Flight-to-Quality and Correlation between Currency and Stock Returns

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Comments welcome

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Abstract

Pair-wise analyses of a sample of 9 developed and 12 emerging markets suggest that emerging country currency returns are positively correlated with their stock returns. These ties between currency and stock returns appear generated by international capital flows based on "flight-to-quality" in down-markets. Since global equity markets are positively correlated, this implies that currencies provide added risks for investors in developed countries investing in emerging markets and natural hedges for investors in emerging countries investing in developed countries. Using a unique sample of 27 "Siamese Twin" Korean international mutual fund pairs holding identical underlying foreign assets but offering different currency hedging alternatives, we find evidence that hedging currency risks undoes the natural hedge and increases the total return volatility.

1. Introduction

Understanding the relationship between currency and equity markets is an essential component of international portfolio management, since investments in foreign stocks inevitably involve investments in foreign currencies. Surprisingly, however, this issue has received relatively little attention from both academics and practitioners, perhaps because the theoretical determinants of exchange rates suggested by macroeconomists have failed to outperform a simple random walk process (Frankel and Rose, 1995). If exchange rates were indeed random, we would observe no systematic correlation between equity and currency. The following *Wall Street Journal* article summarizes practitioners' general perception that the relationship between the two asset classes, if it exists, has been weak:

> Historically, moves by stocks and the currency have tended to show no relationship. But since the stock market bottomed in July and the Federal Reserve started leaning toward policies that have pushed down the dollar, the two asset classes have been moving against each other, raising eyebrows among many analysts and investors. Joseph Mezrich, a quantitative research analyst at Nomura Securities, calls the trend "astonishing" and says he hasn't seen such a strong relationship, or correlation, between stocks and the dollar since Richard Nixon took the dollar off the gold standard in 1971. (*Wall Street Journal*, October 29, 2010)

A notable exception to this negligence is a recent study by Hau and Rey (2006), who develop a theoretical model that generates a systematic negative relationship between equity and currency returns through order flows in the foreign exchange market. Investors in their model face limited hedging opportunities and must thus "rebalance" their foreign equity position following a gain, leading to capital outflows and the subsequent depreciation of the relevant foreign currency. Using data from 17 OECD countries, they provide evidence of such a negative correlation between currency and stock returns. Although this explanation sounds innocuous, the universal negative correlation implied in their model holds only when equity markets are uncorrelated across countries.

If equity markets are positively correlated, however, a negative correlation in one market may imply a positive correlation in another.

This paper examines a broader set of equity-currency pairs and tests whether Hau and Rey's prediction of universal negative correlation still holds in a more general setting. In particular, we analyze pair-wise correlations between currency and stock returns using 9 developed and 12 emerging markets occurring between 1996 and 2009. In contrast to Hau and Rey's universal *negative* correlation observed within developed markets, we find that currency returns are *positively* correlated with stock returns in emerging markets and, thus, that an emerging country's currency tends to appreciate when its stock market is bullish. For example, in a pair-wise analysis of Korea and the U.S., the Korean Won tends to strengthen against the U.S. dollar when the Korean stock market gains and vice versa. This relationship remains quite stable over time and intensifies during down markets. For emerging countries, not only is the correlation between currency and stock returns positive, but it is also larger in magnitude. In contrast, for developed markets such as the U.S., the correlation is negative but weak. This is in line with both the aforementioned *Wall Street Journal* article and Campbell et al. (2010). Hau and Rey's (2006) prediction is empirically supported, however, only when we restrict our attention to developed markets.

We provide an alternative explanation based on capital movements induced by flight-to-quality consistent with both the negative correlation in developed markets and the positive correlation in emerging markets. International portfolio rebalancing may create capital flows in and out of emerging market stocks in a procyclical way, which would create demand and supply in their respective currencies. These capital movements tend to be more pronounced in down markets. For example, during the 2008 global financial crisis, world financial markets witnessed a flight-to-quality phenomenon in which capital moved from emerging market stocks to a market of a higher "quality" or developed markets, often into their bonds.

We use balance of payments information to test these hypotheses. Although the data employed in this analysis are somewhat crude in terms of its frequency, we are nevertheless able to document that the capital flows in and out of emerging market stocks are procyclical on average. Specifically, MSCI world index returns are positively correlated with net capital flows for equity investments in emerging markets but negatively correlated with those in developed markets. When we partition the sample into up markets and down markets, we find that net capital flows are sensitive to overall stock market conditions only in down markets, consistent with the flight-to-quality arguments.

We next examine if such net capital movements, potentially driven by flight-to-quality, can explain the degree of correlation between equity and currency returns, especially in emerging markets. Our results suggest that the positive correlation between equity and currency returns observed in emerging markets becomes stronger when there is a larger capital movement for stock investments in and out of the economy. On the other hand, net capital flows for stock investments in and out of developed countries do not explain the degree of correlation between equity and currency returns in these markets. Presumably, exchange rates in developed markets are determined through a much more complex mechanism involving a host of real and financial factors.

These results have important implications for hedging strategies in international portfolio management. Note that currency return volatility is a key component of overall risk in international stock investments.[1] Our findings suggest that the way the currency return affects overall risk is asymmetric depending on whether the investors are from an emerging or a developed country. Since stock markets around the world are generally positively correlated and an emerging country's currency is positively correlated with its own stock market, the developed country's currency is likely

[1] The total return from an international investment consists of the return from the underlying foreign asset and the return from the corresponding currency.

to be negatively correlated with the two stock markets. Therefore, when investors in developed countries invest in emerging markets, hedging currency risk may reduce the overall volatility since currency return amplifies total return volatility; when investors in emerging countries invest in developed markets, currencies provide a natural hedge since they tend to move in a direction opposite that of the underlying foreign asset. Thus, hedging currency risk may actually increase overall volatility by undoing the natural hedge.

Our final set of analyses explicitly tests this implication on currency hedging. We provide an interesting case study of open-ended international mutual funds, where currency hedging adversely affects total return volatility. Using a unique sample of 27 Korean "Siamese Twin" fund pairs holding identical underlying foreign assets but offering different currency hedging alternatives, we find that the hedged portfolios exhibit larger total return volatility than their non-hedged counterparts, largely because the values of the foreign currency and the underlying assets are negatively correlated, and the hedging schemes effectively undo the natural hedge provided by the currency markets.

The rest of this paper is organized as follows. Section 2 provides a review of the literature on the relationship among exchange rates, stock returns, and capital flows from which we derive our main hypotheses. Section 3 describes our data sources and the construction of our key variables. Section 4 offers a pair-wise analysis of currency and stock returns around the world and provides evidence that emerging market currencies tend to move together with their stock returns. Section 5 investigates how market conditions may affect capital movements in line with flight-to-quality and how such capital movements may affect the relationship between the currency and stock returns using balance of payments data for each country. Section 6 presents a case study of 27 Siamese Twin international mutual funds sold in Korea for which currency hedging inadvertently turned into friendly fire. Section 7 concludes the paper.

2. Literature review and hypothesis development

Our focus is twofold: the relationship between equity and currency markets (potentially linked through cross-border equity investments) and its implication for hedging strategies in international investments. Accordingly, we build on four broad categories of research: a microstructure analysis of the foreign exchange market, cross-border capital flows from equity investment, time varying risk premia and flight-to-quality, and international portfolio management.

Traditional macroeconomic theories on foreign exchange rate based on purchasing power or interest rate parity have unfortunately not satisfactorily explained short- and medium-term movements in exchange rates.[2] It is somewhat surprising that equity market variables have never been seriously considered in this strand of literature as a potential macro-level factor that might be correlated with exchange rates. This might partly reflect the relative neglect of the stock market by macroeconomics literature due to the perception that stock markets are too volatile to have a meaningful influence on real sectors of the economy (Fischer and Merton, 1984).[3]

The next generation of research on foreign exchange was facilitated by scholars studying the implications of market microstructure within a specific financial market. Although the initial interest concerned whether microstructure theories with market makers hold in other dealer-oriented decentralized markets, such as the foreign exchange market, it nevertheless provided important insights for exchange rate determination. For example, Lyons (1995) tracks the actual trading activities of a single spot foreign exchange dealer for five days and shows that the size of the incoming order flow influences the exchange rate set by the dealer. Evans and Lyons (2002) extend this research and provide a formal model of exchange rate determination that critically depends on a

[2] Frankel and Rose (1995) provide a comprehensive survey of the empirical research on nominal exchange rates and conclude that structural models based on macroeconomic fundamental variables such as inflation rate and interest rate differentials generally do not perform well even in-sample, let alone forecasting out of-sample. A key example is Meese and Rogoff (1983), who show that a simple random walk model outperforms sophisticated structural benchmarks in a variety of empirical tests.

[3] A notable exception is Pavlova and Rigobon (2007), who develop a formal model where stock returns and exchange rates may co-move due to demand shocks and trade in goods.

microstructure variable, the order flow or net buying pressure. Using transaction-level data from an interbank trading system, they produce an R^2 of 0.6 for daily changes in mark/dollar exchange rates. Subsequent research finds that country-level net equity flows defined at longer intervals exhibit stronger correlation with exchange rates than with other forms of capital flows, such as those from current accounts or other capital accounts. For example, Brooks et al. (2004) show that net equity flows into the U.S. from the eurozone are significantly correlated with the euro-dollar exchange rate.

