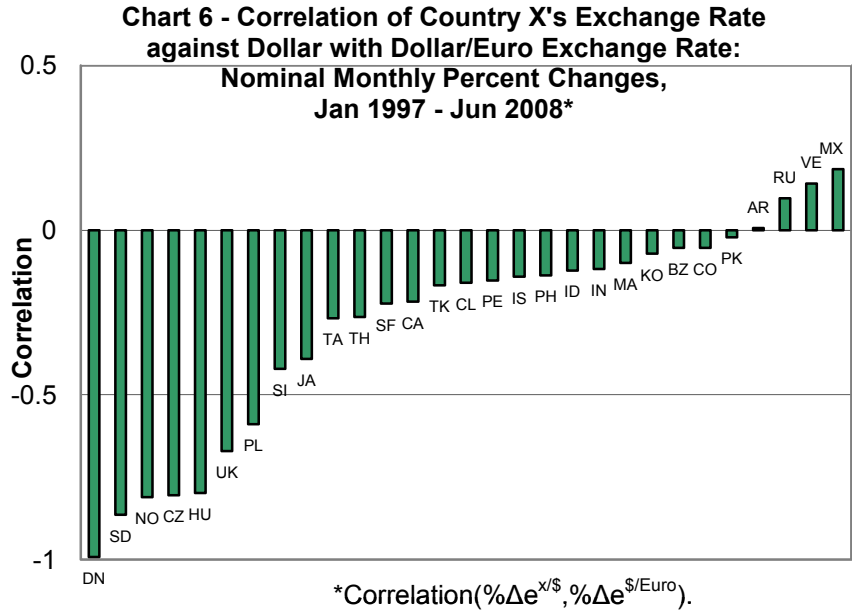


Chart 6 - Correlation of Country X's Exchange Rate against Dollar with Dollar/Euro Exchange Rate: Nominal Monthly Percent Changes, Jan 1997 - Jun 2008*
Correlation
DN
SD
NO
CZ
HU
UK
PL
SI
JA
TA
TH
SF
CA
TK
CL
PE
IS
PH
ID
IN
MA
KO
BZ
CO
PK
AR
RU
VE
MX
*Correlation(%Δe^x/$,%Δe^$/Euro).

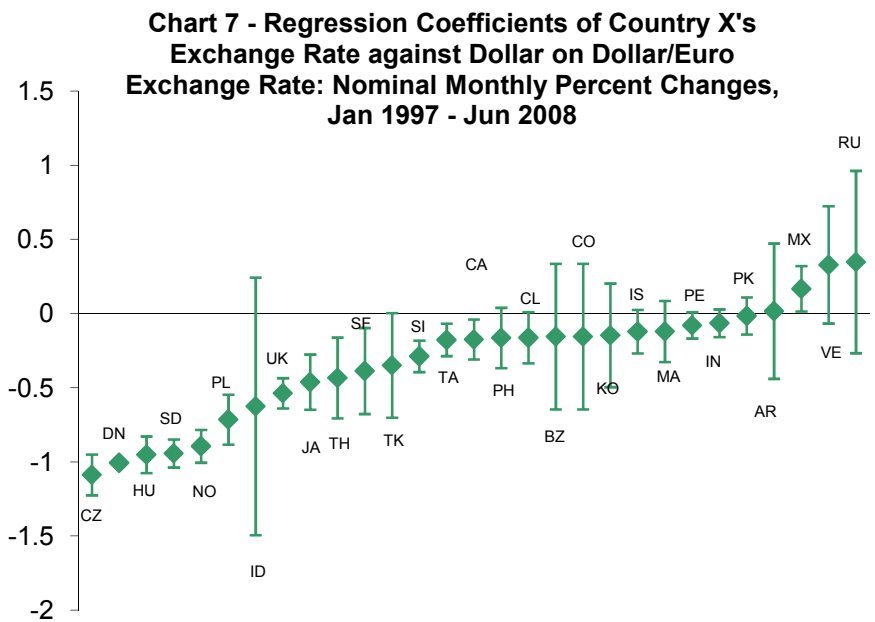


Chart 7 - Regression Coefficients of Country X's Exchange Rate against Dollar on Dollar/Euro Exchange Rate: Nominal Monthly Percent Changes, Jan 1997 - Jun 2008
CZ
DN
HU
SD
NO
PL
ID
UK
JA
TH
SE
TK
SI
TA
CA
PH
CL
BZ
CO
KO
IS
MA
PE
IN
PK
AR
MX
VE
RU

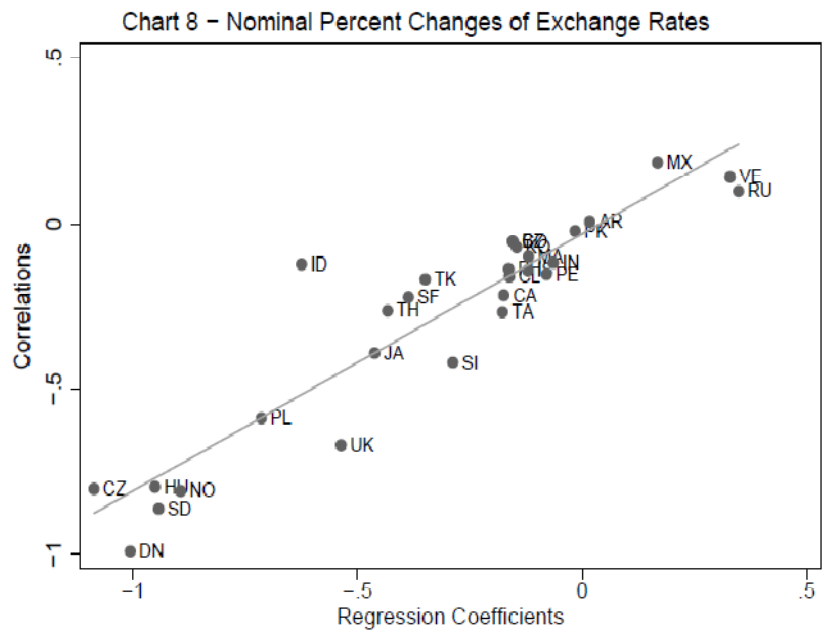


Chart 8 – Nominal Percent Changes of Exchange Rates
Correlations
Regression Coefficients
MX
VE
RU
AR
PK
ID
TK
SF
TH
CA
TA
JA
SI
PL
UK
CZ
HU
NO
SD
DN

Chart 9 - Real Monthly Exchange Rates: Peso/Dollar and Dollar/Euro

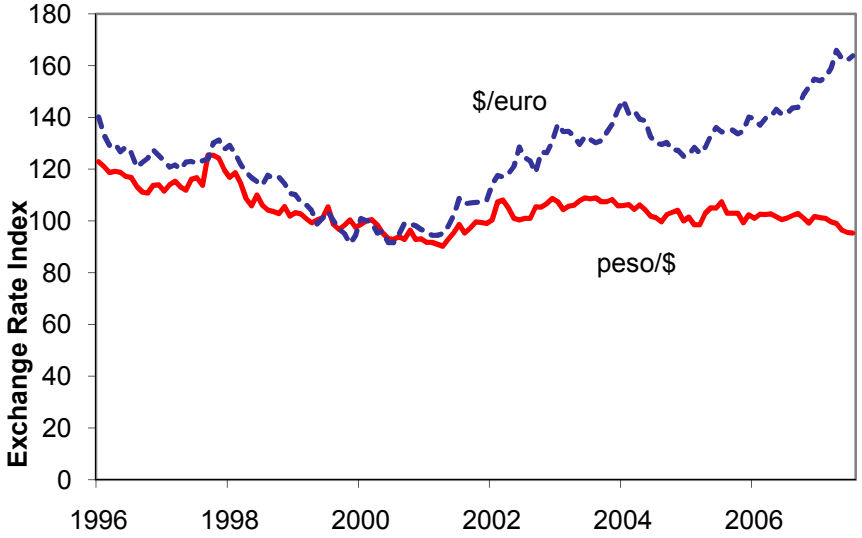


Chart 10 - Month-to-Month Percent Change of Real Peso/Dollar, Dollar/Euro Exchange Rates

