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Journal of Business Research 61 (2008) 657–668
JOURNAL OF BUSINESS RESEARCH

Strategic currency hedging and global portfolio investments upside down

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Received 1 February 2007; received in revised form 1 April 2007; accepted 1 June 2007

Abstract

The literature on the convenience of currency hedging of international portfolio investments has not reached a final verdict. There are arguments for (Perold and Schulman [Perold, A.F. and Schulman, E.C. (1988). The free lunch in currency hedging: implications for investment policy and performance standards, Financial Analysts Journal, May/June Vol. 44, No. 3: 45–52]) and against (Froot [Froot, K. (1993). Currency hedging over long horizons. NBER Working Paper 4355.] and Campbell et al. [Campbell, J.Y., Viceira, L.M. and White, J.S. (2003). Foreign currency for long-term investors. The Economic Journal, Volume 113, Number 486, (March), pp. C1–C25(1)]). This paper analyzes the perspective of global investors based in emerging markets, for which hedging should imply increasing expected returns. The question thus is whether currency hedging is a "free lunch" in this case. No free lunch exists, as it turns out. *Hard currencies* act as *natural hedges* against global (and local) portfolio losses, since they tend to appreciate with respect to emerging market currencies when the world portfolio return is negative. Therefore, in this case currency hedging increases volatility—although also increasing expected returns. This result is likely to hold generally for relatively open economies with flexible exchange rate regimes.

Keywords: Hedging; Currency risk; Global equity; Emerging markets; Portfolio choice

1. Introduction

The literature of international portfolio investments has repeatedly addressed the issue of currency risk hedging, at least since Solnik (1974). Assuming local currency equity values uncorrelated with exchange rates, he finds that optimal portfolios should include positions in forward contracts, that is, currency risk should be partially hedged. Stulz (1984) addresses optimal hedging policies and Black (1990) shows (under relatively strict assumptions) that there exists a universal hedge ratio—or fraction of the total investment abroad that should be covered—which should be identical for all investors, independently of nationality, and also that investors should never fully hedge foreign currency exposures. Adler and Prasad (1992) generalize this result, relaxing some of the earlier assumptions. Summarizing and generalizing much of the earlier literature, Lioui and Poncet (2003) develop a model where deviations from international purchasing power parity can occur. These authors find that investors hedge against movements in international real interest rate differentials with respect to local real rates. These movements obey to purchasing power parity deviations, which in turn depend on real exchange rate fluctuations. Thus, in this model currency hedging does take place.

The empirical evidence regarding the convenience of hedging also shows mixed results. The usual perspective is that of an investor based in a developed country who allocates funds to other (e.g., developed and emerging) markets. Eun and Resnick (1988) argue that exchange rate risk is, to a great extent, non-diversifiable, and find that stock portfolios perform better when fully hedged. Moreover, Perold and Schulman (1988) argue that currency hedging reduces risk without commensurately affecting returns, concluding that there is a free lunch. However, Bekaert and Hodrick (1992) show that the addition of currencies improves the performance of stock portfolios. Solnik (1993, 1988) finds that currency risk hedging has an investor specific role in the short term. Considering developed markets only, Glen and Jorion (1993) find that hedging significantly improves portfolio performance (with and without the use of conditioning information). Statman (2004) concentrates on developed markets and concludes that between 1988 and 2003 hedging makes no significant difference.

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0148-2963/$ - see front matter © 2007 Published by Elsevier Inc.
doi:10.1016/j.jbusres.2007.06.041

Finally, from a prescriptive angle, opinions also are divided. Perold and Schulman (1988) argue for a free lunch and 100% hedging. Solnik (1988) argues that foreign currency may partly hedge local inflation (or interest rate) risk, so there is room for diversification in (partially) unhedged portfolios. Black (1990) recommends a hedge ratio between 30 and 75%, Gastineau (1995) recommends about 50% and Froot (1993) argues against hedging. Campbell et al. (2003) in turn argue that net foreign currency exposure is desirable to hedge against drops in local real interest rates, a particularly important risk for long-term investors. In addition to his own results, this discussion leads Statman (2004) to conclude that investors with reliable information regarding currencies should bet on them, without confusing this decision with the idea of (strategic) hedging since its convenience is not clear.

A perspective usually ignored (for natural reasons) is that of an emerging-market-based investor who invests globally. The latter perspective may be important for several reasons. First, it is interesting to see how and if the interpretation of the arguments presented above can change. Second, these investors may act directly or indirectly as counterparts of developed market investors and understanding the incentives they face may be important. Third, emerging market institutional investors are accumulating significant assets under management, after (Chilean-style) pension reform has been implemented in several countries around the world. About 24 countries—most of them considered "emerging"—have engaged in such reforms, accumulating funds of about 209 billion dollars as of December 2005. Of this total, about 12.4% is invested in foreign assets. These numbers do not include Brazil, for example, which has significant pension assets but has not reformed its pension system (FIAP, 2006). This study considers the optimality of hedging from this perspective.

An important element for the hedging decision is whether currency risk premia exist. There is evidence that currency risk is priced in developed and emerging markets. Regarding the former, see, for example, Dumas and Solnik (1995), De Santis and Gerard (1998), Choi et al. (1998), Doukas et al. (1999), Carrieri (2001) and Roache and Merritt (2006). In the case of emerging markets, Harvey (1995) argues that there are predictably high returns, part of which is likely to be due to currency risk. Claessens et al. (1995) find that currency risk is priced in several emerging markets; Carrieri et al. (2004) conclude that currency risks account for 20 to 30% of emerging market risk premiums, and Carrieri and Majerbi (2005) find evidence of unconditional or long-term currency risk premia.

Since hedging foreign currency risk using forwards is equivalent to selling foreign currency deposits and buying local currency deposits with the proceeds, expected returns should increase from the perspective of an emerging-market-based investor, if the other currencies considered are from developed or safer countries. Does this imply that there is a free lunch in this case, meaning that currency hedging will both increase expected returns and reduce risk? This question is the focus of this work.

After analyzing the "strategic" (long-term or policy) currency hedging decision from the perspective of an emerging-market-based investor who allocates (a fraction of her) assets under management to global equity, the conclusion is that *hard currencies* act as *natural hedges* against global (and local) portfolio losses, since they tend to appreciate with respect to emerging market currencies when the world portfolio return is negative. Specifically, currency betas have significantly increased for most of the countries studied. Therefore, in this case currency hedging actually increases the volatility of investing in global portfolios, but it should also generally increase expected returns. Thus, a result that is likely to hold for open economies with flexible exchange rate regimes is that there is no free lunch. This paper also contrasts this perspective with that of developed market investors and partially addresses estimation issues related with different exchange rate regimes.