Another stream of research explores how equity market returns may influence (and be influenced by) cross-border capital flows. The main difficulty with this research is that cross-country capital flow data are generally available quarterly or monthly at best. Brennan and Cao (1997) examine U.S. investors' portfolio investment abroad at a quarterly frequency and find that host countries' equity returns are positively correlated with U.S. investors' equity purchases, especially when the host country is an emerging market.[4] Froot et al. (2001), using more refined and comprehensive flow data at a daily frequency covering 44 countries, find that capital flows are not only affected by host country returns but also predict future host country returns to some extent. Similarly, Griffin, Nardari, and Stulz (2004) show that a host country's stock returns are positively related to equity flows into these countries at daily frequencies, based on nine emerging market destinations. Richards (2005) documents a similar positive feedback trading pattern in foreigners investing in six Asian emerging equity markets. Taken together, the above literature suggests that equity returns and currency returns may be linked through movements in capital flows, precisely the view this study takes.

The most recent financial crises have revitalized research on the notion of "flight-to-quality," which is supported by both the empirical and theoretical literature. For example, Vayanos (2004) and

[4] Brennan and Cao (1997) examine whether capital flows are related with currency returns but do not find any evidence for U.S. investors investing overseas.

Caballero and Krishnamurthy (2008) suggest that increased volatility and uncertainty during economic recessions make investors more risk averse and lead them to sell risky assets and purchase relatively safe assets instead. In addition, Lettau and Ludvigson (2010) and Lustig and Verdelhan (2011) show that the U.S. stock market exhibits countercyclical risk premia. Verdelhan (2010) develops a habit model to explain the uncovered interest rate parity puzzle in which the countercyclical risk premia are endogenously determined. Since emerging stock markets are generally riskier than developed markets, the notions of flight-to-quality can be explained if investors require countercyclical risk premia. However, these studies do not explore the effects of these capital flows on the relationship between equity and currency markets.

The work arguably most closely related to ours is Hau and Rey (2006), who provide a formal model under which exchange rates, capital flows, and equity returns are endogenously determined in response to random dividend shocks. A key prediction of their model is that bullish equity markets imply weaker (rather than stronger) currency, which is somewhat counterintuitive. This prediction is based on the strong assumption that currency risk is not hedgeable, so that mean-variance optimizing investors will pull out of a bullish foreign market to reduce increased exposure in foreign equity and rebalance their portfolios. Consistent with this prediction, they find that foreign equity returns (in local currencies) and currency returns (in dollars) are negatively correlated for most developed markets from U.S. investors' perspective.[5]

Although Hau and Rey (2006) seem to provide a coherent view of the link between equity and currency markets through capital flows, we challenge their perspective on the following empirical and theoretical grounds. First, their model predicts a universal negative correlation across

[5] Such a negative correlation between equity and currency returns has been documented in other studies as well. Brooks et al. (2004) report a negative relationship between equity and currency returns from the eurozone investors' perspective when investing in U.S. equities. Interestingly, an earlier version describes the phenomenon as "counterintuitive" while the interpretation provided in the later version resembles that of Hau and Rey (2006). Lane and Milesi-Ferretti (2003) document results similar to those provided in Hau and Rey (2006) for a sample of developed markets.

all the countries, which critically hinges on the assumption that the dividend shocks are random across them. However, if the dividend shocks are positively correlated (as evidenced by the positively correlated equity markets across the world), a negative correlation for one country would imply a positive correlation for the other in a bilateral context. For example, Campbell et al. (2010) examine the correlation between currencies and the global equity market and find that, while the euro, the Swiss franc, and, especially, the U.S. dollar are negatively correlated with the global equities, the Australian dollar, Canadian dollar, Japanese yen, and British pound are positively correlated with global equities as well as their own stock market.[6] Similarly, Schmittmann (2010) also reports a positive correlation between British pounds and equity markets. In Eun and Resnick (1994), the only countries that exhibit negative correlation from the U.S. investor's perspective are Switzerland and U.K., while Canada, Japan, and France exhibit positive correlations. Brooks et al. (2004) show that Japanese investors investing in U.S. equities are not subject to a negative correlation. These findings suggest that the predominance of negative correlations may be driven by certain sub-regions within the global equity market. Our results indicate that such a negative correlation applies mostly to emerging market investors investing in developed markets, while a positive correlation prevails for developed market investors investing in emerging markets.

The above findings highlight the importance of the specific numeraire currency used to evaluate currency returns: even for a single destination, the correlation between equity and currency returns may critically depend on which home currency is used to evaluate the currency returns. As emphasized in Schmittmann (2010), an investor's base currency matters significantly in drawing implications for currency hedging policy, which provides a warning against generalizing results obtained using one base currency (e.g., U.S. dollar to another currency). This study employs a full

[6] Australia and Japan are also the only two countries in Hau and Rey (2006) that exhibit a significant positive correlation between currency and equity.

pair-wise analysis that allows the numeraire to vary across home countries. Moreover, if negative correlation is a universal phenomenon, currency hedging should adversely affect international investors' risk-return tradeoff because it would undo the natural hedge provided by currencies moving in the direction opposite to that of equities. On the contrary, the large body of literature on international portfolio diversification reviewed above shows that currency hedging generally benefits cross-border portfolio investors, implying that the underlying correlation structure must have been positive.

Second, Hau and Rey's (2006) argument depends on portfolio rebalancing in which a bullish host stock market leads to a capital outflow from the market. However, this prediction contradicts the empirical findings in Brennan and Cao (1997), Froot et al. (2001), Griffin et al. (2004), and Richards (2005), who all report a positive relationship between capital inflows and equity returns, especially in emerging markets. This again suggests that Hau and Rey (2006) may reflect specific characteristics of certain regions, specifically developed markets. On the other hand, our results are consistent with the literature reporting a positive relationship between capital flows into emerging markets and their equity returns.

Finally, Hau and Rey (2006) is based on the key assumption that currency hedging option is unavailable to international investors. However, given the full menu of financial contracts and derivative products available, especially to institutional investors, this assumption seems too strong. Even emerging market retail investors such as Korea's are provided with the easy option of hedging or not hedging their currency risk when investing overseas, as we elaborate in Section 6. This study considers a full nonsymmetric matrix of bilateral relationships between 21 countries, including both developed and emerging markets, to provide a more complete picture of the link between currency and equity through capital movements.

The final body of literature related to ours examines various implications of international

portfolio diversification. Earlier studies, such as Grubel (1968), Levy and Sarnat (1970), Solnik (1974), and Lessard (1976), extend traditional portfolio theory by including foreign equities in their analyses and show that international diversification generally benefits investors by improving the efficient frontier. Subsequent studies have explicitly incorporated the effect of currency into their analyses to show that hedging currency risks may be beneficial to U.S. investors who invest overseas.[7] These studies also broadly consider how the underlying correlation between equity and currency returns may influence the effectiveness of currency hedging in terms of risk-return tradeoff. For example, Perold and Schulman (1988) point out that hedging is more beneficial the greater the positive correlation, since adding currency risk amplifies the overall volatility of the portfolio. Nevertheless, the underlying correlation structures reported in these studies are generally positive, explaining why hedging currency risks may turn out to be beneficial. Our results indicate that such positive correlation is more prominent in emerging markets, while a negative correlation is generally observed in developed markets. In our final analysis of Korean Siamese Twin international mutual funds investing in overseas assets, we show that, under negative correlation, hedging may actually increase volatility and turn out to be "friendly fire."

3. Data and variable construction

Our first empirical analysis focuses on the pair-wise correlation structure between currency and stock markets. We obtain weekly returns on stock market indices and exchange rates for 21 countries between 1996 and 2009 from Datastream. The sample period is conditioned largely by data availability. All exchange rates are first extracted in U.S. dollars, and, whenever necessary, we

[7] Perold and Schulman (1988) and Glen and Jorion (1993) show that, when U.S. investors buy foreign stocks and bonds, hedging currency risks significantly improves risk-return tradeoffs. Eun and Resnick (1994) and Schmittmann (2010) find similar results for various home-destination pairs. De Santis and Gerard (1998) find that U.S. equities have the least currency risk, consistent with Campbell et al. (2010).

calculate cross-rates in the units of other currencies. For Germany, the exchange rates are based on the Deutsche Mark until December 31, 1998, after which it switches to euro. For the U.S., we use the trade-weighted exchange rates obtained from the Federal Reserve. Both our currency returns and stock index returns are log returns.

We classify 21 countries into 9 developed and 12 emerging markets based on the Economic and Financial Indicators section of *The Economist*.[8] Countries are excluded from the sample if they are under either a fixed or managed float exchange rate regime. This filter excludes most of the countries in the Eurozone, except Germany, which has the largest market capitalization in the region and is thus selected as the stock market representing the Euro.

Our main empirical tests examine how global stock market conditions affect international capital movements, which in turn affect the correlation structure between the currency and stock markets. Our proxy for global stock market conditions is the MSCI world index return obtained from Datastream. We resort to the Balance of Payments (BOP) account to construct our net capital flow data. Quarterly BOP data for 1996 to 2009 are obtained from the International Financial Statistics (IFS) reported by the International Monetary Fund (IMF). Net capital flows for investment in stocks (bonds) are defined as increases in equity (debt) liabilities minus increases in equity (debt) assets during a given quarter. In addition, we consider a number of country-level control variables, including market capitalization, value of shares traded, GDP, and foreign exchange market size. The first two are obtained from the World Federation of Exchanges, the third from the BIS Triennial Central Bank Survey, and the last from the IFS. The BIS Triennial Central Bank Survey provides the average daily foreign exchange market turnover in April for all countries in our sample. The triennial surveys we use are those published every three years from 1998 to 2010.