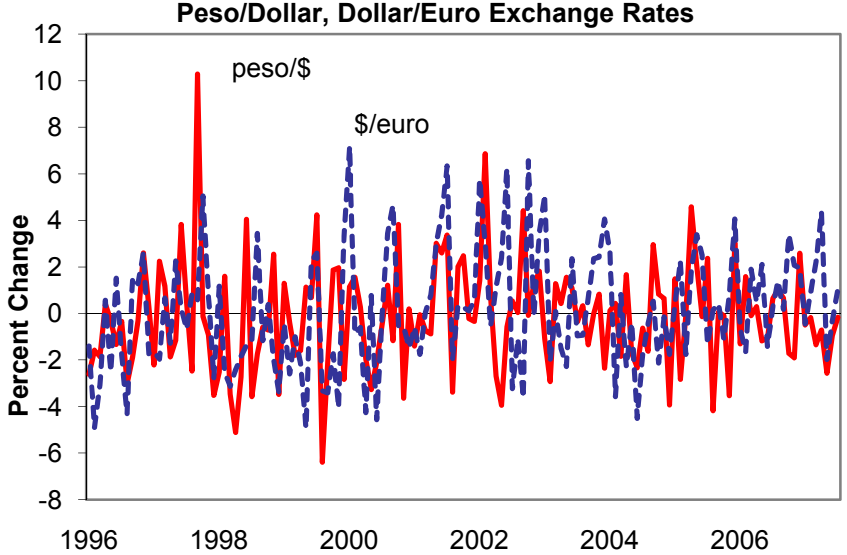
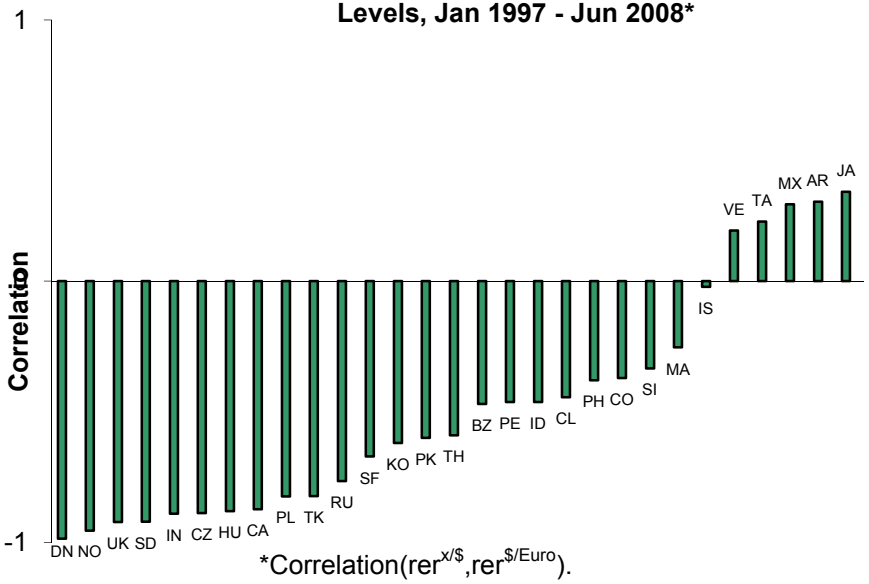
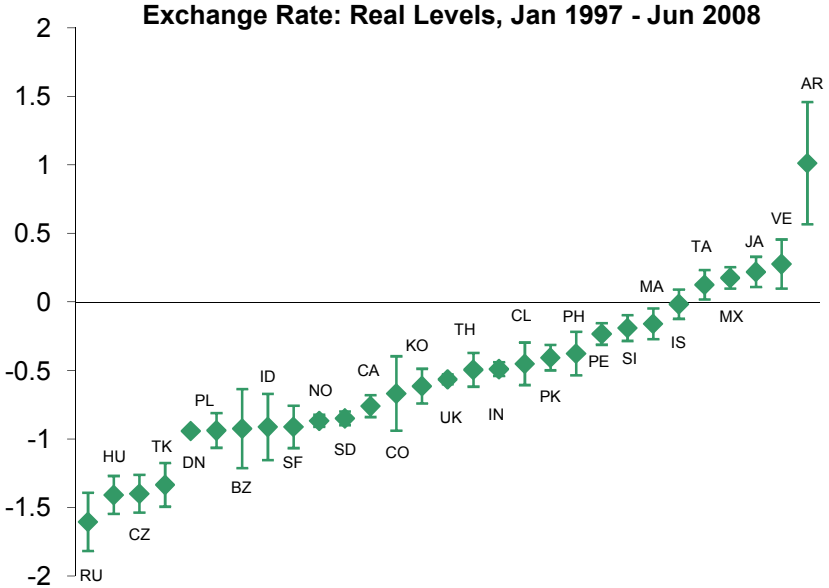


Chart 11 - Correlation of Country X's Exchange Rate against Dollar with Dollar/Euro Exchange Rate: Real Levels, Jan 1997 - Jun 2008*



*Correlation($rer^{x/\$}$,$rer^{\$/Euro}$).

Chart 12 - Regression Coefficients of Country X's Exchange Rate against Dollar on Dollar/Euro Exchange Rate: Real Levels, Jan 1997 - Jun 2008



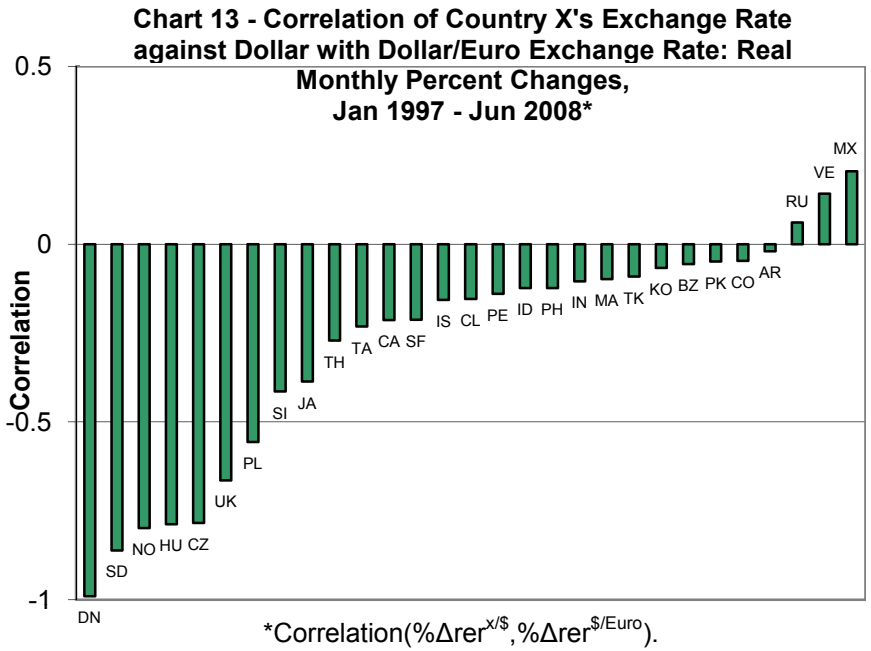


Chart 13 - Correlation of Country X's Exchange Rate against Dollar with Dollar/Euro Exchange Rate: Real Monthly Percent Changes, Jan 1997 - Jun 2008*
Correlation
0.5
0
-0.5
-1
DN SD NO HU CZ UK PL SI JA TH TA CA SF IS CL PE ID PH IN MA TK KO BZ PK CO AR RU VE MX
*Correlation(%Δrer^x/$,%Δrer^$/Euro).

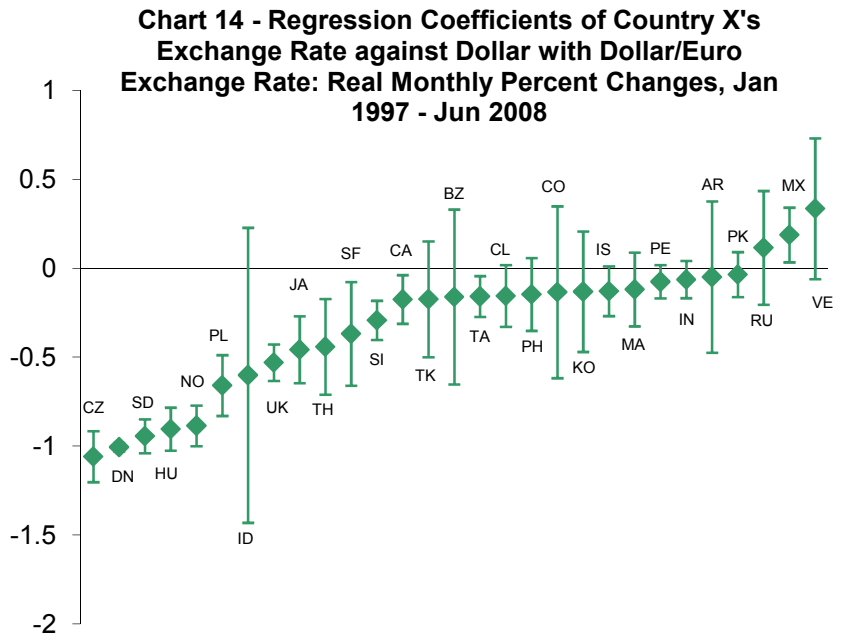


Chart 14 - Regression Coefficients of Country X's Exchange Rate against Dollar with Dollar/Euro Exchange Rate: Real Monthly Percent Changes, Jan 1997 - Jun 2008
1
0.5
0
-0.5
-1
-1.5
-2
CZ DN SD HU NO PL ID UK JA TH SF SI CA TK BZ TA CL PH CO KO IS MA PE IN AR PK RU MX VE