2. The effect of hedging on expected returns

The local currency return of the unhedged global portfolio is

$$r_{GL} = (1 + r_G)(1 + e_L) - 1 = r_G + e_L + r_G e_L \tag{1}$$

where e_L is the exchange rate variation measured as local currency units per dollar. Appendix A shows that if h is the hedged fraction of the initial investment the result is

$$1 + r_{GL}(h) \equiv (1 + r_G)(1 + e_L) + h\left(e_{fL} - e_L\right) \tag{2}$$

Here e_{fL} is the return on the currency forward contract. Finally, Appendix A also shows that if $h=1+r_F$, then Eq. (2) becomes

$$r^*_{GL} \approx r_{FL} + (r_G - r_F) \tag{3}$$

Interestingly, this condition reminds us that with a *full* currency hedge (*ex ante* and *ex post*) the foreign investment risk premium earned with respect to the local risk-free rate is equal to the risk premium with respect to the foreign risk-free rate. Furthermore, ignoring the cross-product in Eq. (1), subtracting Eq. (1) from Eq. (3) and taking the expected value, the following condition results.

$$E\left(r^*_{GL} - r_{GL}\right) = r_{FL} - r_F - E(e) = \pi_{FL} \tag{4}$$

So if emerging market currencies have a positive risk premium ($\pi_{FL}>0$), hedging currency risk should increase the

Table 1
Notation

r_G	Dollar return of a global equity portfolio
r_F	Dollar risk-free interest rate
r_{FL}	Local currency risk-free interest rate, for country L
$r_{GL}(h)$	(Country L) local currency return of the foreign investment when fraction h of the initial investment has been hedged
r_{GL}	$\equiv r_{GL}(0)$
r^*_{GL}	$\equiv r_{GL}(h)$ with $h=1+r_F$
r_{PL}	Return of local equity measured in the local currency of country L
e_L	Exchange rate variation ($X_{1L}/X_{0L}-1$), measured as local currency per dollar
e_{fl}	Forward exchange rate variation ($X_{fL}/X_{0L}-1$), measured as local currency per dollar
π_{FL}	Local currency risk premium
β_{el}	$=\text{cov}(r_G,e_L)/\text{var}(r_G)$, "beta" of the local currency (dollars per unit of local currency) with respect to the global portfolio

expected return by exactly that amount. As discussed, Claessens et al. (1995), Carrieri et al. (2004) and Carrieri and Majerbi (2005) find evidence that currency risk is priced in emerging markets. Then, except for transaction costs, currency hedging should increase expected returns. Also, given that interest rates are known at the beginning of the hedging period, the variance of a fully hedged global portfolio is just the variance of its dollar returns, $\text{var}(r^*_{GL}) \approx \text{var}(r_G)$. An implicit assumption (from the perspective of an emerging-market-based investor) is that the local currency interest rate will be received and the foreign currency rate will be paid with certainty. Table 1 summarizes the notation used.

3. Stylized facts for currency hedging in the perspective of emerging market based investors

This paper considers an (emerging-market-based) investor that destines part of her portfolio to global equities, whose returns are measured using the MSCI World Free index. Returns are translated into the currency of the country of origin. The analysis covers seven Latin American countries. The currency values derive from the ratios of the local currency to dollar value MSCI indices of each country. Local interest rate data comes from the IFS databases. They basically correspond to average local currency deposits.

This section analyzes the impact of hedging on portfolio volatility from different perspectives by looking at variance ratios, currency betas and minimum variance portfolios. The different exchange rate regimes adopted by each country through time are a cause for concern regarding potential biases in the results, but in any case, exchange rate intervention should bias them against the hypothesis that currency hedging increases volatility, since when the exchange rate is pegged, the State provides implicit currency hedging or insurance. The following subsection partially addresses this issue.

3.1. Results without adjusting for different exchange rate regimes

3.1.1. Variance ratios

Given the result presented in Eq. (3), a crude way of measuring the currency hedging benefits associated with global investing from a local perspective is with the ratio $\text{var}(r_{GL})/\text{var}(r_G)$. Appendix B shows that testing whether this variance ratio is significantly different from 1 is equivalent to testing if the regression coefficient $\text{cov}(r_G,-e_L)/\text{var}(e_L)$ is significantly different from 1/2. Fig. 1 depicts the *t*-test of the OLS estimate of this coefficient jointly with the variance ratio, and plots 60-month rolling estimates.

For Chile, Colombia, Mexico and Peru, this ratio has dropped below 1. The ratio has also fallen for Brazil, but not below 1, and for Argentina and Venezuela the ratio has increased. For the cases of Chile, Colombia and Mexico, towards the end of the sample period the ratio has become significantly smaller than