[8] More specifically, we use the April 13, 2002 issue.

Our final analysis consists of a case study on a Korean Siamese Twin international mutual fund, which examines the effect of hedging when the underlying foreign assets and their currencies are negatively correlated. We obtain a weekly per share return series on these funds from the Morningstar Korea Financial Investment Association. There are initially 29 fund pairs between March 2007 and July 2009 offering both hedged and non-hedged classes. From the original 29 fund pairs, we filter out those pairs for which the number of weeks with valid returns is less than 15 or the discrepancy in availability of returns between the two classes is more than two weeks. Two fund pairs are excluded through this filter, leaving us with a final sample of 27 fund pairs.

4. Pair-wise analyses of currency and stock markets

4.1. Correlations between international stock markets

It is widely argued that world equity markets are rapidly being integrated. This integration naturally increases the correlation between stock markets, reducing the magnitude of benefits from international diversification. Indeed, Longin and Solnik (1995) show that the international correlation between markets increased from 1960 to 1990.

Before we examine the relationship between stock returns and currency returns, we first verify whether such correlation exists across stock markets in our sample. Table 1 presents the correlation among international stock markets based on weekly index returns denominated in local currencies. The first column shows the averages of correlations between the home country's stock market with twenty other destination markets. The first column represents the correlation over the entire sample period, from January 1996 to December 2009, based on 720 weekly returns. Columns (A) and (B) present the corresponding numbers for two subperiods of equal length. The last column, (B)-(A), presents the correlation changes over the two subperiods. The last four lines of the table

report the average correlations for all countries, emerging markets, and developed markets, as well as the difference between emerging and developed markets. The *p*-values are given in parentheses.

A number of stylized facts emerge from the table. First, all 21 countries in our sample experience an increase in average correlation, as in Longin and Solnik (1995), all of which are statistically significant at the 1% level. The countries with a higher than 0.2 increase in the second half of the sample period are Brazil, the Czech Republic, Korea, and Turkey among emerging markets and Australia and Japan among developed markets. These are the countries that have rapidly integrated into the global capital market in recent years.

Second, developed markets exhibit higher correlations on average than emerging markets. For example, the overall average for all countries in our sample is 0.472, while the corresponding numbers for developed and emerging markets are 0.536 and 0.425, respectively. This relationship holds in both subperiods, where the average of correlations is about 0.1 higher for developed markets.

The strong positive correlation across stock markets around the world raises a critical challenge to the key assumption in Hau and Rey (2006) that stock returns in each country are randomly generated. This also implies that, as long as the returns from the currency markets are not considered or the currency returns can be hedged away, investors in developed markets may gain a higher diversification effect by including emerging market stocks in their portfolios.

4.2. Correlation between currency and domestic stock markets

Once currency markets are taken into account, however, the gains from international diversification are not so straightforward, as the return from currencies constitutes an integral part of the "total return" from an international investment. Studies that explicitly consider currency risks in their analyses include Eun and Resnick (1988, 1994) and Jorion (1989). Using U.S. and Japanese bond and equity market returns, Eun and Resnick (1994) find that, when the exchange rate risks are taken into account, the gains from international diversification from the U.S. investors' perspective

occur mainly in terms of higher returns and, from the Japanese investors' perspective, in terms of lower risk. In other words, they show that currency returns provide different channels of diversification benefits depending on the origination of the investors.

We now investigate the correlation between each stock market in our sample and the local currency based on weekly currency returns and stock index returns. For all countries except the U.S., the currency values are initially measured in U.S. dollars.[9] For the U.S., trade-weighted exchange rates are used. The results are reported in Table 2. In Panel A, we report the correlations for the entire sample period and two subperiods, as well as the correlation changes from the first half to the second half, as in Table 1. The upper section presents the correlation between the currency return and stock index return for each country, while the lower section reports the average correlations across all countries as well as within emerging and developed markets. The last row shows the difference in correlation between developed and emerging markets; *p*-values are given in parentheses. In Panel B, we report the results separately for up markets and down markets within each country. Specifically, we calculate two sets of correlations for each country (and each subperiod), one using only positive stock index returns and the other using only negative returns. The last column within each subperiod reports the differences in correlation between down market and up market.

The results from Panel A indicate that stock returns are generally positively correlated with the currency returns. The average correlation is 0.204, which is statistically significant at 1%. Only three countries, the U.S., Japan and Switzerland, exhibit negative correlations throughout the whole sample period. This finding is broadly consistent with the findings in Campbell et al. (2010), who demonstrate that the values of the U.S. dollar, the euro, and the Swiss franc are negatively correlated with the stock markets, while the Australian dollar, Canadian dollar, British pound, and Japanese yen

[9] This analysis is from U.S. investors' perspective. In the next subsection, we allow the investor's home country and the numeraire to vary.

are positively correlated with their domestic stock markets.[10] On the other hand, our results contrast with those provided in Hau and Rey (2006), who document negative correlations for most of their sample of developed countries.

The average correlation between equity and currency returns increased from 0.117 in the first half of the sample period to 0.292 in the second half. The increase of 0.175 is statistically significant. Taken together with the results from Table 1, this implies that the relationship between the currency and stock markets has become tighter as the international stock markets have integrated over recent years. A careful examination reveals that both the positive correlation between currency and stock markets and increases in the correlation over time are mostly being driven by emerging markets.

For example, the average correlation for the developed countries as a whole is not significantly different from zero for the full sample period or for each subperiod. For the U.S., the correlation is actually negative for both subperiods and becomes more negative in the second half. For Japan, the correlation turns negative, to -0.3510, in the second half after a positive correlation of 0.0360 during the first half. All emerging markets, in contrast, exhibit positive correlation over the whole sample period, and all but New Zealand and the Philippines exhibit a stronger correlation in the second half. Even for New Zealand and the Philippines, the decrease is somewhat modest, at -0.003 and -0.05, respectively.

The results from the last row of Panel A indicate that, for both subperiods, the average correlation among the emerging countries is larger than that across the developed countries. However, the difference-in-difference between the two periods is not significantly different from zero. Specifically, the difference in the first half is 0.221, while the corresponding number for the second half is 0.257, a difference that is statistically insignificant. This implies that emerging markets exhibit

[10] The only cases for which the results of Campbell et al. (2010) differ from ours are Germany (euro) and Japan. For Japan, however, we also find the correlation to be positive for the first half, which overlaps with their sample period.

stronger ties between their local currency and the stock markets than the developed countries and that this relatively tighter relationship has been stable over time.

The results reported in Panel B suggest that the correlation between equity and currency returns is generally stronger in down markets. For example, for all emerging markets, the correlation in down markets is more positive than those in up markets. On the other hand, for U.S., Swiss, and Japan, we observe a negative correlation only during down markets. This pattern suggests that flight-to-quality, which occurs in down markets, could be related with the correlation structure between equity and currency.

The results from Tables 1 and 2 can be summarized as follows: (i) the international stock markets have become more integrated; (ii) the correlation between their local currencies and stock markets is more pronounced during down markets; and, (iii) for emerging markets, the correlation is positive and has become stronger over time. We conjecture that increases in cross-border investments seeking flight-to-quality during market downturns, which we document in the following section, may be a common factor in these findings. Accordingly, portfolio rebalancing can generate a correlation structure between currency and stock markets, as Hau and Rey (2006) argue.

4.3. Pair-wise analysis between the currency and stock markets

Table 3 presents an extension of the analysis in the previous subsection by expanding the numeraire of the destination's currency from U.S. dollars to all other currencies, except its own, as in Schmittmann's (2010) analysis of five developed markets. Specifically, we calculate pair-wise correlations between weekly stock index returns and local currency returns for 21 countries in our sample, where currency returns are measured as the home currency price of the destination currency. We report the results in three Panels: Panel A reports the results for developed market destinations, while Panel B reports the results for emerging market destinations. Bold letters indicate statistical

significance at the 5% level. Panel C presents the averages of the correlations for developed and emerging market destinations (separately) for each home country in our sample. Bold letters indicate statistical significance at the 5% level. and ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively. Note that the structure of the table is nonsymmetric and that the diagonal cells are all empty by design.

A number of interesting and significant observations can be made. Panel A indicates that, when the destination is a developed market, the currency and the corresponding stock index are generally negatively correlated. There is a total of 180 correlations, of which 149 (83%) are statistically significant. Out of the 149 significant correlations, about 72% (108) are negative. If we restrict home countries to emerging markets, the proportion of negatively significant correlations becomes even larger, at 86% (77 out of 90 significant correlations). On the other hand, correlations are mostly positive when the home country is the U.S. (6 out of 8).[11] This provides a clear warning against using a single currency such as the U.S. dollar as the sole numeraire and thus validates our approach of using multiple numeraires.