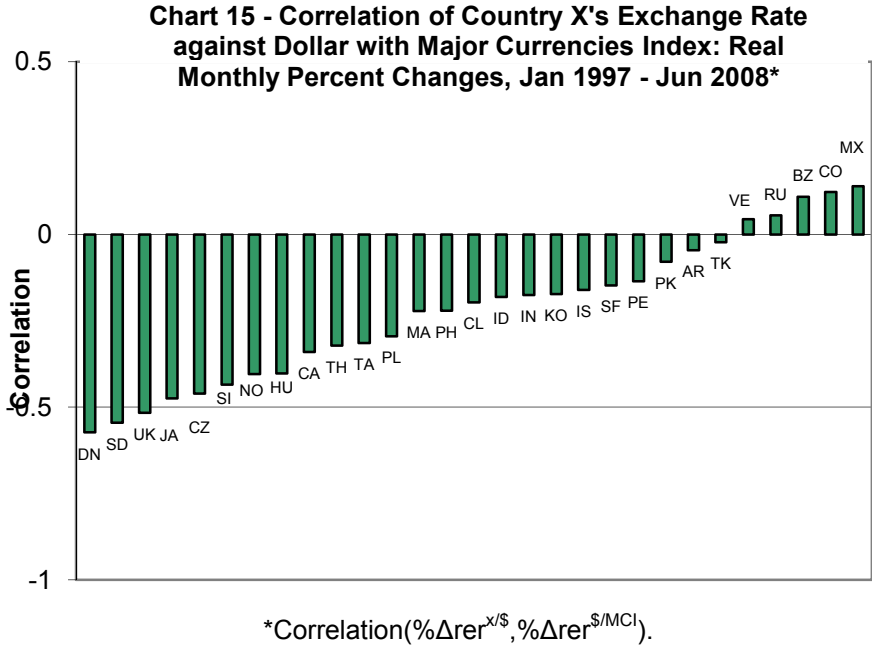


Chart 15 - Correlation of Country X's Exchange Rate against Dollar with Major Currencies Index: Real Monthly Percent Changes, Jan 1997 - Jun 2008*
Correlation
0.5
0
-0.5
-1
DN SD UK JA CZ SI NO HU CA TH TA PL MA PH CL ID IN KO IS SF PE PK AR TK VE RU BZ CO MX
*Correlation(%Δrer^x/$,%Δrer^$/MCI).

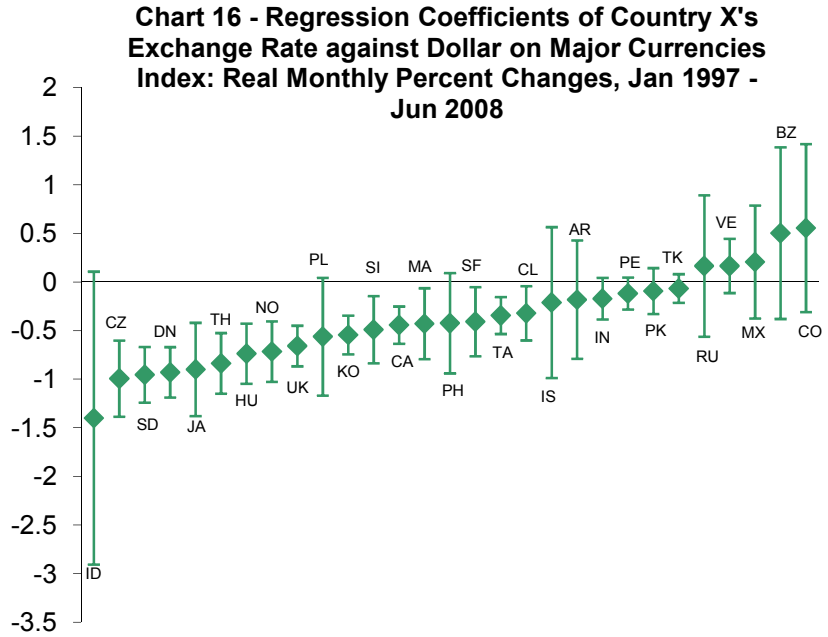
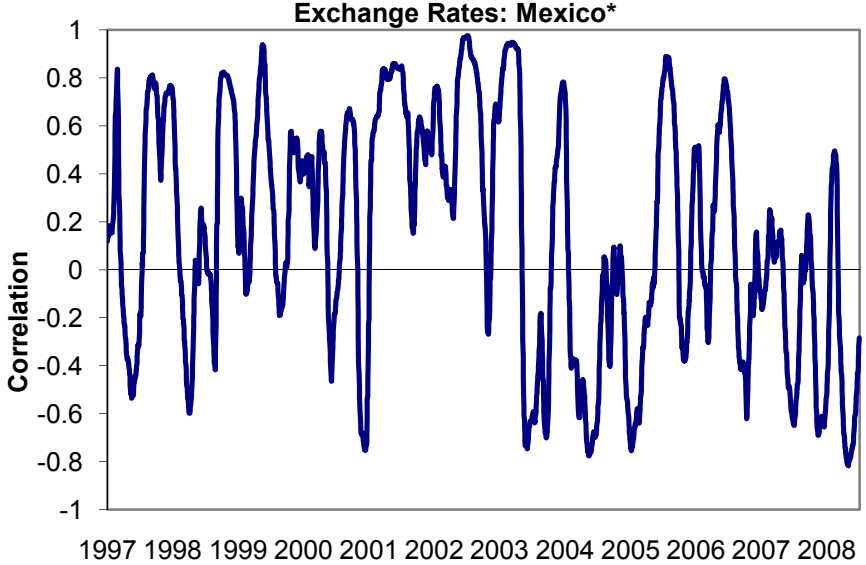


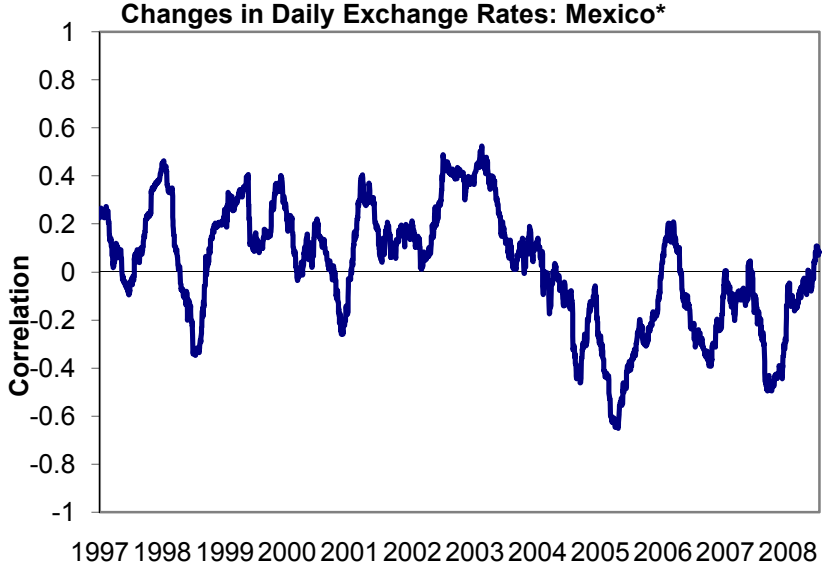
Chart 16 - Regression Coefficients of Country X's Exchange Rate against Dollar on Major Currencies Index: Real Monthly Percent Changes, Jan 1997 - Jun 2008
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
ID CZ SD DN JA TH HU NO UK PL KO SI CA MA PH SF TA CL IS AR IN PE PK TK RU VE MX BZ CO

Chart 17 - Rolling 90-day Correlation of Daily Exchange Rates: Mexico*



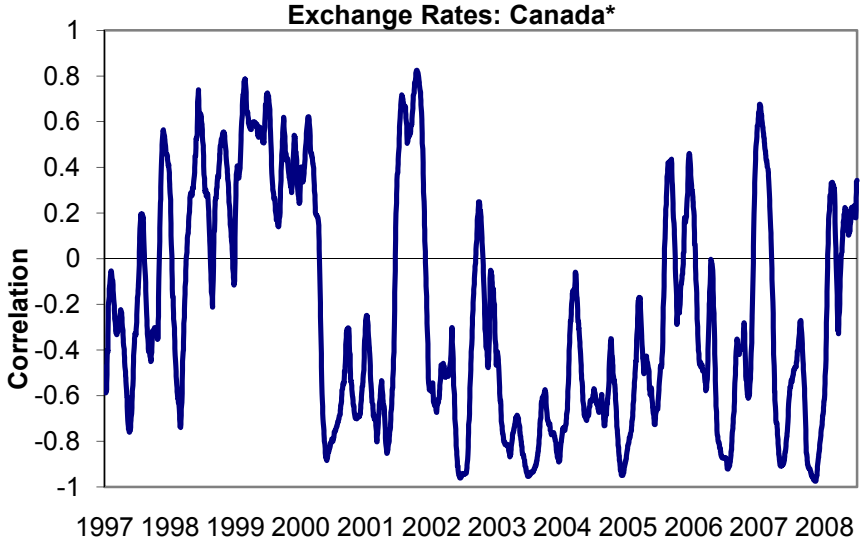
*90 day rolling correlation($e^{Mex/\$}$,$e^{\$/Euro}$).