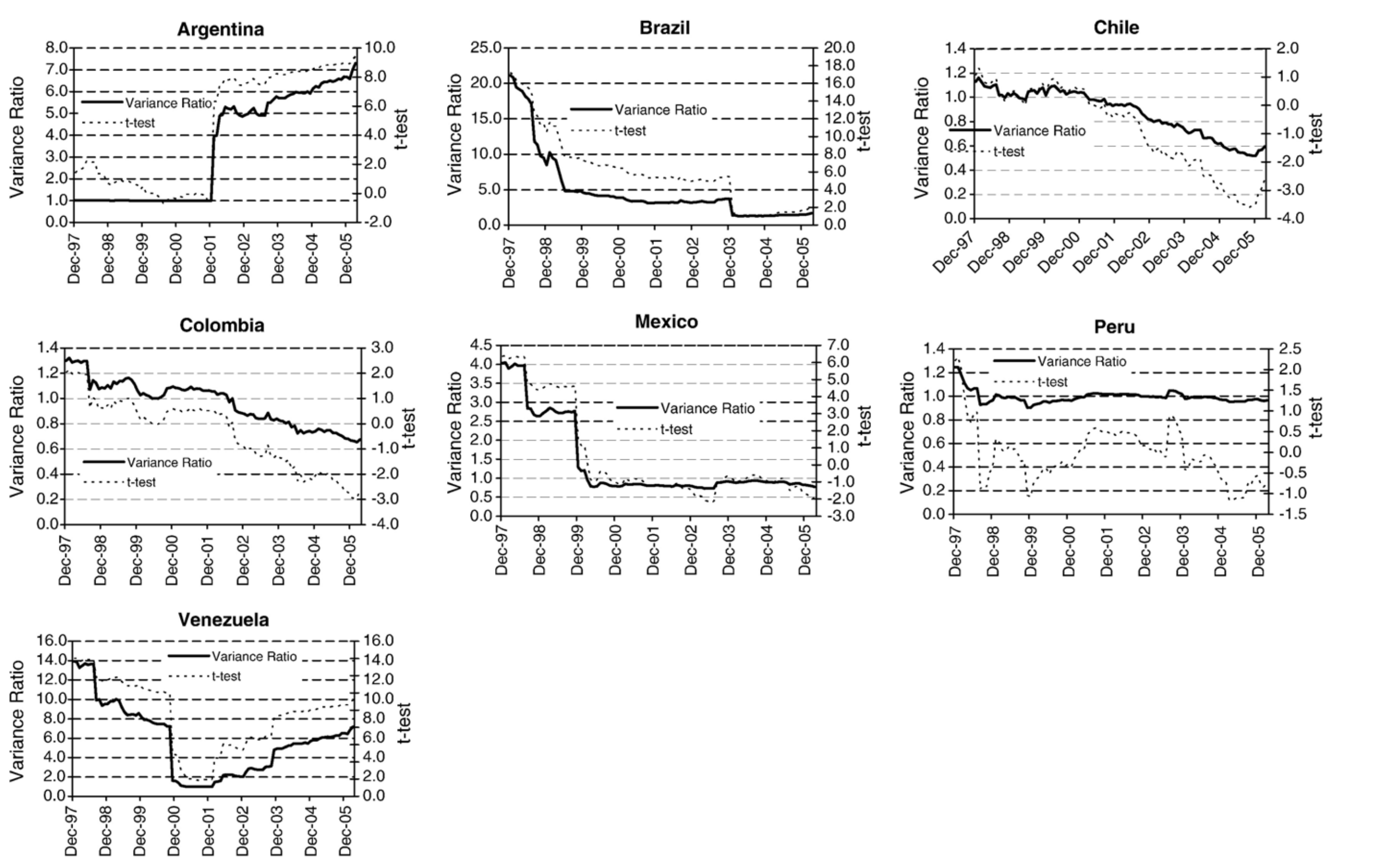

Fig. 1. Ratio of the unhedged versus the hedged variance of investing in the MSCI World Index Free.

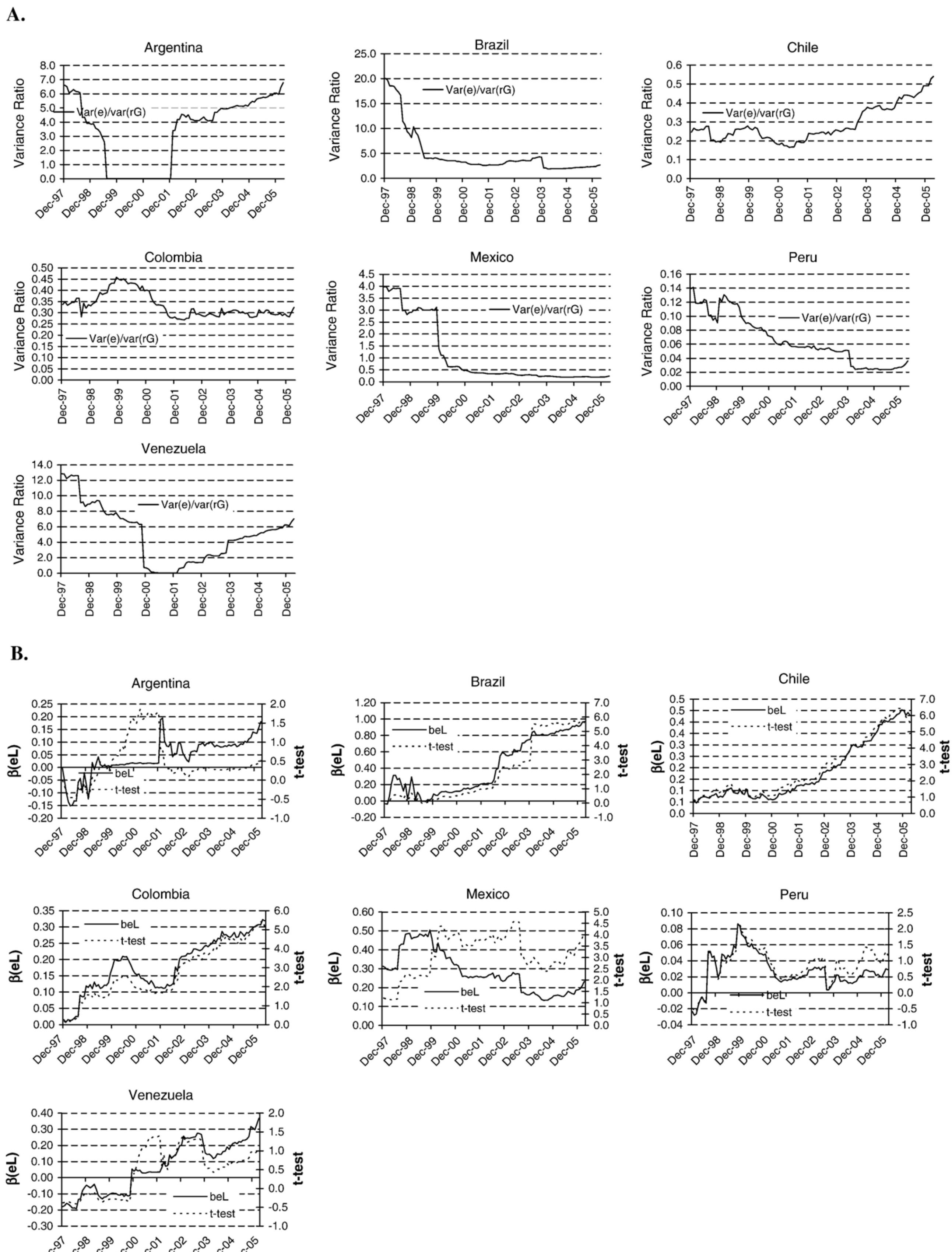

Fig. 2. Currency variances and betas relative to the world equity index. A. Rolling 60-month relative variances (var(e)/var(r_G)). B. Rolling 60-month currency betas.

one, but not so for Peru. For Argentina, Brazil and Venezuela this ratio is significantly larger than one.

It is interesting to highlight findings for Chile, Colombia, Mexico and Peru, probably the most stable economies in the region during the last 10 years. For these, perhaps surprisingly, currency hedging increases the variance of investing in the world market portfolio, from the local perspective. Towards the end of the sample period the unhedged return variances are 59.5, 67.5, 77 and 96.5% of the hedged variances, respectively.

3.1.2. Relative exchange rate volatility and currency betas with respect to the world index

For hedging to increase risk, a necessary condition is that var $(r_G+e_L)<\text{var}(r_G)$, or, equivalently, that $\text{var}(e_L)+2\text{cov}(r_G,e_L)<0$. Defining

$$\beta_{el} = \text{cov}(r_G, e_L)/\text{var}(r_G) \tag{5}$$

as the "currency beta" (which by definition corresponds to the marginal contribution of the local currency or of the short term local bond to the volatility of a global stock investor's portfolio based in a developed market) the variance ratio becomes:

$$\text{var}(r_{GL})/\text{var}(r_G) = 1 + \text{var}(e_L)/\text{var}(r_G) - 2\beta_{eL} \tag{6}$$

Therefore, the variance ratio may fall either because the relative volatility of the exchange rate falls or because "currency betas" increase. Notice the different perspectives: all else equal, higher currency betas imply by definition that the local currency is riskier for an international investor. However, a higher beta reduces the risk of international investments for an emerging-market-based investor, if unhedged.

Fig. 2 allows a look at the issue. Panel A shows the variance of the exchange rate relative to that of the world equity index returns and panel B shows the corresponding currency betas. All beta estimates and corresponding *t*-tests use OLS regressions with 60-month rolling samples. Adjusting for autocorrelations and/or heteroskedasticity has no material effect on these results. Panel A shows that relative exchange rate volatilities have had quite different evolutions recently. For Argentina, Brazil and Venezuela, the effects of the different exchange rate regimes are apparent. For Chile the trend is upward, Colombia's has remained relatively constant, whereas for Mexico and Peru trends are downward from a longer term perspective, having remained fairly constant in the recent years. The relative magnitude of Peru's exchange rate volatility reflects that the country's exchange rate does not float freely.