The negative correlation between destination currency and its stock index is more conspicuous when the currency of the destination is considered to be a hard currency (i.e., the U.S., the U.K., Germany representing the eurozone, Japan, and Switzerland). Out of 100 correlations, 88 (88%) are significant, and about 92% (81 out of 88) are negative. This is consistent with Hau and Rey's (2006) observation that correlations are mostly negative within developed markets. When the home country is an emerging market, out of 60 correlations, 55 (about 98%) are all negatively significant. For example, investors from most of the countries in our sample (all of 12 emerging markets and 6 out of 8 developed markets) investing in the U.S. equity market face a negative

[11] Note that the correlations reported in the last line of Panels A and B of Table 3 (with the U.S. as the home country) are identical to those reported in the first column of Panel A in Table 2 by design.

correlation between the value of the underlying stocks and the value of the dollar. The U.S. dollar returns measured in these home country currencies therefore provide a natural hedge for the investments in U.S. stocks. Specifically, at least part of the loss from the underlying stocks might be offset from gains in the currency position and vice versa. Therefore, volatility-minimizing investors should not hedge the currency risks. In fact, Campbell et al. (2010) suggest that it may be optimal to take even long positions in the U.S. dollar to optimize risk-return tradeoff when investing in U.S. stocks. We observe similar negative correlations when emerging home countries invest in developed destinations.

The results for emerging market destinations provided in Panel B are quite different from what we observe in Panel A for developed destinations. First, the number of significant correlations is smaller. Out of 240 correlations, 164 (68%) are statistically significant. In contrast to the findings in Panel A, most of the significant correlations, 139 out of 164 (85%), are positive. Moreover, most of the positive correlations affect developed market investors investing in an emerging market. Out of 86 significant correlations conditional on developed home markets, 79 (92%) are positive. Taking Japan, Switzerland, the U.K., and the U.S. as home countries, the value of all emerging market destination currencies measured in Japanese yen, Swiss franc, British pound, or U.S. dollar is positively correlated with the value of the destination stock market. Except for the U.K.-Czech pair, all cases are significant. Therefore, for most of these developed-country investors investing in emerging markets, currency returns will add volatility to the total return, and volatility minimizing investors should hedge the currency risks by taking short positions in the destination currency.

The results from pair-wise analyses in Panels A and B characterize the currency market as an agent that shifts risks from the investors in emerging markets to those in developed ones. This characterization is summarized in Panel C. First, Emerging Home Average and Developed Home Average in Panel C clearly indicate that, for emerging market investors investing in the developed

markets, the destination currency and stocks are on average negatively correlated, while for the developed market investors investing in the emerging, the two are on average positively correlated. For investments within developed markets, the currency and stocks are not significantly correlated. The last column, (A)–(B), indicates that, for all home countries, the correlation between destination currency and stocks is more positive when they invest in emerging markets. The differences are mostly significant at the 10% significance level (at the lowest), except for Japan and Switzerland.

We believe that these correlation patterns between equity and currency markets are interesting in themselves but also suggest a number of important practical implications with respect to international portfolio management. In the next section, we explore what may be driving these patterns in international stock and currency returns. Specifically, we formally test the conjecture that international capital movements, especially during down markets, are one of the important factors behind the correlation structure between currency and stock returns.

5. Capital flows and the correlation between currency and stock returns

A number of factors may be responsible for the patterns we document in the previous section. In what follows, we explore the possibility that international capital movements, especially during market downturns, are important in determining the correlation between currency and stock returns. We test this conjecture in two steps. First, we examine whether the capital movements accompanying international equity investments in and out of emerging countries are influenced by the global stock market conditions. We hypothesize that, during bullish global stock market, capital moves into riskier emerging stock markets and moves out of these countries during bearish markets. The latter phenomenon is widely known as the "flight-to-quality." To describe the former phenomenon, we coin the term "flight-to-risk."

Once we establish that the capital flows in and out of the emerging markets are procyclical, we test whether the correlation between the currency and stock returns depends on the magnitude of these capital flows. We argue that the relationship between the currency and the stock markets is tighter for the emerging countries, since the market for foreign exchange is far smaller and simpler. For example, bond markets for most emerging countries are relatively inactive and small compared to those of developed countries. Therefore, if investors want to invest in emerging countries, their choice is largely restricted to equity investments. This will make the capital flows in and out of emerging countries induce a more direct influence on the correlation between currency and stock returns. In the case of developed markets, however, the process of exchange rate determination is far more complicated, and, with significantly large bond markets, the capital flows associated with stocks alone may not be enough to explain the movements in their currency values.

Unfortunately, testing these conjectures empirically is not easy, mainly because of the lack of appropriate data. Data on pair-wise capital flows appear to be publicly available only at an annual frequency.[12,13] Since global stock markets can fluctuate significantly within a calendar year, we would lose too much information if we estimated the relationship between stock markets and capital flows over yearly intervals. Even if daily data were available, they would be inadequate for a reliable estimate of the correlation between stock and currency returns. As an alternative, we use information provided in the Balance of Payment (BOP) data, available quarterly, to construct a measure of capital flow and match them with the correlation between weekly stock and currency returns calculated for each calendar quarter. Although this measure of capital flows is admittedly somewhat crude, it biases

[12] The IMF Coordinated Portfolio Investment Survey (CPIS) provides data on pair-wise capital flows for equity and debt instruments for 1997 and from 2001 to 2009.

[13] Two exceptions are Griffin et al. (2004), who use aggregate equity flows in nine emerging markets at a daily frequency, and Richards (2005), who uses a similar dataset for six Asian emerging markets.

against finding any meaningful statistical relationship between capital flows and the degree of correlation between the stock and currency markets.

5.1. Trends in market sizes and international capital flows

Before we formally test our capital flow hypothesis based on a multivariate framework, we first provide a quick glance at trends in global capital markets and international capital flows. Fig. 1 illustrates the trends in average market sizes of debt securities (domestic and international) and equities from 1996 to 2009 for all countries in our sample.[14] Panel A presents average market sizes across the developed countries and Panel B presents them across the emerging countries. For Panel B, due to data availability, domestic bond outstanding and equity market capitalization are averaged over eight countries, excluding Israel and Chile. First, the market sizes of the developed countries in our sample are roughly more than ten times as large as those of emerging countries. In 2009, developed countries' average stock market capitalization was about USD 3 trillion, and the average debt securities outstanding was USD 5 trillion, while the corresponding amounts for emerging countries were only USD 0.4 trillion and USD 0.3 trillion, respectively. The market sizes of both stocks and bonds exhibit an upward trend for both developed and emerging countries over the whole sample period. Bond markets show a relatively steady increase in their values, while stock markets have a couple of troughs, indicating that equity market sizes are more volatile than bonds. For example, in 2008, in the midst of the global financial crisis, both developed and emerging stocks lost approximately 50% of their values. Even though the crisis was triggered mostly by developed country capital markets, emerging countries' stocks took the most damage, giving up more than 50% of their market capitalization. On the other hand, the value of developed countries' bonds actually increased in 2008. Out of the four asset classes, only this class saw its value increase. This is broadly

[14] The data for Fig. 1 are obtained from BIS International Banking and Financial Market Developments.

consistent with flight-to-quality, where riskier emerging countries' stocks lose their values while the less risky bonds of developed countries gain value in bear markets. We conjecture that, during this period, international portfolio rebalancing may have facilitated capital flows from emerging countries' stocks to developed countries' bonds.

Fig. 2 presents the trends in average international net capital flows for stocks and bonds as well as the trends in MSCI world index returns during our sample period. Net capital flows for investment in stocks (bonds) are obtained by subtracting increases in equity (debt) assets from increases in equity (debt) liabilities using the IMF's BOP data. Panel A reports the average net capital flows for nine developed countries, while Panel B presents the corresponding numbers for 12 emerging countries.

Note that net capital flows in developed markets are about ten times as large as those in emerging markets, similar to the difference reported in Fig. 1. On the other hand, we do not observe a clear time-series trend in net capital flows, except for net debt flows into developed markets, where it increases steadily until 2008. This is again broadly consistent with the view that increases in world-wide demand for safer securities may have been one of the fallouts from the 2008 global financial crisis.

More important is the clear contrast between Panel A and Panel B concerning capital flow in response to global stock market conditions. Specifically, net equity flows are procyclical for emerging markets and countercyclical for developed markets. This implies that net equity flows generally move in opposite directions for developed and emerging markets. Thus, when there is a positive net equity flow in emerging markets, we observe a negative net equity flow in developed markets. These results are consistent with Griffin et al. (2004) and Richards (2005), who report that equity flows into emerging markets are positively correlated with stock returns in the home market as well as markets abroad.

We also observe large negative net equity flows in emerging markets in 2007 and 2008. In contrast, net bond flows in developed markets are positive, and the magnitude is largest during the same period. When the stock market recovers in 2009, net investment in emerging market stocks turns positive while net investment in developed market bonds turns negative. Overall, Fig. 2 suggests that net capital flows in and out of developed and emerging markets exhibit distinct patterns that may be able to explain the tight correlation between stocks and currency in emerging markets.