Chart 18 - Rolling 90-day Correlation of Percent Changes in Daily Exchange Rates: Mexico*



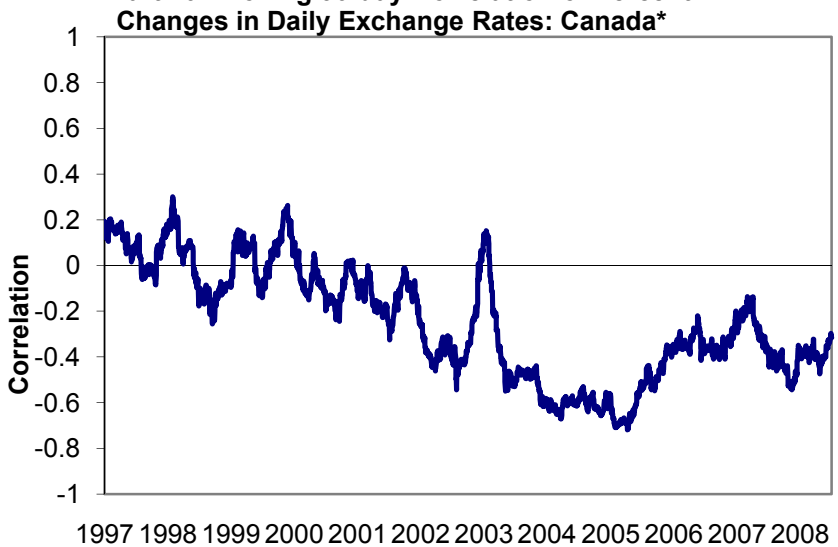
*90 day rolling correlation(%$\Delta e^{Mex/\$}$,%$\Delta e^{\$/Euro}$).

Chart 19 - Rolling 90-day Correlation of Daily Exchange Rates: Canada*



*90 day rolling correlation($e^{Can/\$}$,$e^{\$/Euro}$).

Chart 20 - Rolling 90-day Correlation of Percent Changes in Daily Exchange Rates: Canada*



*90 day rolling correlation(%$\Delta e^{Can/\$}$,%$\Delta e^{\$/Euro}$).

Chart 21 - Monthly Exchange Rates: Venezuelan Bolivar/Dollar and Dollar/Euro

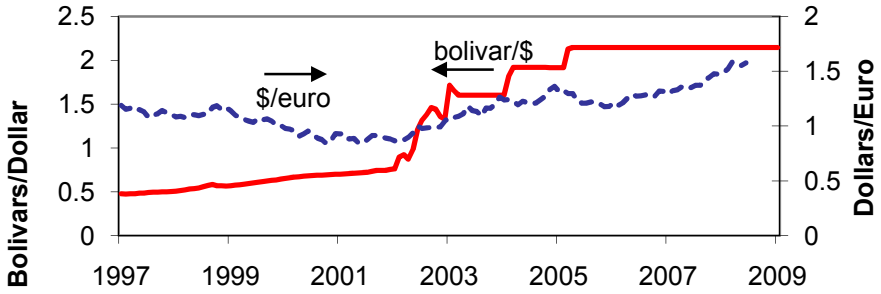
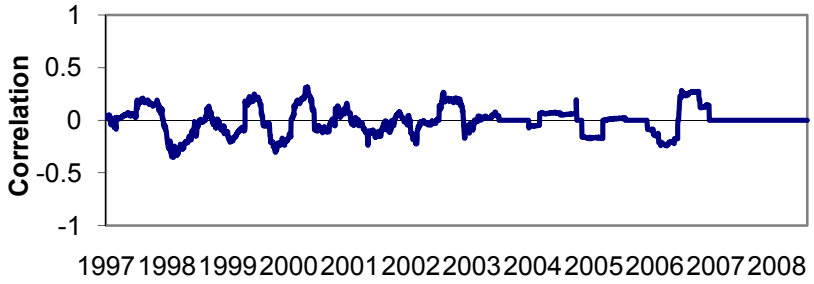


Chart 22 - Rolling 90-day Correlation of Percent Changes in Daily Exchange Rates: Venezuela*



*90 day rolling correlation($\%\Delta e^{Ven/\$}$,$\%\Delta e^{\$/Euro}$).

Chart 23 - Monthly Exchange Rates: Ruble/Dollar and Dollar/Eur

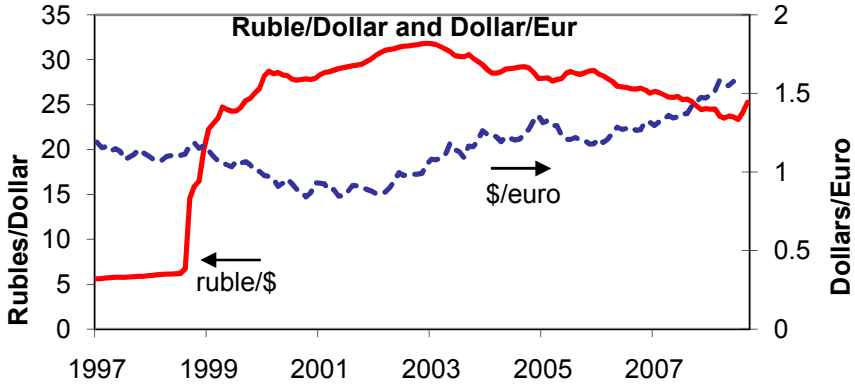
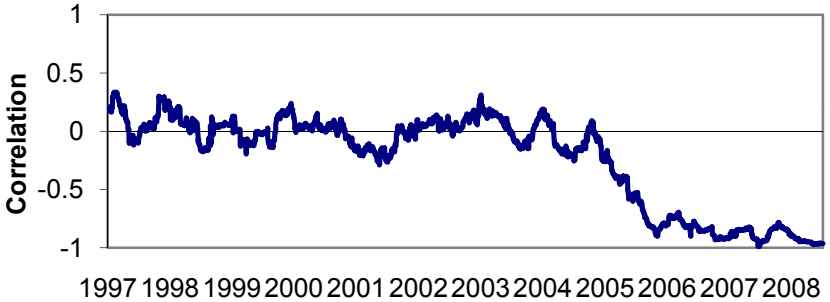


Chart 24 - Rolling 90-day Correlation of Percent Changes in Daily Exchange Rates: Russia*



*90 day rolling correlation($\%\Delta e^{Rus/\$}$,$\%\Delta e^{\$/Euro}$).

Chart 25 - Monthly Exchange Rates: Argentine Peso/Dollar and Dollar/Euro

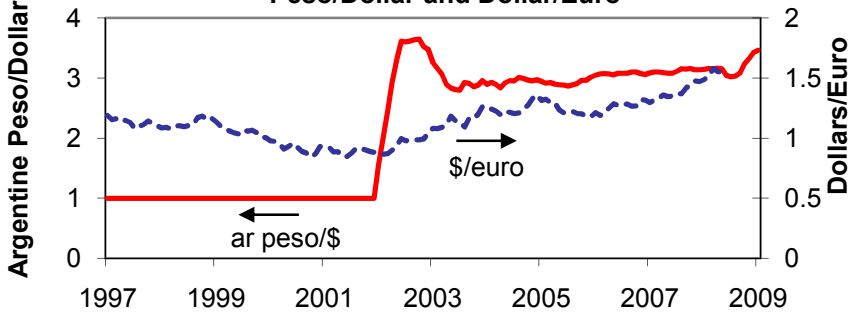
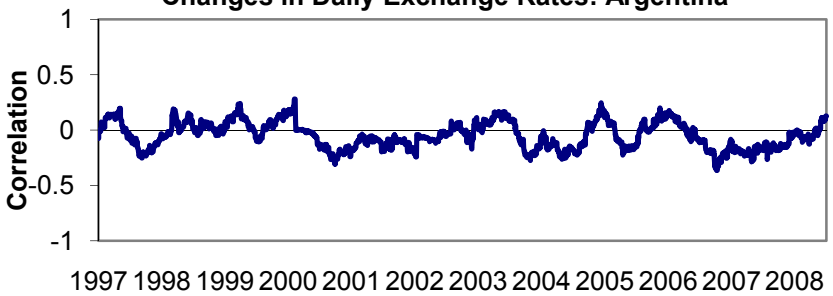


Chart 26 - Rolling 90-day Correlation of Percent Changes in Daily Exchange Rates: Argentina*



*90 day rolling correlation($\%\Delta e^{Arg/\$}$,$\%\Delta e^{\$/Euro}$).