Interestingly, the cases for which currency hedging increases volatility cannot be fully explained by the recent evolution in the relative volatilities of the exchange rates. Looking at panel B, however, a coherent explanation arises: except for Mexico (whose beta has been cyclical) and Peru (whose exchange rate does not seem to float), currency betas with respect to global equity have increased. These coefficients are economically and statistically significant for Chile, Brazil, Colombia and Mexico.

3.1.3. Minimum variance portfolios without adjustments for exchange rate intervention

The following analysis focuses on global minimum variance portfolios (GMV), always from the perspective of emerging-market-based investors, considering as eligible asset classes for each country a local equity portfolio (represented by the local MSCI index, in local currency), a hedged global portfolio and an unhedged global portfolio (represented, as before, by the MSCI All Country World Investment Free index). No times-series is available for forward exchange rates, so the assumption is that, in order to hedge, the investor sells dollar deposits and with the proceeds buys local currency deposits. The methodology of estimating minimum variance portfolios has two advantages. First, it considers how exchange rate variations correlate with local and global stock markets. Second, it does not require expected return estimates. Given the above discussion, if (for example) the minimum variance portfolio does not include currency hedged global equity, the conclusion is that hedging should be used only to increase expected returns.

Kempf and Memmel (2003) propose a simple way of estimating GMV portfolio weights using OLS regressions. These authors' estimation approach applied to this case is the following. The return on the portfolio will be:

$$w_{hL}r^*_{GL} + w_{PL}r_{PL} + (1 - w_{hL} - w_{PL})r_{GL} \tag{7}$$

where w are the weights in the different asset classes, corresponding to the hedged global portfolio, the local portfolio and the unhedged global equity portfolio respectively. Using the definitions given above and recalling that r^*_{GL} is equal to $r_G+r_{FL}-r_F$, which in turn is equal to $r_{GL}-e_L+r_{FL}-r_F$, rearranging Eq. (7), the minimum variance portfolio is the one that minimizes the following expression with respect to the w's:

$$\text{Min}_{w_{hL},w_{PL}}\text{var}(r_{GL} - \alpha_L - w_{hL}(r_F + e_L - r_{FL}) - w_{PL}(r_{GL} - r_{PL})) \tag{8}$$

Here α_L is the minimum variance portfolio's expected return. The above is equivalent to regressing r_{GL} on $r_F+e_L-r_{FL}$ and $r_{GL}-r_{PL}$, and the regression coefficients correspond to the portfolio weights. Given the hedging horizon, local and global risk-free rates should be known in advance. Therefore, they are not random. Thus, one can estimate the minimum variance portfolio weights from the following regression:

$$r_{GL} = \alpha'_L + w_{hL}e_L + w_{PL}(r_{GL} - r_{PL}) + u_L \tag{9}$$

As before, the estimations consider 60-month rolling regressions, as illustrated in Fig. 3. Except for Argentina and Venezuela, for which towards the end of the sample period the minimum variance portfolios are fully invested in global hedged equity with a coefficient not significantly different from 1 (since January and February 2002, respectively), in all the other cases the relative importance of the fraction invested in unhedged global equity has increased notably. Table 2 presents the numerical results for the 60 months ending in December 2005. Notice that for Chile, Colombia, Mexico and Peru the weight of unhedged global equity is insignificantly different from 1. For

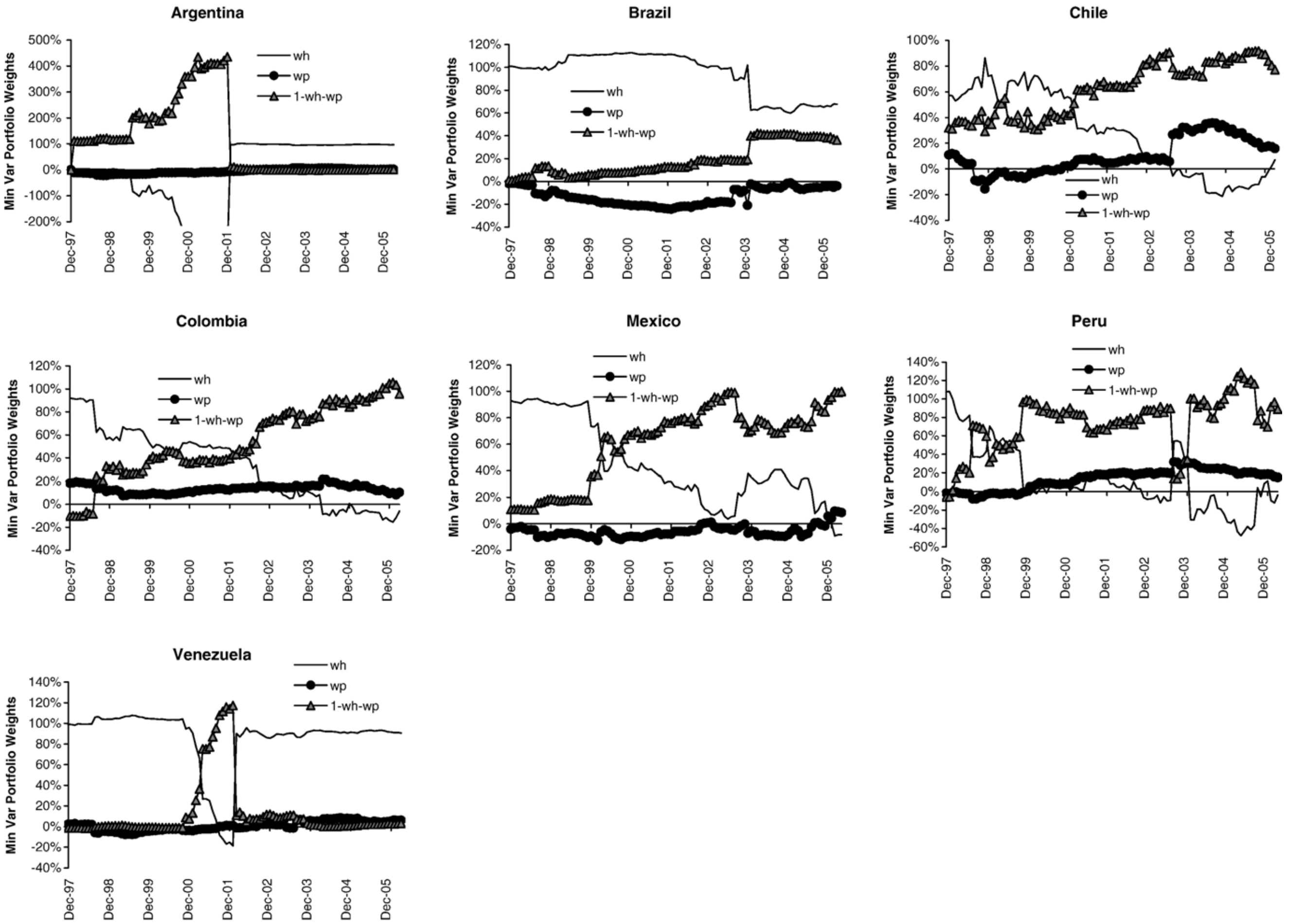

Fig. 3. Global minimum variance portfolio weights (local perspective) without adjusting for different exchange rate regimes. Note: wh represents the fraction invested in the global currency hedged portfolio; wp represents the fraction invested in the local equity portfolio; 1–wh–wp represents the fraction invested in unhedged global equity.