5.2. Global stock market conditions and movement of capital

We now examine how international equity capital movement is correlated with global equity market conditions in a multivariate framework. Our hypothesis can be summarized in the notions of flight-to-quality and flight-to-risk. Table 4 presents the OLS estimates of the panel regressions of each country's quarterly net equity flow in USD billion on quarterly MSCI world returns.[15] The first two columns report the results for the full panel set, while the remaining columns exclude Japan. Columns (5), (6), (7), and (8) report subpanel results based on market conditions, where up (down) markets are those quarters during which MSCI world return is positive (negative). Every second column includes additional control variables, the total stock market capitalization of each country in USD trillions, the turnover measured by the value of shares traded divided by year-end market capitalization in percentages, and the annual GDP growth rate (percentage). We also include Relative Equity Flows defined as the absolute value of net capital flows for stocks over the absolute sum of the net capital flows for stocks plus bonds as an additional control variable. Standard errors are adjusted for clustering at the country level, and the corresponding *t*-statistics are presented in

[15] In what follows, we use the terms "net equity flow," "net capital flows for stocks," "net portfolio investment in stocks," and "capital flows in and out of the stock market" interchangeably.

parentheses; ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

The notions of flight-to-quality and flight-to-risk imply that net capital flows in and out of emerging countries' stocks are positively related to the MSCI world returns. Therefore, the key variable of interest is the interaction term between MSCI world return and the emerging market dummy. When Japan is included, as in columns (1) and (2), this term is not statistically significant. However, once we exclude Japan in columns (3) and (4), not only the interaction term but the MSCI return itself also become significant, indicating that global stock return has opposite effects on the net equity flows into developed and emerging markets: when stock markets are bullish (bearish), international equity investments are directed towards emerging (developed) markets. These results imply that Japan behaves more like an emerging country, at least in terms of net equity flows. These observations are corroborated by previous research on Japanese capital flows. Brennan and Cao (1997), Brooks et al. (2004), and Hau and Rey (2006) all find that Japan differs from other developed countries as far as capital flows are concerned. Brennan and Cao (1997) show that capital moves out of Japan when the Japanese yen appreciates. Brooks et al. (2004) find that capital flows associated with stocks cannot explain the yen-U.S. dollar exchange rate. Similarly, Hau and Rey (2006), in footnote 28, argue that "Japan on the other hand is special because international portfolio flows concern mostly bonds as opposed to equity." Therefore, it appears that, for Japan, equity capital flows due to flight-to-quality is obscured by bond capital flows, unlike in other developed countries.

The analyses in the previous section suggest, however, that the correlation between yen and Japanese stocks is negative, similar to other developed countries. We conjecture that yen-carry related investment strategies that take advantage of extremely low interest rates may reconcile both procyclical equity capital flows and the negative correlation observed in Japan. When the global economy is bullish, even though capital moves into Japanese stocks, a large amount of yen-carry

related capital, possibly more than the net flow into stocks, moved out of Japan. Therefore, in these periods, even though the capital flows into Japanese stocks similarly to what is observed in emerging market stocks, the yen would likely lose its value. On the contrary, when the global economy is bearish, a large amount of capital flows into Japan in order to unwind yen-carry transactions. We present the supporting evidence for this argument in Appendix I. In what follows, we focus on the empirical results excluding Japan.

Having confirmed our conjecture that capital flows in and out of emerging stock markets are procyclical, we next explore whether these procyclical capital movements are largely due to flight-to-quality or flight-to-risk. Specifically, we divide the sample into two subsets based on whether the MSCI world return for a given quarter is positive or negative and report the results for up markets in columns (5) and (6) and those for down markets in columns (7) and (8). There are 575 up-market quarters and 345 down-market quarters. The results clearly indicate that coefficient estimates from the whole sample are driven by flight-to-quality rather than flight-to-risk. In fact, estimates of the key variables lose statistical significance in up-market regressions. This is largely consistent with the results reported in Panel B of Table 2, that correlation between equity and currency returns is more pronounced during market downturns. The coefficient on Relative Equity Flows also turns marginally significantly negative in columns (7) and (8), indicating that net equity flows are more negative where bond markets are less developed. In contrast, we do not find these patterns in the up-market sample. In sum, Table 4 suggests that flight-to-quality drives international capital to flow in and out of developed stock markets countercyclically and in and out of emerging stock markets procyclically.[16]

5.3. Net capital flows and correlation between currency and stock returns

[16] In an unreported analysis, we control for the 2008 global financial crisis period and find similar results.

In this subsection, we examine how net capital flows in and out of each country are related to the degree or strength of the correlation between stocks and currency in that market. Table 5 presents the OLS estimates of panel regressions where the dependent variable is each country's quarterly correlation between weekly currency returns based on U.S. dollar values and weekly stock index returns. The key explanatory variable is the absolute value of quarterly Net Equity Flow, as defined in the previous subsection. As in Table 4, we report the results with and without Japan and also for two subpanels based on market conditions. Additional control variables include foreign exchange market size measured by the average daily foreign exchange market turnover, the total stock market capitalization of each country, changes in foreign reserves (proxying for foreign exchange market intervention), and the annual GDP growth rate. The level control variables are all in USD trillions. Standard errors are adjusted for clustering at the country level, and the corresponding *t*-statistics are presented in parentheses.

As in Table 4, our baseline discussions focus on results excluding Japan. Unlike in Table 4, however, we obtain similar results even when we include Japan. This is somewhat expected, since what makes Japan different from the other developed countries is how global market conditions affect net equity capital flows. As far as the correlation between currency and stock returns are concerned, Japan behaves similarly to the other developed countries.

For all regressions, coefficients on two variables, Emerging Dummy and the interaction term between the absolute value of Net Equity Flow and Emerging Dummy, are consistently significant. By contrast, the absolute value of the Net Equity Flow itself is insignificant in all specifications. These results suggest that (i) the correlation between currency and stock returns are higher on average for emerging countries, and (ii) this correlation becomes stronger when there are large net capital flows but only for the emerging countries.[17] For developed countries, however, capital flows

[17] We also ran a tobit regression in which the dependent variable is truncated at -1 and +1 and found similar results.

in and out of stock markets do not seem to affect the correlation between currency and stock returns. Figs. 1 and 2 show that the bond markets are relatively better developed in developed countries, providing a viable candidate as an investment outlet for interested foreign investors. Therefore, the commonality between currency and stock values will be weaker for developed countries than for emerging countries.

The constant term reflecting the unconditional correlation for developed markets is also insignificantly different from zero. This is partly due to the fact that only the U.S., Switzerland, and Japan exhibit a negative correlation, while all other developed countries exhibit a positive correlation, as reported in Table 2. In Campbell et al. (2010), only the values of the U.S. dollar, the euro, and the Swiss franc are found to be negatively correlated with the stock markets. In their analysis, even the Japanese yen is found to be positively correlated with the domestic stock market, as are the Australian and Canadian dollars and the British pound.

The estimates of the coefficient on Emerging Dummy imply that the quarterly correlation between weekly currency and stock returns are, on average, between 0.22 to 0.27 higher in emerging countries than in developed ones. The coefficient for the interaction term for the whole sample in columns (3) and (4) is 0.019, implying that a one billion dollar net equity flow into an emerging country is expected to increase the correlation by roughly 2%. The subsample analyses indicate that the sensitivity of correlation to net equity flows in emerging markets is little different between up and down markets, although the coefficients for down markets is slightly larger. The GDP growth rate returns a negatively significant coefficient, except in the up-market sample, indicating that higher GDP growth is expected to weaken the correlation between currency and stock returns. It appears that the real sector performance of a country affects the link between currency and financial sector, stocks in this case. This point warrants further investigation, which we leave for a future study.

In fact, the overall significance of the coefficients and R^2 actually improves under tobit specification.

6. A case study: Shooting yourself in the foot by currency hedging

The previous sections have shown that, when an investor in an emerging country invests in stocks in a developed country, the value of the destination currency tends to move in a direction opposite that of the stocks. On the other hand, when an investor in a developed country invests in an emerging country's stocks, the value of the destination currency tends to move together with the stocks. This finding has important implications for hedging strategies in international portfolio management. For example, investors from developed countries investing in the stocks of emerging countries should hedge the currency risks, while investors from emerging countries investing in the stocks of developed countries should not if their objective is to reduce the overall volatility of the total return. In this section, we provide a case study that illustrates how hedging may adversely affect total return volatility when currency and underlying foreign asset values are negatively correlated.

We use a unique sample of 27 Siamese Twin international mutual fund pairs in Korea holding identical underlying foreign assets but offering different currency hedging alternatives. Tables 3 and 4 suggest that Korea is one of the countries for which most of the destination currencies and stocks are negatively correlated. Therefore, currency positions should provide a natural hedge for Korean investors investing in foreign currency denominated assets. Hedging currency risks under such a negative correlation would actually increase the volatility of the total return since the hedging activity unwinds the natural hedge.

6.1. Institutional background

Investing in global assets is a relatively recent phenomenon in Korea. Formerly, most of the available international funds were offshore funds created and managed abroad. Since 2006, however, both the number and assets under management (AUM) of onshore overseas funds have rapidly

increased. First-generation offshore funds did not provide a hedging mechanism against currency risks. As the Korean won strengthened, however, distribution channels such as commercial banks and investment banks started requiring fund managers to provide hedges against currency risks. In response, most of the subsequent onshore overseas funds decided to provide hedges against currency risks. The typical hedging strategy adopted by these funds is the dynamic hedging scheme in which target hedge ratios are often set around a prespecified level (e.g., 100% or 80%) or within a prespecified range (e.g., between 80 and 100%) of the underlying value.