Chart 27 − Interest Rate Differential vs. Exchange Rate

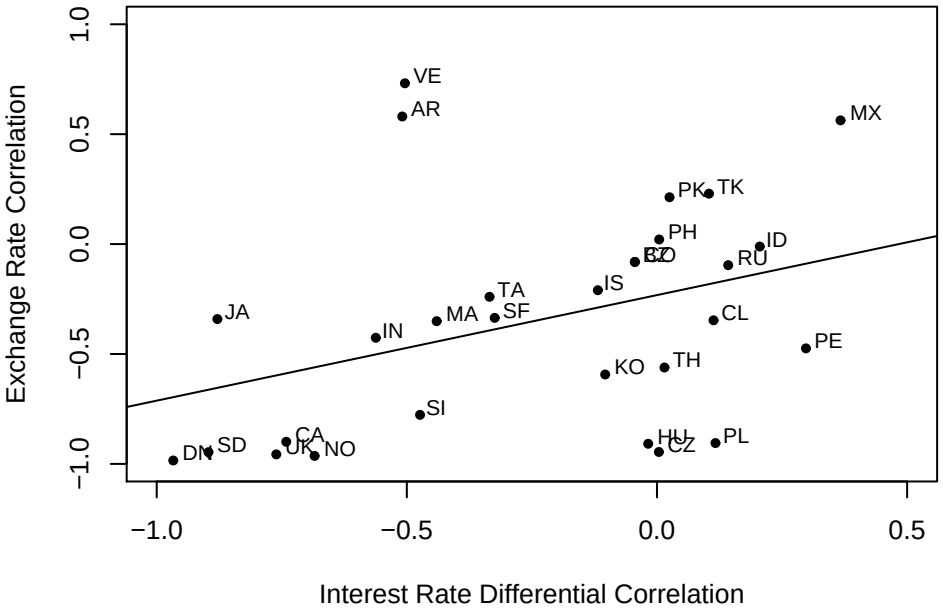


Chart 28 − Interest Rate Differential vs. Exchange Rate in 12 month changes

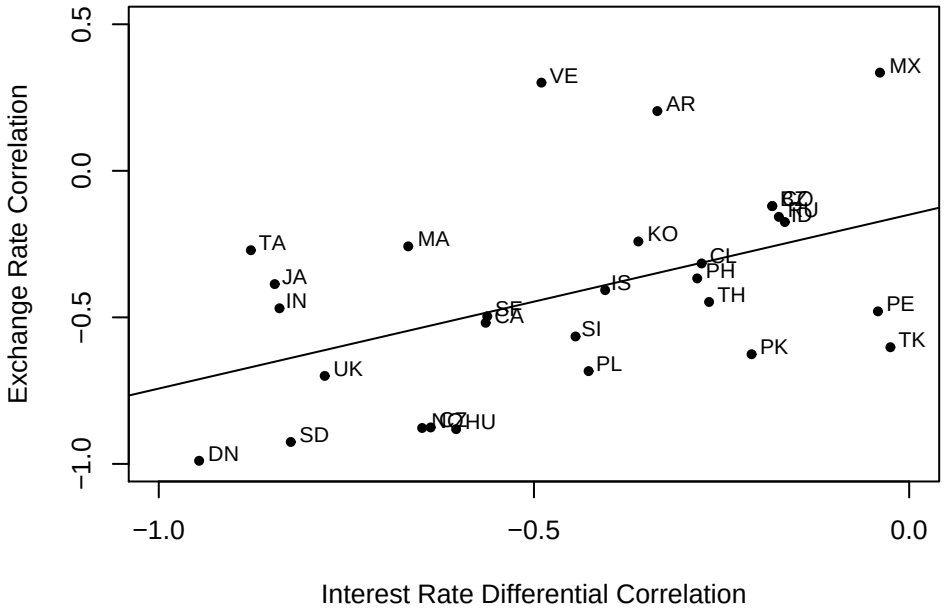


Chart 29 − Real Interest Rate Differential vs. Exchange Rate

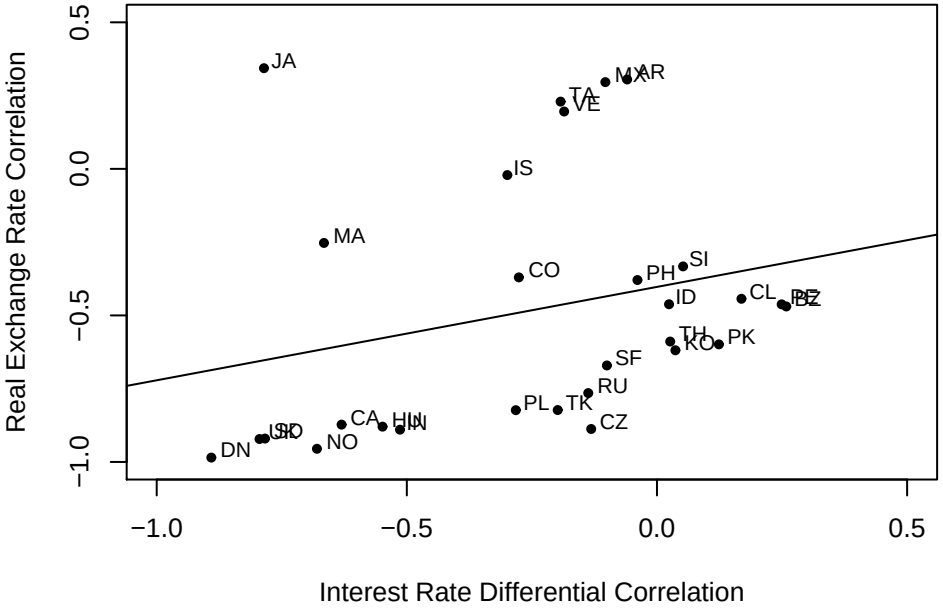


Chart 30 − Real Interest Rate Differential vs. Exchange Rate in 12 month changes

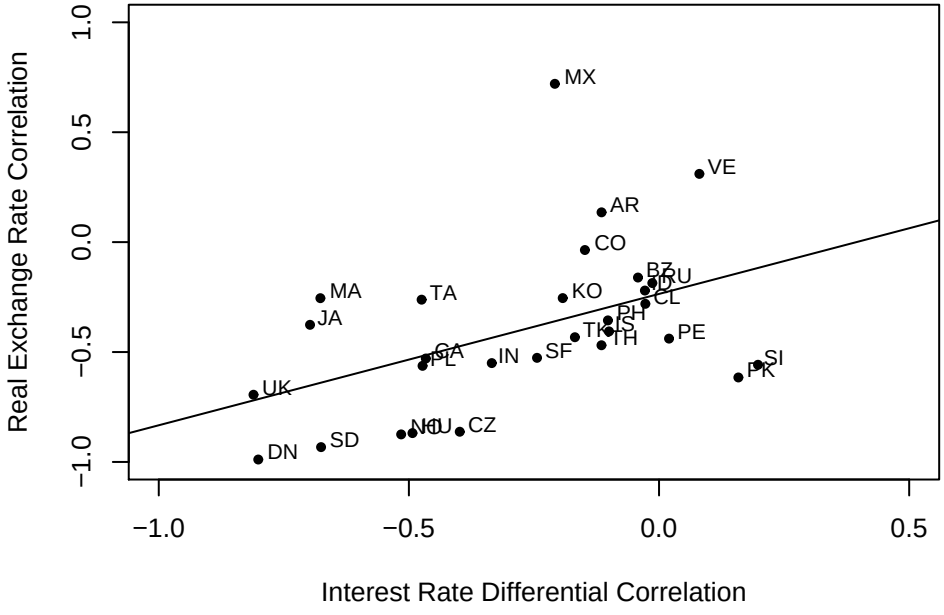
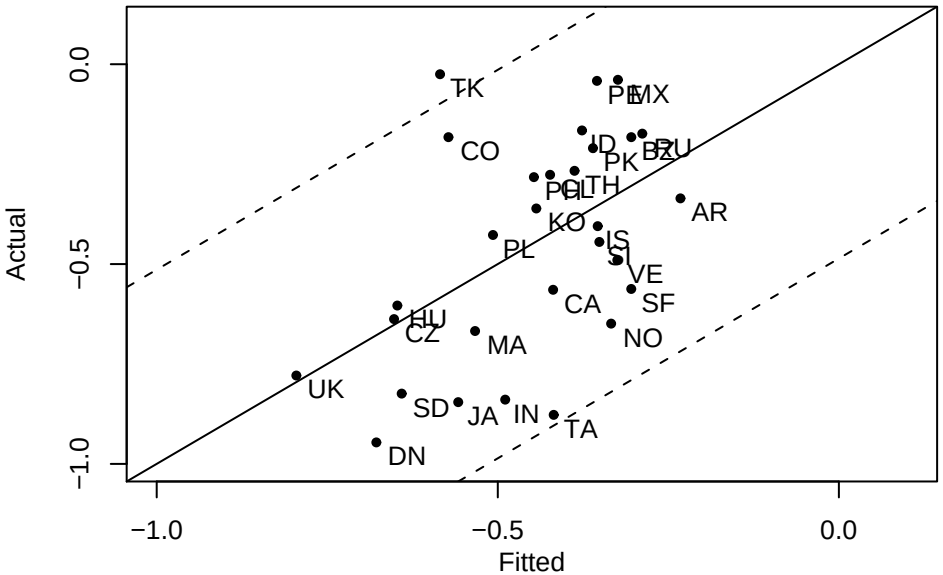
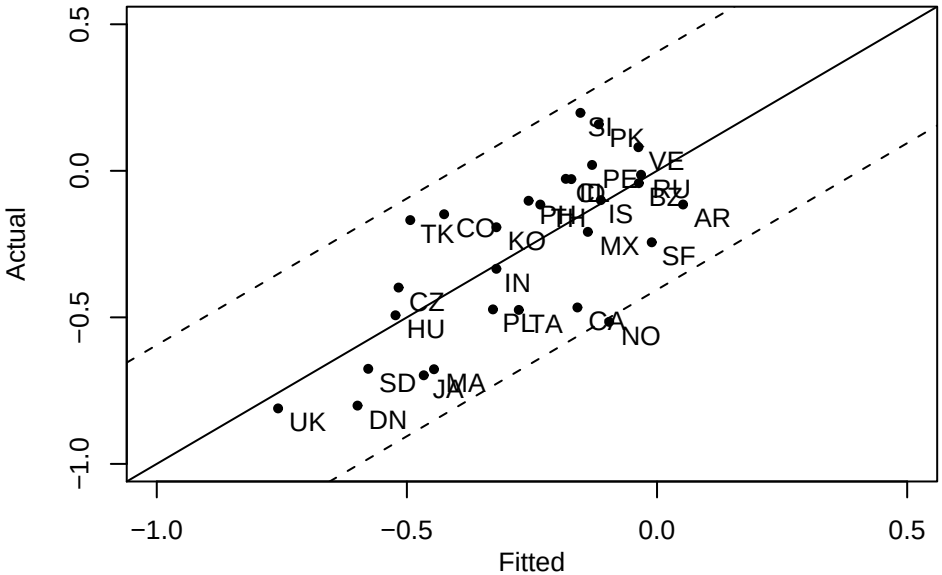