Brazil, the same weight is close to 40%, being significantly different from zero. For Argentina, Brazil and Venezuela, the fraction invested in hedged global equity is significant. Chile, Colombia and Peru also have marginally significant local equity included in the minimum variance portfolios.

Therefore, except for Argentina and Venezuela, whose exchange rate variations have much idiosyncratic risk, in the other cases unhedged global equity is a significant fraction of the minimum variance portfolio. Most notably, given the statistical significance of these results, the conclusion is that, at least for Chile, Colombia and Mexico, currency hedging has no role in reducing global portfolio risk. Its only function is to increase expected returns. In the case of Brazil, a significant fraction close to 40% should remain unhedged in the minimum variance portfolio. Hedging currency risk beyond this mark would also have the sole purpose of increasing expected returns.

3.2. Considering different exchange rate regimes

The results so far indicate that for Argentina and Venezuela the minimum variance portfolio should be fully hedged. For the other countries, currency hedging increases the volatility of global portfolio investments, so the conjecture is that this particular result is likely to be related with the exchange rate regimes of these countries. Investors in countries with managed exchange rates definitely face “peso problem risks”—in the terminology first proposed by Krasker (1980) for Mexico–US interest rate differentials—and the covariances and other statistics may not adequately reflect the relevant risks.

The evolution of interest rate differentials should reflect devaluation risk and changes in expectations through time,

Table 2
Estimated minimum variance portfolio weights (sample: 2001:01–2005:12)

		$\alpha_L{}'$	w_{GL}	w_{hL}	w_{PL}
Argentina	Coefficient	0.00	0.01	0.97	0.01
	t-Statistic [a]	0.27	0.35	21.86	0.24
Brazil	Coefficient	0.00	0.38	0.66	−0.04
	t-Statistic	0.35	5.84	5.75	−0.45
Chile	Coefficient	0.00	0.92	−0.10	0.18
	t-Statistic	0.20	5.41	−0.69	1.59
Colombia	Coefficient	0.01	1.05	−0.15	0.09
	t-Statistic	1.08	5.79	−0.78	1.69
Mexico	Coefficient	0.00	0.96	0.00	0.04
	t-Statistic	0.56	3.08	0.00	0.34
Peru	Coefficient	0.00	0.89	−0.08	0.19
	t-Statistic	0.77	1.10	−0.10	2.31
Venezuela	Coefficient	0.00	0.03	0.90	0.06
	t-Statistic	0.58	0.77	12.66	0.70

[a] White heteroskedasticity-consistent standard errors & covariance.

Table 3
Estimated minimum variance portfolio weights—considering gains and losses from a replicated 3-month forward (sample: 2001:01–2005:12)

		α_L	w_{GL}	w_{hL} [a]	w_{PL}
Argentina	Coefficient	0.01	0.03	0.93	0.04
	t-Statistic [b]	1.21	0.48	14.96	0.59
Brazil	Coefficient	0.00	0.55	0.51	−0.06
	t-Statistic	0.44	4.53	3.38	−0.61
Chile	Coefficient	0.00	0.96	−0.13	0.17
	t-Statistic	0.05	3.83	−0.57	1.42
Colombia	Coefficient	0.00	1.10	−0.19	0.09
	t-Statistic	0.95	5.13	−0.86	1.58
Mexico	Coefficient	0.00	0.78	0.11	0.11
	t-Statistic	0.85	2.07	0.27	0.80
Peru	Coefficient	0.00	1.08	−0.27	0.18
	t-Statistic	0.27	0.73	−0.18	2.25
Venezuela	Coefficient	0.01	−0.01	0.96	0.06
	t-Statistic	1.22	−0.12	8.58	0.60

[a] Dimson-adjusted with one lead and one lag.
[b] White heteroskedasticity-consistent standard errors & covariance.

especially in one-period excess returns of longer-term bonds measured in a common currency. For example, in one period the previously expected devaluation may not occur, but if markets revise devaluation expectations by reacting to global equity returns, it should be possible to capture this situation through the covariance of the realized excess returns of local currency deposits with respect to foreign currency deposits with the global equity returns. See Appendix C. Conceptually, the idea is to replicate a three-month forward contract by shorting a three-month foreign currency deposit in order to purchase a three-month local currency deposit, and then to monthly mark to market the excess return of such position, which is assumed to be renewed every month. These excess returns should reflect changes in devaluation expectations. For such purpose, this paper uses as the dollar deposit rate the 90-day Libor and, for the local deposits, the local interest rate information from the IFS database. Given the current purposes, one problem with this data set is that interest rates are not month-end rates but monthly averages, so there is asynchronicity with the equity return data. Accordingly, this paper estimates the minimum variance regression in Eq. (8) using leads and lags, as in Dimson (1979).

Table 3 shows the results. They do not differ much from earlier findings, but in all cases except Mexico the coefficient representing the investment in the unhedged portfolio is slightly larger, which tends to confirm previous results and conjectures. Therefore, for Chile, Colombia, Mexico and Peru the fraction invested in unhedged global equity is still insignificantly different from one in the GMV portfolio. For Brazil now the minimum variance portfolio includes roughly 50% in hedged and unhedged global equity. However, as before, and despite these methodological efforts, Argentina and Venezuela's GMV portfolios still include 100% in hedged global equity.

4. Interpretation of the results

Summarizing, the stylized facts indicate that from the perspective of several emerging-market-based investors currency hedging increases the volatility of portfolios that include global equity. A common explanation is that, in recent years, there has been an upward trend in emerging-market currency betas with respect to global equity returns. Furthermore, the emerging market investor's view of global efficient portfolios implies significant investments in unhedged global equity. Except for Argentina and Venezuela, whose exchange rate movements show significant idiosyncratic volatility, currency hedging principally has a role in increasing expected returns, and not in reducing volatility. In what follows, this paper proposes a partial explanation to the above. In any case, from the perspective of global investors investing in emerging market currencies, the conclusion is the opposite: covariance risk has increased.