Unlike most of these onshore funds, which offered only hedged portfolios, some foreign currency denominated funds were made available to investors in two separate forms: one with a hedging option and the other without. These two types of funds share the same underlying assets with the same portfolio weights, as well as the same management fees.[18] Therefore, all differences between them depend solely on whether they are hedging currency risks. We believe that these Siamese Twin funds provide a natural experimental setting for an investigation of the effects of foreign currency hedging on a fund's return distribution. The results from this empirical analysis can then be used to infer the effect of hedging in the remaining majority of funds that provide only the hedging alternative.

In our sample of 27 fund pairs, the financial instruments used for hedging consists of both futures and forward contracts. Relatively smaller funds with AUM of less than KRW 2 billion (roughly USD 2 million) used only futures contracts, while most of the larger funds used a mixture of forward and futures, on a roughly 50:50 basis. The typical maturities of forward contracts ranged from three to six months, while those of futures contracts lasted for two to three months. The most important factors in determining maturity seemed to be the liquidity of the contracts.

[18] For hedged funds, however, transaction costs from implementing hedging activities are additional.

Table 6 presents the descriptive statistics of the mutual fund pairs in our sample. For each fund in the sample, the first six columns report the type, its numerical ID,[19] the number of paired weekly returns available, the total AUM separately for non-hedged assets and hedged assets, and the currency the fund targets to hedge. There are 18 regional funds and nine sector funds, out of which seven are energy funds.[20] On average, weekly returns are available for 70 weeks, or one year and four months. This reflects the fact that funds with options to hedge or not became available only recently. The average AUM for hedged funds is about three times larger than that of nonhedged funds. This implies that investors' demand for a hedging option was much stronger than that for a nonhedging option during the sample period. Note, however, that even the average AUM of the hedged funds was KRW 16 billion (roughly USD 15 million), which would be considered small by U.S. standards. There were 14 funds that targeted to hedge the U.S. dollar, six funds targeting the Hong Kong dollar, two funds targeting the Japanese yen, two funds targeting the euro, and the remaining three targeting a basket of currencies. For the last three funds, we develop a matching currency index using the weights declared by the funds.

The final two columns present the correlation between weekly currency return based on the KRW denominated price and the weekly underlying asset return. Since the underlying return net of the currency return is not directly observable, however, we need proxies for the true underlying return. We employ two different proxies for this purpose. Our first candidate is the hedged return itself. Although dynamic hedging may not be able to perfectly unbundle the currency return and hence replicate the true underlying return, it could be used as a reasonable proxy for estimating the

[19] Appendix II provides the fund names associated with the IDs

[20] The sample includes funds that invest in commodities. Even though these funds do not hold international equities, they still serve our purpose, as, just like equities, returns on commodities are negatively correlated with returns on foreign currencies from the Korean investor's point of view. Daskalaki and Skiadopoulos (2011) provide evidence that return correlations between commodity and U.S. equities was exceptionally high from 2005 to 2009. Note that this period encompasses the sample period of this case study. Apparently, we observe negative correlation between commodities and currencies because of the high correlation between commodities and equities.

correlation structure. In our second approach, we infer the "implied" underlying return by removing currency return from the nonhedged return, both of which are directly observable. Note the nonhedged total return from an international investment: $1 + r^{nh}$ equals $(1 + r^{a})$ $(1 + e)$, where r^{a} represents the return from the foreign asset measured in the foreign currency, and e is the home currency return of the destination currency. Therefore, the "implied" underlying asset return r^{a} can be inferred from

$$\hat{r}^{a} = \frac{r_t^{nh} - e}{1 + e} . \tag{1}$$

As can be seen from the final two columns of Table 6, the correlations between the underlying return and currency return are all negative, regardless of which measure is used to proxy for the true underlying return. This is consistent with the previous results reported in Table 3, where the home country is Korea. The average correlation is -0.479 when a hedged return is used as the proxy for the true underlying and -0.639 when implied underlying is used instead. The prevalence of a negative correlation indicates that currency hedging may increase return volatilities. Moreover, since the correlations range from -0.086 to -0.70 based on hedged returns and from -0.242 to -0.911 based on implied underlying returns, not only the direction but also the magnitude of hedging effects can be reasonably estimated by exploiting the cross-sectional variation in correlations.

For all 27 fund pairs, however, the correlations based on implied underlying is unilaterally more negative than the correlations based on hedged returns, suggesting a potential underestimation of the true covariance structure when implied underlying is used. In what follows, we use the correlations obtained from hedged returns as the baseline since they exhibit less extreme values. Nevertheless, our basic results are robust to using correlations based on implied underlying returns instead.

6.2. Effects of currency hedging on return volatility

Since the correlation between underlying assets and the corresponding currency is all negative, as reported in Table 6, we expect the volatility of a hedged fund to be larger than that of its nonhedged counterpart. Table 7 presents a comparison of return volatilities between hedged and nonhedged funds. The first four columns repeat the type, fund ID, and number of paired weekly returns available. The next two columns present the standard deviation of the weekly returns for both hedged assets and their nonhedged counterparts. The final column presents the difference in volatilities between each pair of funds. The last four rows present the means, medians, and corresponding test statistics.

As expected, volatility is generally greater in hedged than in nonhedged assets. For 23 out of 27 funds, dynamic hedging increases return volatility. The average increase in the weekly standard deviation is 0.67% points, and the corresponding median is 0.63% points, both statistically significant. These differences in weekly standard deviations translate into 4.5% to 4.8% per annum. These differences also amount to an approximately 15% increase from nonhedged mean and median volatility.

To investigate the magnitude of the effect of negative correlation on hedged fund volatility, we first plot the relationship between correlation and differences in return volatilities in Fig. 3. In both Panels A and B, the horizontal axis measures the correlation between the underlying return and the currency return, while the vertical axis measures the differences in standard deviations between hedged and nonhedged assets using the weekly returns for each of the 27 fund pairs in our sample. In Panel A, the underlying return is proxied by the hedged return to calculate its correlation with the currency return, while, in Panel B, we infer the “implied” underlying return, as in equation (1), and use this measure to obtain the correlation with the currency return. Each dot in the figure represents one mutual fund pair.

The results from both Panels A and B strongly suggest that hedged fund return volatility increases relative to nonhedged volatility, as the correlation between the underlying asset and the corresponding foreign currency becomes more negative. In fact, the four funds for which the volatility of the hedged funds was lower than the nonhedged funds in Table 7 are the four funds that showed the least negative correlation in absolute terms in Table 6.[21]

We would expect that, as the correlation between destination currency and asset returns becomes more negative, currency hedging would adversely affect the total return volatility to a greater extent. Table 8 reports the results from cross-sectional analyses that formally test this hypothesis, controlling for other fund characteristics. We report the OLS regression results where the dependent variable is the difference in volatility between hedged asset and nonhedged asset measured as the standard deviation of weekly returns from the hedged fund minus that from its nonhedged counterpart. The correlation between the underlying and the currency return are calculated for each mutual fund using weekly returns, where the underlying return is proxied by the hedged return. We take the natural log of assets under management (KRW million) to control for any potential size related effect. To examine whether the results are influenced by the target currency itself, we introduce a non-U.S. dollar dummy.

The results from Table 8 clearly indicate that a more (less) negative correlation leads to a larger (smaller) volatility of the hedged return relative to the nonhedged return. Even though the sample size is only 27, the correlation between the underlying asset and currency returns turns out to be the most important factor in explaining the differences between hedged and nonhedged return volatilities. The R^2 value in specification (1), where we include only the correlation and a constant, amounts to 0.458, implying that close to half of the variation in volatility differences is explained by the correlation between the underlying and currency only. These results provide strong evidence in

[21] The IDs of these four funds are 2, 3, 17, and 19.

support of our conjecture that a negative correlation between destination currency and asset returns would undermine the effectiveness of currency hedging. We refer to this phenomenon as "shooting yourself in the foot" or "friendly fire" incurred by currency hedging.

The results of this case study strongly suggest that currency hedging strategies should be carefully designed according to the correlation structure between destination currency and underlying asset returns. When the correlation between the currency and asset values is negative, currency hedging may actually increase return volatility. The results in the previous sections indicate that this may well apply to most of the emerging country investors investing in the stocks of developed countries. For investors in developed countries investing in the stocks of emerging countries, however, currency hedging may contribute to reducing total return volatility.

7. Conclusion

This paper has examined pair-wise correlations between currency and stock markets. We have formed pairs with nine developed and 12 emerging countries spanning 1996 to 2009. The results show that currency returns are generally positively correlated with an emerging country's stock returns. In other words, when an emerging country is paired with a developed country, the emerging country's currency returns measured against the developed country's currency are positively correlated with the emerging country's stock returns. The value of the developed country's currency measured in the units of the emerging country's currency will then be negatively correlated with its own stocks. For emerging countries, we also find that the return correlation between currency and stock is not only positive but also stronger. For developed markets such as the U.S., we find that the correlation is negative and weak. We thus provide evidence that international capital flows motivated by flight-to-quality play an important role in determining correlations between currency and stock returns.