Chart 31 − Correlations of 12−Month Changes in Nominal Interest Rates: Actual vs. Fitted*



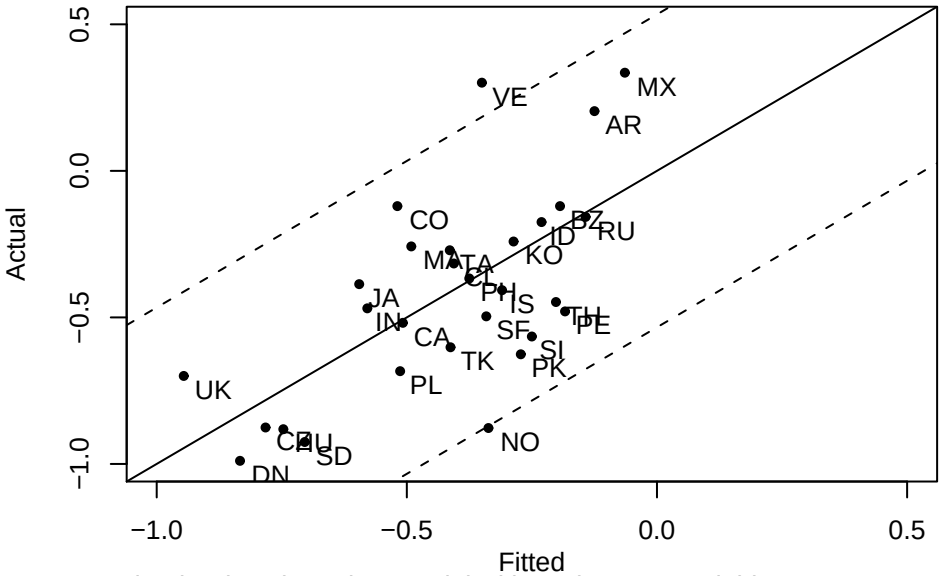
* Fitted Values based on model with explanatory variables:
ΔIP growth differentials, Δπ gap differentials

Chart 32 − Correlations of 12−Month Changes in Real Interest Rates: Actual vs. Fitted*



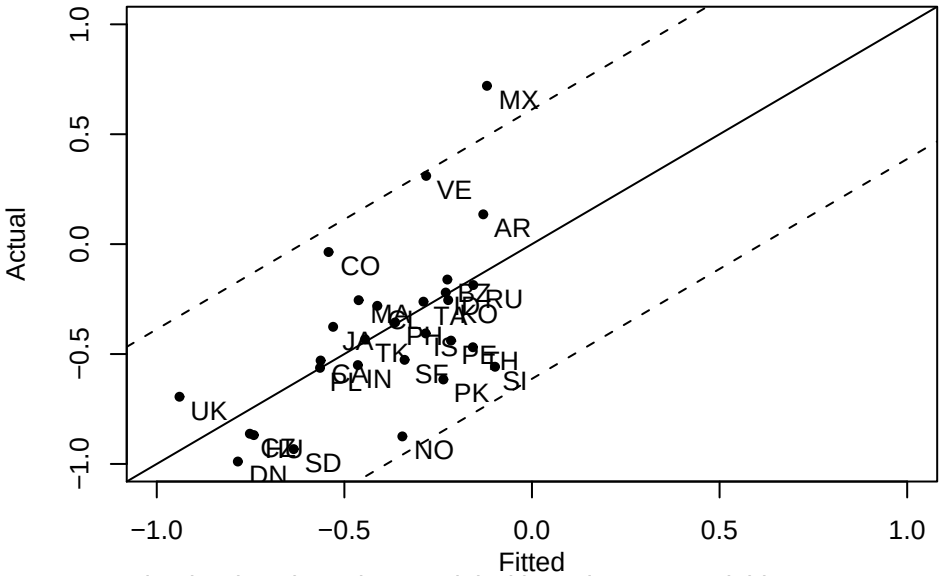
* Fitted Values based on model with explanatory variables:
ΔIP growth differentials, Δπ gap differentials

Chart 33 − Correlations of 12−Month Changes in Nominal Exchange Rates: Actual vs. Fitted*



* Fitted Values based on model with explanatory variables:
ΔIP growth differentials, Δπ gap differentials, Δi differential

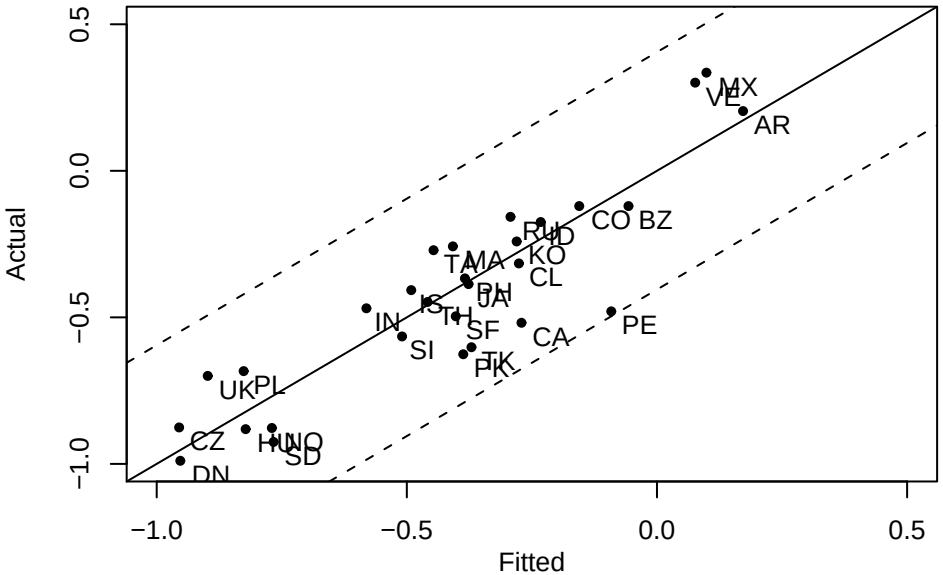
Chart 34 − Correlations of 12−Month Changes in Real Exchange Rates: Actual vs. Fitted*



* Fitted Values based on model with explanatory variables:
ΔIP growth differentials, Δπ gap differentials, Δr differential

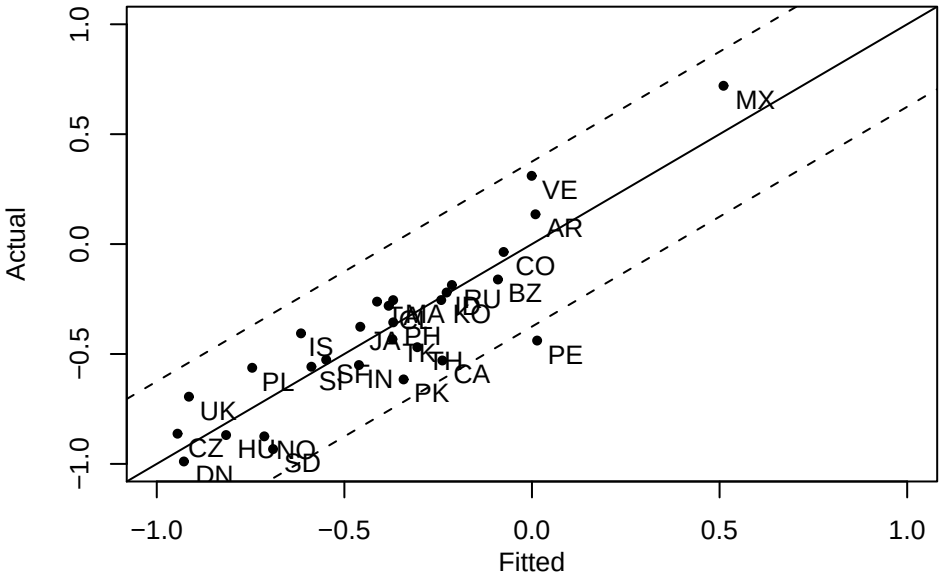
Note: Solid 45º line indicates actual = fitted. Dashed lines equal solid line +/− twice the standard error of the regression.