4.1. Exchange rate intervention and reserve volatility

A prerequisite for observing increased covariances is that exchange rates must be allowed to float, otherwise all volatility-related measures will be downward biased. Thus, a necessary condition to detect an increase in currency betas, if existing, is that countries allow currencies to float, overcoming what Calvo and Reinhart (2002) denominate "the fear of floating". Fischer (2001) explains that, after successive capital market-related crises, countries have tended to adopt one of two extreme exchange rate regimes, either fixed or floating. He argues that the trend should be towards floating. Brazil, Chile, Colombia, Mexico and Peru are categorized as countries with independent floats in 1999. Argentina had a fixed exchange rate and Venezuela had established rates within crawling bands. Of course, these regimes have changed through time, as the reviewed evidence indicates. An imperfect way of measuring the degree of exchange rate intervention is through the volatility of foreign reserves, since if the local monetary authorities want to impede exchange rate movements they need to generate movements in reserves of the same sign; for example, to avoid local currency devaluation they need to sell reserves. This measure is imperfect because exchange rates can vary due to changes in expectations regarding the future availability of foreign currency, and when the exchange rate is not allowed to float this situation is not reflected in the current level of reserves.

Fig. 4 shows 60-month rolling estimates of monthly reserve variation volatility. Towards the end, a natural segmentation appears. The low-reserve-volatility countries are Chile, Colombia, Mexico and Peru, precisely the countries for which the hypothesis that the GMV portfolio is fully invested in unhedged global equity cannot be rejected. The high reserve volatility countries are Argentina, Venezuela and Brazil, although in the latter case there is a clear downward trend. Therefore, these results suggest that, at least partially, increased betas are due to a world trend toward floating.

4.2. Flight to quality or expectations?

A frequent explanation for sudden currency devaluations is the "flight to quality" hypothesis (see, for example, Bernanke et al., 1996). Under this view, a sudden increase in risk aversion (or fear) leads investors to sell risky investments in favor of safer

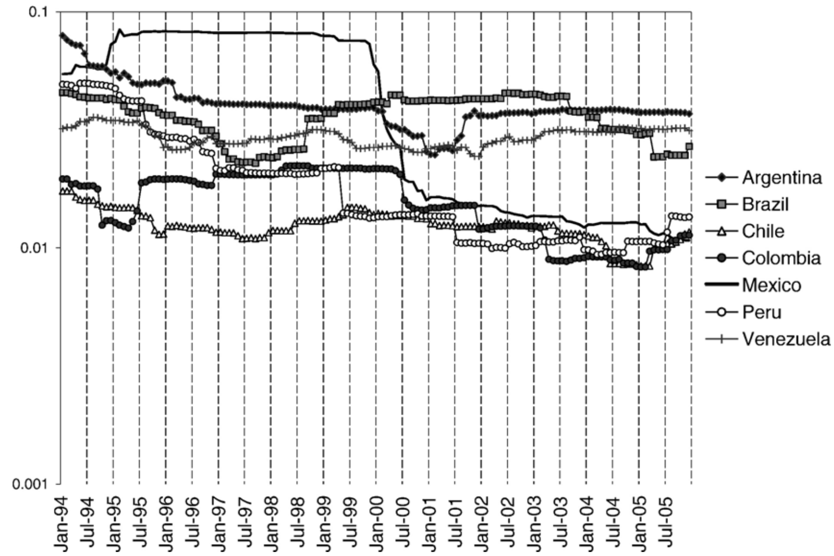

Fig. 4. Reserve variation volatility (60-month rolling estimates). Source: estimated based on IFS statistics.

ones. This is one of the possible explanations for positive currency betas: global stock markets tend to fall when there is flight to quality, and this situation is correlated with capital flights from emerging markets, creating the negative correlation between local exchange rate variations (measured as local currency units per unit of foreign currency) and world equity returns. The above is a flow of funds approach. An alternative explanation is that global equity markets anticipate future economic growth (Fama, 1990), which positively affects emerging market export prices (see Borensztein and Reinhart, 1994; Hua, 1998). For open economies that significantly rely on exports, especially commodities, this condition implies that the behavior of global stock markets helps revise expectations regarding future export returns and availability of foreign currency, implying the negative correlation. Since this explanation is via expectations, it would usually be associated with an asset pricing approach for explaining exchange rates. For example, Lefort and Walker (1999) analyze the Chilean peso's similarities with other local financial assets.

This issue is not fully addressed here, since a comprehensive analysis is beyond the scope of this paper, but a way to begin discerning between the two explanations is by analyzing the incremental explanatory power of a variable that captures at least partially the flight to quality phenomenon: credit spreads. The interest rate spread between investment-grade (Baa-rated) and high-grade (Aaa) US bonds should increase when there is flight to quality. Thus, if this is the appropriate explanation, changes in this variable should take away at least part of the explanatory power of global equity returns.

Table 4 shows the results for currency betas separately for the periods 1995–2000 and 2001–2005. Local currency returns measured in dollars are regressed against global equity market returns, changes in credit spreads, the lagged level of the credit spread and dummy variables representing major devaluations. Panel A shows, for the pooled regressions, a significant average currency beta of around 0.1. In that period, "flight to quality" proxy variables are significant in the pooled regressions but including them does not reduce the significance of the currency beta. Including devaluation dummies does not have an impact on the average currency betas either, so they are not the result of outliers. Turning to Panel B, currency betas average three-times the value of the first sample period. The "flight to quality" proxies lower the average beta but only slightly. Similar phenomena stand out for individual countries, but at the same time the averages of the pooled regressions tend to hide very large increases in currency betas in Brazil, Chile and Colombia. Therefore, the evidence does not support the hypothesis that the higher betas are caused by a "flight to quality" phenomenon.

5. Summary and conclusions

This article discusses the currency hedging decision for international equity investing from the perspective of emerging-market-based investors. For these investors, currency hedging should increase expected returns, so the question is whether there is a free lunch in this case. There is not, since in this case currency hedging on average increases volatility. For Brazil, Chile, Colombia, Mexico—and, to a less significant extent, Peru—, global minimum variance portfolios include a large fraction invested in unhedged global equity. The explanation for this is that Latin American currency betas with respect to global equity have tripled on average, comparing the last five years until 2005 with the previous five. Intuitively this means that—more strongly than before—emerging market currencies tend to depreciate when global equity returns are negative and vice versa. Therefore, *hard currencies* act as *natural hedges* against negative returns in global equity. This condition could be due to a "flight to quality" phenomenon. When there is flight to quality, global stock markets tend to fall at the same time that capital flights from emerging markets depreciate local currencies. The evidence does not support this hypothesis. An alternative explanation is that global stock returns anticipate

Table 4
Currency betas and flight to quality

Panel A: 1995:01–2000:12

$-e_{Lt}=c_L+\beta_{eL}r_{Gt}+\gamma_{eL}\Delta S_{\mathrm{Baa},t}+\phi_{eL}S_{\mathrm{Baa},t-1}+\delta_{eL}\mathrm{Dummies}_t+\upsilon_{Lt}$