These findings have important implications for hedging strategies in international portfolio management. Currency returns add risks asymmetrically on the total return from an international investment depending on whether the investors are from an emerging or a developed country. In particular, investors in developed countries investing in emerging markets find that the currency market adds risks to the total return, while those in emerging countries investing in developed markets find that it provides a natural hedge. This issue is further explored in an interesting case study of open-ended international mutual funds, in which the effects of currency hedging on fund performance are examined. Using a unique sample of 27 Korean Siamese Twin fund pairs holding identical underlying foreign assets but offering different currency hedging alternatives, we find that the hedged portfolios provide higher return volatility than their nonhedged counterparts. This is largely because the values of the foreign currency and the underlying assets are negatively correlated, and the hedging schemes effectively undo the natural hedge provided by the currency markets. The results suggest that currency hedging strategies should be designed carefully after the correlation structure between destination currency and asset returns is thoroughly examined.

References

Brennan, M. J., Cao, H. H. 1997. International portfolio investment flows. Journal of Finance 52, 1851-1880.

Brooks, R., Edison, H., Kumar, M., Slok, T., 2004. Exchange rates and capital flows. European Financial Management 10, 511-533.

Caballero, R., Krishnamurthy, A., 2008. Collective risk management in a flight-to-quality episode. Journal of Finance 63, 195-230.

Campbell John Y., Serfaty-de Medeiros, K., Viceira, L. M., 2010. Global currency hedging. Journal of Finance 65, 87-121.

Daskalaki, C., Skiadopoulos, G., 2011. Should investors include commodities in their portfolios after all? New evidence. Journal of Banking and Finance 35, 2606-2626.

De Santis, G., Gérard, G., 1998. How big is the premium for currency risk? Journal of Financial Economics 49, 375-412.

Eun, C. S., Resnick, B. G., 1988. Exchange rate uncertainty, forward contracts and international portfolio selection. Journal of Finance 43(1), 197-215.

Eun, C. S., Resnick, B. G., 1994. International diversification of investment portfolios: U.S. and Japanese perspectives. Management Science 20, 140-161.

Evans, M., Lyons, R., 2002a. Order flow and exchange rate dynamics, Journal of Political Economy.110(1), 170-180.

Fischer, S., Merton, R. C., 1984. Macroeconomics and finance: the role of the stock market, NBER Working Paper No. 1291

Frankel, J., Rose, A., 1995. Empirical research on nominal exchange rates, In: Grossman, G., K. Rogoff (Eds.), Handbook of International Economics, North-Holland, Amsterdam.

Froot, K., O'Connell, P., Seasholes, M., 2001. The portfolio flows of international investors. Journal of Financial Economics 59, 151-193.

Glen, J., Jorion, P., 1993. Currency hedging for international portfolios. Journal of Finance 48, 1865-1886.

Griffin, J., Nardari, F., Stulz, R., 2002. Daily cross-border equity flows: pushed or pulled? NBER Working Paper No. 9000.

Grubel, H., 1968. Internationally diversified portfolios: welfare gains and capital flows. American Economic Review 58, 1299-1314.

Hau, H., Ray, H., 2006. Exchange rates, equity prices, and capital flows. The Review of Financial

Studies 19, 273-317.

Jorion, P., 1989. Asset allocation with hedged and unhedged foreign stocks and bonds. Journal of Portfolio Management 15, 49-54.

Lane, P., Milesi-Ferretti, G. M., 2003. International financial integration. Working Papers 03/86, IMF.

Lessard, D., 1976. World, country and industry relationships in equity returns: implications for risk reduction through international diversification. Financial Analyst Journal 32, 2-8.

Lettau, M., Ludvigson, S. C., 2010. Chapter 11: Measuring and modeling variation in the risk-return trade-off, Handbook of Financial Econometrics.

Levy, H., Sarnat, M., 1970. International diversification of investment portfolios. American Economic Review. 60, 668-675.

Longin, F., Solnik, B., 1995. Is the correlation in international equity returns constant: 1960-1990? Journal of International Money and Finance 14, 3-26.

Lustig, H., Verdelhan, A., 2011. Business cycle variation in the risk-return trade-off, Journal of Monetary Economics, forthcoming.

Lyons, 1995. Tests of microstructural hypotheses in the foreign exchange market. Journal of Financial Economics 39, 321-351.

Meese, R., Rogoff, K., 1983. Empirical exchange rate models of the seventies: do they fit out-of-sample? Journal of International Economics 14(2), 3-24.

Pavlova, A., Rigobon, R., 2007. Asset prices and exchange rates. Review of Financial Studies 20 (4), 1139-1181.

Perold, A. F., Schulman, E. C., 1988. The free lunch in currency hedging: implications for investment policy and performance standards. Financial Analysts Journal 44, 45-50.

Richards, A., 2005. Big fish in small ponds: the trading behavior and price impact of foreign investors in Asian emerging equity markets. Journal of Financial and Quantitative Analysis 40, 1-27.

Solnik, B., 1974. Why not diversify internationally? Financial Analyst Journal 20, 48-54.

Schmittmann, J. M., 2010. Currency hedging for international portfolios, IMF Working Paper

Vayanos, D., 2004. Flight to quality, flight to liquidity, and the pricing of risk. NBER Working Paper No. 10327.

Verdelhan, A., 2010. A habit-based explanation of the exchange rate risk premium. Journal of Finance 65, 123-146.

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A. 1. Japanese net capital flows

This Appendix provides evidence that capital flows in and out of Japan were uncharacteristic for a developed country. We conjecture that yen-carry related investment strategies that take advantage of extremely low interest rates in Japan were the main reason for the uncharacteristic flows. A typical developed country would witness countercyclical net capital flows in and out of its stock market. In other words, the correlation between the MSCI world index and net capital flows to a developed stock market is generally negative, as illustrated in Fig. 2. If we measure the correlation using quarterly observations over the sample period, the average over the developed countries excluding Japan is -0.111. The correlation for Japan is, however, 0.592. In fact, this is the largest for all the countries in our sample, including the emerging countries. The emerging country average is 0.163, with South Africa having the highest correlation among the emerging countries, at 0.489. Therefore, as far as capital flows are concerned, Japan behaved more like an emerging country.

Nevertheless, Japan has a negative correlation between currency and stock returns, just like a typical developed country. Table 1 shows that the Japanese stock market is highly correlated with the other stock markets around the world. When the MSCI world index gains, it is highly likely that Japanese stocks will also gain. The high correlation of 0.592 between the MSCI world index and net capital flows then predicts that the Japanese stock market will receive net capital inflows. Since this inflow should create demand for Japanese yen, we expect the Japanese yen to gain value. This should therefore lead the correlation between currency and stock returns to be positive. Surprisingly, however, Table 2 shows that it was negative, at -0.144, over the whole sample period, and -0.351 over the second half of our sample period. The clue to this seemingly contradictory result lies in the capital flows for bonds. The yen-carry related investment strategies yielded significant capital flows in and out of the Japanese bond market. The bond-related capital flows were countercyclical:

outflows when the return to MSCI world index was positive and inflows otherwise. The following table shows capital flows in and out of Japanese capital markets over the second half of the sample period. The U.S. flows are also provided as a benchmark of a developed country over the same period. The data are constructed similarly to those in Tables 4 and 5, but the quarterly observations are summed over a year.

	Japan		US	
Year	Net Equity Flows	Net Debt Flows	Net Equity Flows	Net Debt Flows
2002	-19,594	-140,557	-142,559	19,594
2003	157,454	-227,486	-229,489	-157,454
2004	92,047	-94,191	-96,195	-92,047
2005	338,882	-55,071	-57,076	-338,882
2006	27,040	-35,165	-37,171	-27,040
2007	-72,114	72,011	70,004	72,114
2008	-310,889	61,017	59,009	310,889
2009	-126,033	-347,973	-349,982	126,033

As can be seen from the table, the U.S. and Japan exhibit strikingly different patterns. For the U.S. (except for 2002 and 2009), net equity flows and net debt flows have the same sign. When investors find the U.S. attractive, they invest in both stocks and bonds, and vice versa. For Japan, however (except for 2002 and 2009), net equity flows and net debt flows have different signs. We believe this to be a consequence of yen-carry trades. When the global economy was booming, for example from 2002 to 2006, large net outflows were initiated from Japanese debt instruments in order to find riskier investment opportunities; when the global economy was lagging, for example in 2007 and 2008, large net inflows were made in order to unwind the positions. We observe a negative correlation between the Japanese yen and its stock index because net debt flows are negatively correlated with the stock index. We conclude that Japan is quite different from the other developed countries as far as net equity flows are concerned and exclude Japan from the empirical analyses of Tables 4 and 5.

A. 2. Sample funds

This Appendix provides the actual names of the "Siamese Twin" international mutual funds in Korea that provide the investors with the option of either hedging or not hedging the currency risks.