Chart 35 − Correlations of 12−Month Changes in Nominal Exchange Rates: Actual vs. Fitted*



* Fitted Values based on model with explanatory variables:
Distance to US, Distance to EU, Intl. Financial Size, and Rating.

Chart 36 − Correlations of 12−Month Changes in Real Exchange Rates: Actual vs. Fitted*



* Fitted Values based on model with explanatory variables:
ΔIP growth differentials, Distance to US, Distance to EU, and Rating.

Note: Solid 45º line indicates actual = fitted. Dashed lines equal solid line +/− twice the standard error of the regression.

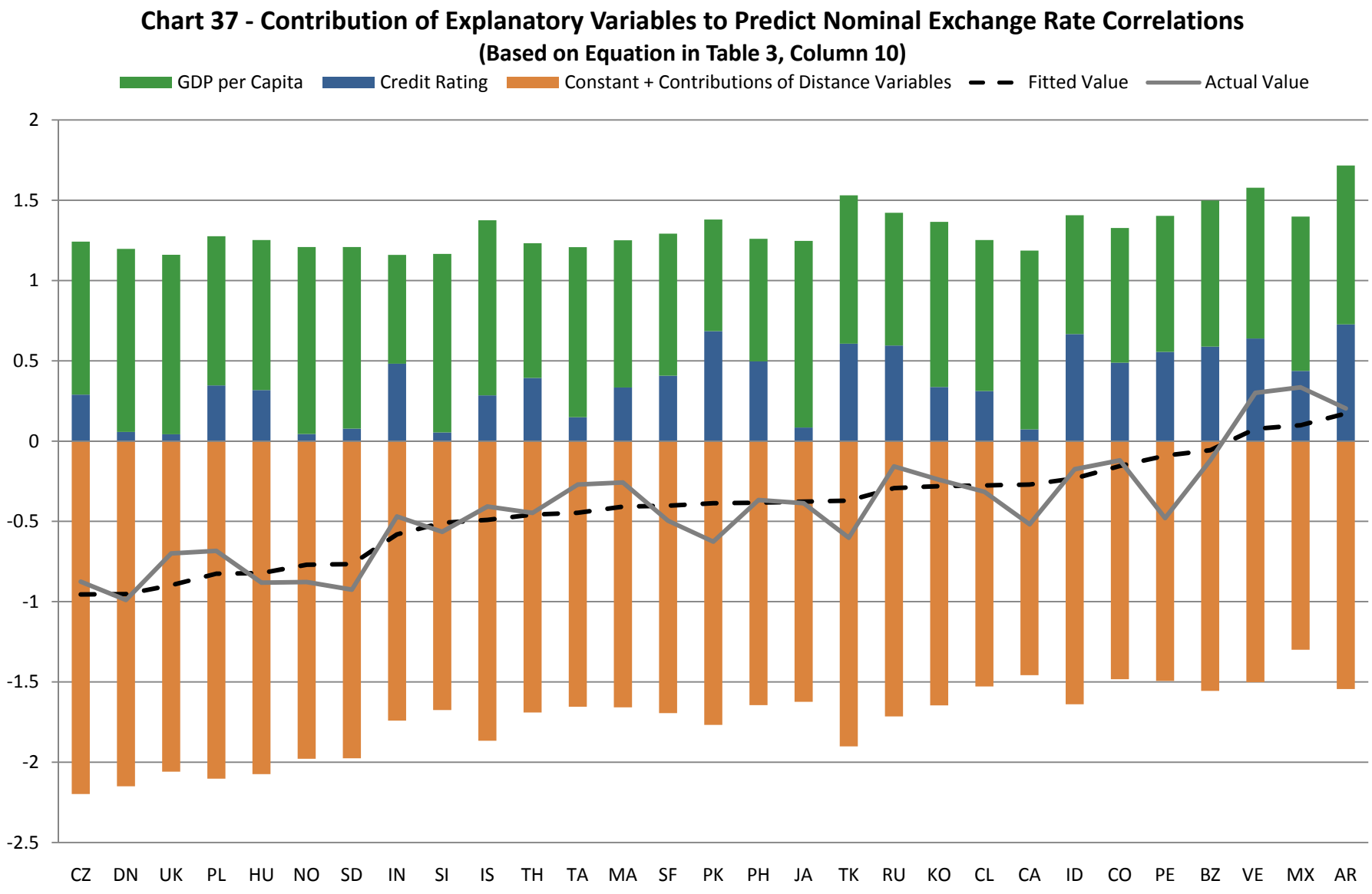


Chart 37 - Contribution of Explanatory Variables to Predict Nominal Exchange Rate Correlations
(Based on Equation in Table 3, Column 10)
GDP per Capita
Credit Rating
Constant + Contributions of Distance Variables
Fitted Value
Actual Value
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
CZ DN UK PL HU NO SD IN SI IS TH TA MA SF PK PH JA TK RU KO CL CA ID CO PE BZ VE MX AR

Chart 38 - Contribution of Explanatory Variables to Predict Real Exchange Rate Correlations

(Based on Equation in Table 4, Column 10)

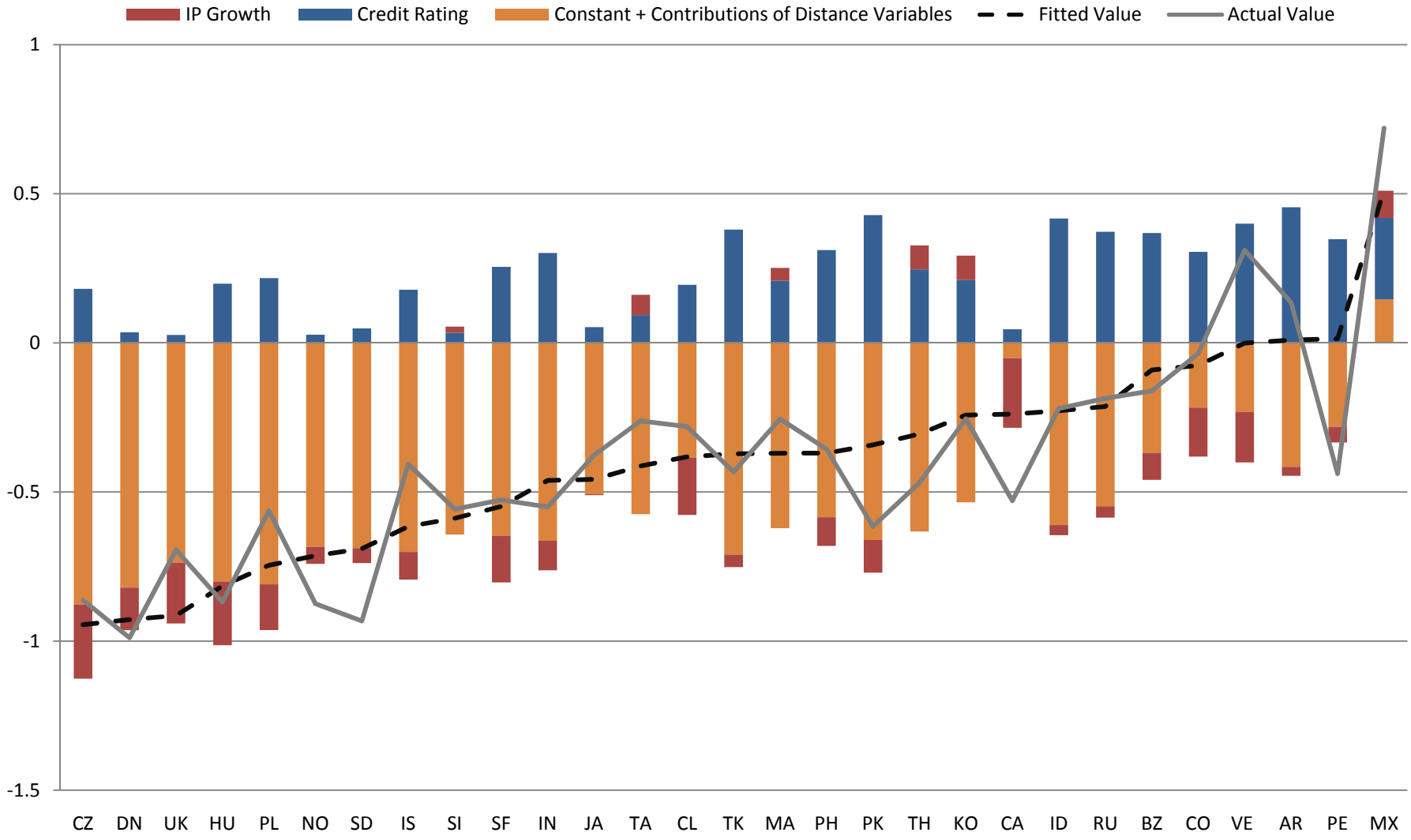


Table 1: Cross-Country Regressions for Correlations of Interest Rate Differentials