	β_{eL}	γ_{eL}	ϕ_{eL}	$\delta_{eL,\mathrm{Venezuela}}$	$\delta_{eL,\mathrm{Brazil}}$	Adj. R^2	SSR	DW stat
Pooled	0.09					0.01	1.15	2.09
	(2.50)							
Pooled	0.10	−0.06				0.01	1.14	2.09
	(2.68)	(−2.17)						
Pooled	0.10	−0.01	−0.06			0.01	1.14	2.09
	(2.74)	(−0.44)	(−1.96)					
Pooled	0.12	0.02	−0.02	−0.11	−0.10	0.13	0.99	2.08
	(4.00)	(1.52)	(−1.08)	(−1.17)	(−1.43)			
Argentina	0.00					−0.01	0.00	2.18
	(−0.10)							
Brazil	0.10					−0.01	0.34	2.01
	(1.00)							
Chile	0.09					0.03	0.02	1.50
	(1.97)							
Colombia	0.15					0.04	0.04	1.47
	(2.40)							
Mexico	0.36					0.11	0.10	2.10
	(2.73)							
Peru	0.05					0.02	0.01	1.85
	(1.47)							
Venezuela	−0.09					−0.01	0.62	2.15
	(−0.61)							
Argentina	0.00	0.00				0.02	0.00	2.06
	(−0.00)	(−0.00)						
Brazil	0.11	−0.22				0.01	0.32	2.00
	(1.21)	(−2.25)						
Chile	0.10	−0.03				0.02	0.02	1.50
	(2.03)	(−0.81)						
Colombia	0.15	0.00				0.03	0.04	1.47
	(2.36)	(−0.02)						
Mexico	0.36	0.00				0.10	0.10	2.10
	(2.71)	(0.03)						
Peru	0.06	−0.03				0.04	0.01	1.87
	(1.58)	(−1.68)						
Venezuela	−0.08	−0.13				−0.02	0.62	2.13
	(−0.57)	(−0.93)						
Argentina	0.00	0.00	0.00			0.00	0.00	2.06
	(−0.02)	(−1.83)	(0.18)					
Brazil	0.13	−0.29	−0.14			0.06	0.30	2.11
	(1.40)	(−1.69)	(−0.77)					
Chile	0.10	−0.05	−0.04			0.08	0.02	1.56
	(2.34)	(−1.71)	(−2.13)					
Colombia	0.15	0.01	0.01			0.02	0.04	1.47
	(2.37)	(0.09)	(0.62)					
Mexico	0.35	0.03	0.05			0.11	0.10	2.16
	(2.72)	(0.47)	(1.33)					
Peru	0.06	−0.04	−0.02			0.05	0.01	1.90
	(1.58)	(−1.64)	(−0.80)					
Venezuela	−0.09	−0.11	0.04			−0.03	0.62	2.14
	(−0.60)	(−0.85)	(1.18)					
Argentina	0.00	0.00	0.00	0.00	0.00	0.01	0.00	2.00
	(−0.01)	(−1.51)	(0.68)	(2.05)	(−3.87)			
Brazil	0.15	−0.12	0.05	0.00	−0.55	0.87	0.04	1.69
	(1.96)	(−3.03)	(1.05)	(1.88)	(−30.74)			
Chile	0.10	−0.04	−0.04	0.01	−0.02	0.06	0.02	1.56
	(2.27)	(−1.55)	(−1.67)	(2.28)	(−2.07)			
Colombia	0.15	0.01	0.02	0.01	−0.01	0.00	0.04	1.45
	(2.32)	(0.12)	(0.71)	(2.55)	(−1.11)			

(continued on next page)

Table 4 (*continued*)

Panel A: 1995:01–2000:12

$-e_{Lt} = c_L + \beta_{eL} r_{Gt} + \gamma_{eL} \Delta S_{\text{Baa},t} + \phi_{eL} S_{\text{Baa},t-1} + \delta_{eL} \text{Dummies}_t + \upsilon_{Lt}$

	β_{eL}	γ_{eL}	ϕ_{eL}	$\delta_{eL,\text{Venezuela}}$	$\delta_{eL,\text{Brazil}}$	Adj. R^2	SSR	DW stat
Mexico	0.36	0.05	0.06	−0.06	−0.04	0.13	0.09	2.28
	(2.79)	(0.87)	(1.59)	(−10.88)	(−3.79)			
Peru	0.06	−0.02	0.00	−0.02	−0.05	0.38	0.01	1.92
	(1.79)	(−0.97)	(0.25)	(−13.88)	(−14.2)			
Venezuela	0.04	0.01	0.02	−0.74	−0.02	0.87	0.08	1.44
	(0.97)	(0.33)	(1.32)	(−177.21)	(−3.84)			

Panel B: 2001:01–2005:12

$-e_{Lt} = c_L + \beta_{eL} r_{Gt} + \gamma_{eL} \Delta S_{\text{Baa},t} + \phi_{eL} S_{\text{Baa},t-1} + \delta_{eL} \text{Dummies}_t + \upsilon_{Lt}$

	β_{eL}	γ_{eL}	ϕ_{eL}	$\delta_{eL,\text{Argentina}}$	Adj. R^2	SSR	DW stat
Pooled	0.33				0.07	1.61	2.03
	(4.98)						
Pooled	0.34	0.02			0.05	1.61	2.03
	(4.99)	(0.86)					
Pooled	0.33	0.00	−0.05		0.08	1.56	2.08
	(4.98)	(−0.14)	(−2.52)				
Pooled	0.31	0.00	−0.04	−0.08	0.10	1.52	2.08
	(4.93)	(−0.03)	(−2.42)	(−0.91)			
Argentina	0.12				−0.01	0.65	1.83
	(0.45)						
Brazil	0.91				0.34	0.17	2.45
	(3.89)						
Chile	0.48				0.47	0.03	2.03
	(8.84)						
Colombia	0.31				0.32	0.02	1.67
	(4.11)						
Mexico	0.19				0.16	0.02	1.61
	(3.17)						
Peru	0.02				0.01	0.00	1.48
	(1.24)						
Venezuela	0.32				0.00	0.67	2.05
	(1.57)						
Argentina	0.12	0.02			−0.03	0.65	1.81
	(0.46)	(0.20)					
Brazil	0.93	0.08			0.35	0.16	2.49
	(3.97)	(1.02)					
Chile	0.48	0.01			0.46	0.03	2.04
	(8.58)	(0.33)					
Colombia	0.31	0.02			0.32	0.02	1.70
	(4.18)	(1.56)					
Mexico	0.20	0.03			0.18	0.02	1.64
	(3.31)	(1.84)					
Peru	0.02	0.00			−0.01	0.00	1.49
	(1.24)	(−0.10)					
Venezuela	0.31	−0.01			−0.02	0.67	2.05
	(1.43)	(−0.11)					
Argentina	0.08	−0.07	−0.15		0.05	0.58	1.94
	(0.29)	(−0.73)	(−1.53)				
Brazil	0.93	0.07	−0.03		0.35	0.16	2.52
	(4.18)	(0.81)	(−0.87)				
Chile	0.49	0.01	0.01		0.46	0.03	2.06
	(8.41)	(0.49)	(0.78)				
Colombia	0.31	0.00	−0.04		0.44	0.02	2.07
	(4.94)	(0.34)	(−2.97)				
Mexico	0.19	0.02	−0.02		0.21	0.02	1.78
	(3.22)	(1.40)	(−1.87)				
Peru	0.02	0.00	0.00		0.00	0.00	1.53
	(1.15)	(−0.37)	(−1.00)				
Venezuela	0.29	−0.06	−0.09		0.00	0.64	2.13
	(1.27)	(−0.53)	(−1.42)				