Dependent Variable: Correlation(interest rate differential between country X and US, interest rate differential between US and Euro Area)

	Nominal Interest Rate Changes[1]		Real Interest Rate Changes[2]	
	(1)	(2)	(3)	(4)
corr(Δ πgap differentials)[3]	0.50	0.51	0.79	0.80
	(2.7)	(2.8)	(5.3)	(5.2)
corr(Δ IPgap differentials)[4]	0.19		0.23	
	(1.0)		(1.5)	
corr(Δ IP growth differentials)[5]		0.25		0.22
		(1.2)		(1.3)
Adjusted R^2	.25	.25	.50	.49

t-statistics in parentheses, n = 29

1. $\text{corr}(\Delta i^{S}-\Delta i^{x}, \Delta i^{eu}-\Delta i^{S})$
2. $\text{corr}(\Delta r^{S}-\Delta r^{x}, \Delta r^{eu}-\Delta r^{S})$
3. $\text{corr}[\Delta(\pi gap^{S} - \pi gap^{x}),\Delta(\pi gap^{eu} - \pi gap^{S})]$
4. $\text{corr}[\Delta(ipgap^{S} - ipgap^{x}),\Delta(ipgap^{eu} - ipgap^{S})]$
5. $\text{corr}[\Delta(\Delta ip^{S} - \Delta ip^{x}),\Delta(\Delta ip^{eu} - \Delta ip^{S})]$

Table 2: Cross-Country Regressions for Correlations of Exchange Rates

Dependent Variable: Correlation(exchange rate of country x against dollar, exchange rate of dollar against euro)

	Nominal Exchange Rate Changes[1]			Real Exchange Rate Changes[2]		
	(1)	(2)	(3)	(4)	(5)	(6)
corr(Δ πgap differentials)[3]		0.49	0.54		0.33	0.42
		(2.0)	(2.3)		(0.9)	(1.3)
corr(Δ IPgap differentials)[4]		0.26			0.21	
		(1.2)			(0.8)	
corr(Δ IP growth differentials)[5]			0.51			0.59
			(2.2)			(2.2)
corr(Δ interest differential)[6]	0.59	0.34	0.28	0.60	0.36	0.27
	(2.8)	(1.5)	(1.3)	(2.7)	(1.1)	(0.9)
Adjusted R^2	.31	.27	.36	.18	.16	.28

t-statistics in parentheses, n = 29

1. $\text{corr}(\Delta e^{x/\$}, \Delta e^{\$/eu})$
2. $\text{corr}(\Delta re^{x/\$}, \Delta re^{\$/eu})$
3. $\text{corr}[\Delta(\pi gap^{\$} - \pi gap^{x}), \Delta(\pi gap^{eu} - \pi gap^{\$})$
4. $\text{corr}[\Delta(ipgap^{\$} - ipgap^{x}), \Delta(ipgap^{eu} - ipgap^{\$})]$
5. $\text{corr}[\Delta(\Delta ip^{\$} - \Delta ip^{x}), \Delta(\Delta ip^{eu} - \Delta ip^{\$})]$
6. $\text{corr}(\Delta i^{\$} - \Delta i^{x}, \Delta i^{eu} - \Delta i^{\$})$ or $\text{corr}(\Delta r^{\$} - \Delta r^{x}, \Delta r^{eu} - \Delta r^{\$})$

Table 3: Cross-Country Regressions for Correlations of Nominal Exchange Rates with Additional Regressors

Dependent Variable: Correlation(12-month change in nominal exchange rate of country x against dollar, 12-month change in nominal exchange rate of dollar against euro)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
corr(Δ πgap differentials)	0.54	0.15	0.49	0.49	0.63	0.45	0.63	0.35	-0.02		0.50
	(2.3)	(0.8)	(2.1)	(2.1)	(2.5)	(1.8)	(2.5)	(1.6)	(-0.1)		(2.4)
corr(Δ IP growth differentials)	0.51	0.20	0.42	0.51	0.58	0.46	0.49	0.49	0.30		0.48
	(2.2)	(0.9)	(1.6)	(2.2)	(2.4)	(1.8)	(1.9)	(2.3)	(1.5)		(2.4)
corr(Δ interest differential)	0.28	0.08	0.36	0.23	0.28	0.24	0.39	-0.07	-0.45		
	(1.3)	(0.5)	(1.5)	(1.1)	(1.3)	(0.9)	(1.6)	(-0.3)	(-2.1)		
Distance from the United States		-0.22							-0.26	-0.18	
		(-2.7)							(-2.7)	(-2.8)	
Distance from the Euro Area		0.20							0.21	0.21	
		(3.7)							(3.8)	(6.4)	
Trade Share			0.00						-0.00		0.01
			(1.2)						(-0.2)		(2.2)
Correlation of Stock Market Returns				-0.44					0.12		
				(-1.5)					(0.5)		
U.S. Portfolio Integration					0.00				0.00		
					(1.0)				(1.5)		
International Financial Integration						-0.03			-0.04		
						(-0.9)			(-1.3)		
International Financial Size							0.00		-0.00		0.00
							(1.2)		(-0.8)		(2.3)
Credit Rating								0.05	0.06	0.04	0.04
								(2.6)	(3.8)	(4.0)	(3.7)
GDP per Capita								0.10	0.11	0.11	
								(1.6)	(2.1)	(2.6)	
Adjusted R^2	.36	.63	.37	.39	.36	.37	.36	.46	.78	.77	.57

t-statistics in parentheses, n = 28 in regressions (3), (6), (7), (10), and (11), n = 29 in all others

Table 4: Cross-Country Regressions for Correlations of Real Exchange Rates with Additional Regressors

Dependent Variable: Correlation(12-month change in real exchange rate of country x against dollar, 12-month change in real exchange rate of dollar against euro)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
corr(Δ πgap differentials)	0.42	-0.01	0.32	0.46	0.50	0.31	0.49	0.28	-0.11		
	(1.3)	(-0.1)	(0.9)	(1.4)	(1.4)	(0.9)	(1.4)	(0.9)	(-0.4)		
corr(Δ IP growth differentials)	0.59	0.36	0.51	0.60	0.65	0.56	0.61	0.53	0.32	0.43	
	(2.2)	(1.5)	(1.8)	(2.2)	(2.3)	(2.0)	(2.1)	(2.2)	(1.3)	(2.3)	
corr(Δ interest differential)	0.27	0.24	0.37	0.15	0.28	0.17	0.34	-0.02	-0.03		
	(0.9)	(1.0)	(1.2)	(0.5)	(0.9)	(0.5)	(1.0)	(-0.1)	(-0.1)		
Distance from the United States		-0.36							-0.31	-0.37	
		(-4.1)							(-2.8)	(-5.2)	
Distance from the Euro Area		0.18							0.17	0.15	
		(3.0)							(2.5)	(3.5)	
Trade Share			0.01						0.00		0.01
			(1.5)						(0.1)		(2.3)
Correlation of Stock Market Returns				-0.35					0.09		
				(-1.0)					(0.3)		
U.S. Portfolio Integration					0.00				0.00		
					(0.8)				(0.8)		
International Financial Integration						-0.05			-0.04		
						(-1.4)			(-1.1)		
International Financial Size							0.00		-0.00		
							(0.9)		(-0.3)		
Credit Rating								0.06	0.05	0.03	0.07
								(2.7)	(2.7)	(3.4)	(4.3)
GDP per Capita								0.12	0.10		0.15
								(1.6)	(1.5)		(2.1)
Adjusted R^2	.28	.63	.31	.27	.27	.30	.27	.40	.72	.75	.47

t-statistics in parentheses, n = 28 in regressions (3), (6), (7), (10), and (11), n = 29 in all others