Table 4 (*continued*)

Panel B: 2001:01–2005:12

$-e_{Lt} = c_L + \beta_{eL} r_{Gt} + \gamma_{eL} \Delta S_{\mathrm{Baa},t} + \phi_{eL} S_{\mathrm{Baa},t-1} + \delta_{eL} \mathrm{Dummies}_t + \upsilon_{Lt}$

	β_{eL}	γ_{eL}	ϕ_{eL}	$\delta_{eL,\mathrm{Argentina}}$	Adj. R^2	SSR	DW stat
Argentina	−0.08	−0.05	−0.07	−0.65	0.68	0.19	1.91
	(−0.44)	(−0.56)	(−1.15)	(−24.01)			
Brazil	0.93	0.07	−0.03	0.00	0.33	0.16	2.52
	(4.07)	(0.80)	(−0.79)	(0.02)			
Chile	0.48	0.02	0.01	−0.02	0.45	0.03	2.01
	(8.24)	(0.50)	(0.95)	(−3.54)			
Colombia	0.31	0.00	−0.04	0.03	0.45	0.02	2.09
	(5.08)	(0.25)	(−3.28)	(4.74)			
Mexico	0.20	0.02	−0.02	0.02	0.21	0.02	1.80
	(3.21)	(1.38)	(−1.98)	(2.88)			
Peru	0.02	0.00	0.00	−0.01	−0.01	0.00	1.52
	(1.08)	(−0.35)	(−0.81)	(−2.39)			
Venezuela	0.30	−0.07	−0.10	0.06	−0.01	0.64	2.10
	(1.30)	(−0.54)	(−1.43)	(1.53)			

higher future export growth for emerging markets, anticipating also greater future availability of foreign currency. As international trade has grown and many countries have adopted floating exchange rate regimes, the consequence is that currency betas have increased.

Acknowledgment

The author acknowledges Consuelo Edwards for useful editing suggestions.

Appendix A

The local currency return of the unhedged global portfolio is

$$r_{GL} = (1 + r_G)(1 + e_L) - 1 = r_G + e_L + r_G e_L \tag{A1.1}$$

and with fraction h of the initial investment hedged, the result is

$$\begin{aligned} 1 + r_{GL}(h) &= (1 + r_G)\frac{E_{1L}}{E_{0L}} + h\left(\frac{E_{fL}}{E_{0L}} - \frac{E_{1L}}{E_{0L}}\right) \\ &\equiv (1 + r_G)(1 + e_L) + h\left(e_{fL} - e_L\right) \end{aligned} \tag{A1.2}$$

where $e_{fL} = (E_{fL}/E_{0L} - 1)$ and E_{fL} corresponds to the *forward* exchange rate, which is known in advance. Recall also that due to covered interest rate parity

$$e_{fL} = \frac{E_{fL}}{E_{0L}} - 1 = \frac{1 + r_{LF}}{1 + r_F} - 1 = \frac{r_{FL} - r_F}{1 + r_F} \tag{A1.3}$$

Replacing Eq. (2) in Eq. (1) and rearranging yields

$$r_{GL}(h) = r_G + e_L + r_G e_L + \frac{h}{1 + r_F}\left(r_{FL} - r_F - e_L(1 + r_F)\right) \tag{A1.4}$$

As a special case, consider $h = 1 + r_F$, since (1′) becomes

$$r^*_{GL} = r_{FL} + (r_G - r_F) + e_L(r_G - r_F) \tag{A1.5}$$

$$r^*_{GL} \approx r_{FL} + (r_G - r_F) \tag{A1.6}$$

Appendix B

Testing whether the slope coefficient of regressing $r_{GL} + r_G$ on $r_{GL} - r_G \approx e_L$ is significant is equivalent to verifying if var (r_{GL}) is significantly different from var(r_G), even if both series are correlated. This happens because the slope coefficient of this regression is

$$\begin{aligned} &\mathrm{cov}(r_{GL} + r_G, r_{GL} - r_G)/\mathrm{var}(r_{GL} - r_G) \\ &\quad = (\mathrm{var}(r_{GL}) - \mathrm{var}(r_G))/\mathrm{var}(e_L) \end{aligned} \tag{A2.1}$$

It is possible to rewrite the previous equation as

$$\mathrm{cov}(2r_G + e_L, e_L)/\mathrm{var}(e_L) = 1 + 2\mathrm{cov}(r_G, e_L)/\mathrm{var}(e_L) \tag{A2.2}$$

Thus, the variance ratios will be significantly different from one if the regression coefficient cov(r_G,$-e_L$)/var(e_L) is significantly different from 1/2. This test is the t-test presented in Fig. 1.

Appendix C

The assumption is that local currency interest rates are set in such a way that *ex ante* investors are indifferent between buying a dollar deposit and a local currency deposit. The price of a three-month deposit that will pay 1 unit of local currency is

$$P_0 = e^{-3r^{(0)}_{FL}} \tag{A3.1}$$

If the foreign currency expected return on this deposit is "fair", then the local interest rate should be set as to compensate for currency risk premia and devaluation. Thus, this interest rate will expectedly be set as:

$$r_{FL}^{(0)} = r_F^{(0)} + \pi_{FL} + \mu_e^{(0)} - \frac{1}{2}\sigma_e^2 \tag{A3.2}$$

Here μ_e is the average expected (log) devaluation of the exchange rate until the deposit matures, and σ_e^2 is the variance of the log exchange rate variation. This term appears because of Jensen's inequality. One period later, the market price of the deposit shall be:

$$P_1 = e^{-2r_{FL}^{(1)}} = e^{-2\left(r_F^{(1)} + \pi_{FL} + \mu_e^{(1)} - \frac{1}{2}\sigma_e^2\right)} \tag{A3.3}$$

The observed log return of the deposit measured in foreign currency will be

$$\begin{aligned} r_{L1} - e_{L1} &= -2\left(r_F^{(1)} + \pi_{FL} + \mu_e^{(1)} - \frac{1}{2}\sigma_e^2\right) \\ &\quad + 3\left(r_F^{(0)} + \pi_{FL} + \mu_e^{(0)} - \frac{1}{2}\sigma_e^2\right) - e_{L1} \\ &= r_{F1} + \pi_{FL} - \frac{1}{2}\sigma_e^2 - 2\mu_e^{(1)} + 3\mu_e^{(0)} - e_{L1} \end{aligned} \tag{A3.4}$$

Here r_{F1} is the one-period return of the foreign currency (three-month) deposit. Thus,

$$r_{L1} - e_{L1} - r_{F1} = \pi_{FL} - \frac{1}{2}\sigma_e^2 - \left(2\mu_e^{(1)} + e_{L1}\right) + 3\mu_e^{(0)} \tag{A3.5}$$

So this excess return should reflect the risk premium as well as changes in devaluation expectations. Assuming that the currency risk premium is constant, it is possible to capture the changes in expectations from the excess returns of investing in the local currency over the foreign one.

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