Fund ID	Fund Name
1	Daishin Vitamin Feeder Equity 2 A
2	Daishin GlbWarming Theme Eq Master
3	Tongyang Dual Index Feeder Equity UH A
4	MiraeAsset China A Share Feedr Equity 1(H) F
5	BlackRock World Gold Feeder Equity (UH) A
6	BlackRock World Mining Feeder Equity (UH) A
7	BlackRock World Energy Feeder Equity (UH) A
8	BlackRock Emerg Eurp Fdr Eq (UH) A
9	BlackRock Latin America Feeder Equity (UH) A
10	Samsung China 2.0 Mainland Feeder Equity 2 A
11	Samsung China Feeder Equity 2
12	Samsung Great China Feeder Equity 2 A
13	Samsung Global Water Feeder Equity 2 A
14	Samsung Global Alternative Energy Feeder Equity 2 A
15	Samsung FouU N Japan Conversion Feeder Equity 2 A
16	Samsung Latin America Feeder Equity 2 A
17	Schroders Emerging Raw Materials Feeder Equity B A
18	Shinyoung China Value Plus Feeder Equity A
19	Woori Brazil Explorer Feeder Equity 2 A1
20	Franklin Templeton BRIC Feeder FoFs (UH) A
21	Franklin Templeton Asian Growth Feeder Equity (UH)
22	Franklin Templeton Frontier Market Feeder Equity (UH) A
23	Hanwha Global Natural Resources Conversion Feeder Equity UH Ce
24	Hanwha Southeast Asia Conversion Feeder Equity UH C-e
25	Hanwha Euro Conversion Feeder Equity UH A
26	Franklin Templeton MENA Feeder FoFs (UH) A
27	HanaUBS Japan Feeder Equity U-1 C

Table 1: Average Correlation Coefficients among Stock Market Indices

This table presents the average correlations among international stock markets. The first column presents the average correlations between the indicated country's weekly stock market index return with the twenty other markets' weekly index return. All averages are significantly positive at the 1% level. The Overall Period column presents the correlations over the entire sample period, from January 1996 to December 2009 based on 720 weekly returns. The next two columns, (A), and (B), report the results for two subperiods of equal length. The last column, (B)-(A), reports the increases in correlations over the two subperiods. The lower section of the table shows the summary statistics of the average correlations for all sample countries, emerging markets and developed markets. The last row reports the difference in averages between the emerging markets and developed markets. The *p*-values are given in the parentheses.

Country		Overall Period	(A) 1996~2002	(B) 2003~2009	(B) - (A) 2nd half – 1st half
Emerging Markets	Brazil	0.492	0.397	0.617	0.221
	Chile	0.423	0.362	0.493	0.131
	Czech	0.438	0.322	0.556	0.235
	Hungary	0.484	0.425	0.572	0.147
	Israel	0.364	0.333	0.412	0.079
	Korea	0.382	0.298	0.544	0.246
	Mexico	0.507	0.427	0.620	0.194
	New Zealand	0.398	0.342	0.473	0.131
	Philippines	0.358	0.279	0.471	0.193
	Poland	0.435	0.377	0.538	0.161
	South Africa	0.489	0.436	0.560	0.124
	Turkey	0.326	0.267	0.471	0.204
Developed Markets	Australia	0.525	0.423	0.628	0.205
	Canada	0.550	0.470	0.639	0.169
	Germany	0.579	0.507	0.668	0.161
	Japan	0.432	0.297	0.576	0.279
	Norway	0.519	0.437	0.607	0.170
	Sweden	0.551	0.488	0.637	0.150
	Swiss	0.533	0.446	0.639	0.193
	UK	0.580	0.485	0.682	0.197
	USA	0.557	0.470	0.662	0.192
Overall Avg. (21 countries)		0.472 (0.000)	0.395 (0.000)	0.575 (0.000)	0.180 (0.000)
Emerging Mkt. Avg. (12 countries)		0.425 (0.000)	0.355 (0.000)	0.527 (0.000)	0.172 (0.000)
Developed Mkt. Avg. (9 countries)		0.536 (0.000)	0.447 (0.000)	0.638 (0.000)	0.191 (0.000)
Avg.(Developed) - Avg.(Emerging)		0.112 (0.000)	0.092 (0.003)	0.110 (0.000)	0.019 (0.369)

Table 2: Correlation between Currency and Domestic Stock Markets

This table reports the correlation between weekly stock market index returns and weekly domestic currency returns measured in U.S. dollars. For the U.S., the trade-weighted exchange rate is used. Panel A reports the results for the full sample, while Panel B reports subpanel results conditional on market conditions. We classify each weekly return pair as up (down) market if the stock index return for that week is positive (negative). Using these up (down) market returns, we calculated two sets of correlations. In both Panels, the Overall Period column presents the correlations over the entire sample period, from January 1996 to December 2009 based on 720 weekly returns. The next two columns in Panel A, (A) and (B), report the results for two subperiods of equal length. The last column, (B)-(A), reports the increases in correlations over the two subperiods. In Panel B, up (down) market correlations and the differences between the two are reported separately for the whole sample period and also for each of the subperiods. The lower section of Panels A and B reports the summary statistics of correlations for all sample countries, emerging markets and developed markets. The last row reports the differences in average correlations between the developed markets and the emerging markets. The *p*-values are given in parentheses.

Panel A : Full Sample Correlation

Country		Overall Period	(A) 1996~2002	(B) 2003~2009	(B) - (A) 2nd half – 1st half
Emerging Markets	Brazil	0.380	0.163	0.663	0.500
	Chile	0.258	0.180	0.314	0.134
	Czech	0.121	-0.037	0.243	0.280
	Hungary	0.216	-0.024	0.418	0.442
	Israel	0.232	0.227	0.250	0.023
	Korea	0.430	0.368	0.575	0.207
	Mexico	0.485	0.473	0.522	0.049
	New Zealand	0.212	0.220	0.217	-0.003
	Philippines	0.351	0.367	0.317	-0.050
	Poland	0.272	0.166	0.403	0.237
	South Africa	0.253	0.231	0.286	0.055
	Turkey	0.311	0.200	0.617	0.417
Developed Markets	Australia	0.391	0.177	0.504	0.327
	Canada	0.412	0.306	0.489	0.183
	Germany	0.048	0.020	0.139	0.119
	Japan	-0.144	0.036	-0.351	-0.387
	Norway	0.187	-0.044	0.314	0.358
	Sweden	0.169	0.040	0.285	0.245
	Swiss	-0.223	-0.333	-0.114	0.219
	UK	0.036	-0.255	0.211	0.466
	USA	-0.111	-0.031	-0.174	-0.143
Overall Avg. (21 countries)		0.204 (0.000)	0.117 (0.0014)	0.292 (0.000)	0.175 (0.002)
Emerging Mkt. Avg. (12 countries)		0.293 (0.000)	0.211 (0.000)	0.402 (0.000)	0.191 (0.005)
Developed Mkt. Avg. (9 countries)		0.085 (0.291)	-0.009 (0.890)	0.145 (0.184)	0.154 (0.120)
Avg.(Developed) - Avg.(Emerging)		-0.208 (0.027)	-0.221 (0.008)	-0.257 (0.019)	-0.037 (0.713)

Panel B : Correlation by Market Condition

Country		Overall Period			1996~2002			2003~2009		
		Up Market (A)	Down Market (B)	Down-Up (B-A)	Up Market (A)	Down Market (B)	Down-Up (B-A)	Up Market (A)	Down Market (B)	Down-Up (B-A)
Emerging Markets	Brazil	0.111	0.352	0.241	-0.039	0.088	0.128	0.416	0.678	0.262
	Chile	0.097	0.285	0.188	-0.015	0.208	0.223	0.190	0.334	0.143
	Czech	0.125	0.142	0.016	0.039	-0.116	-0.155	0.186	0.335	0.149
	Hungary	0.144	0.189	0.045	-0.004	0.000	0.003	0.355	0.362	0.007
	Israel	0.035	0.217	0.182	0.009	0.299	0.290	0.088	0.165	0.077
	Korea	0.367	0.453	0.086	0.335	0.438	0.103	0.554	0.530	-0.024
	Mexico	0.394	0.443	0.049	0.367	0.342	-0.025	0.446	0.549	0.102
	New Zealand	0.029	0.258	0.230	0.074	0.196	0.123	0.001	0.306	0.305
	Philippines	0.224	0.387	0.162	0.307	0.406	0.099	0.057	0.343	0.286
	Poland	0.094	0.290	0.196	0.029	0.164	0.135	0.247	0.444	0.197
	South Africa	0.159	0.345	0.186	0.122	0.312	0.190	0.205	0.425	0.221
	Turkey	0.086	0.311	0.225	0.136	0.276	0.140	0.512	0.433	-0.079
Developed Markets	Australia	0.170	0.506	0.336	0.102	0.218	0.116	0.208	0.613	0.405
	Canada	0.220	0.433	0.213	0.218	0.339	0.121	0.262	0.483	0.221
	Germany	0.108	0.111	0.003	0.170	-0.119	-0.289	-0.009	0.323	0.332
	Japan	0.042	-0.210	-0.253	0.203	-0.041	-0.244	-0.146	-0.378	-0.231
	Norway	0.132	0.240	0.108	0.007	0.059	0.052	0.176	0.319	0.143
	Sweden	0.136	0.205	0.069	0.100	0.056	-0.044	0.204	0.332	0.128
	Swiss	-0.158	-0.122	0.036	-0.155	-0.315	-0.159	-0.142	0.062	0.204
	UK	-0.002	0.138	0.140	-0.163	-0.178	-0.015	0.087	0.283	0.196
	USA	0.019	-0.231	-0.249	-0.088	0.037	0.124	0.060	-0.397	-0.457
Overall Avg. (21 countries)		0.121 (0.000)	0.226 (0.000)	0.105 (0.004)	0.084 (0.017)	0.127 (0.010)	0.044 (0.203)	0.188 (0.000)	0.312 (0.000)	0.123 (0.010)
Emerging Mkt. Avg. (12 countries)		0.155 (0.001)	0.306 (0.000)	0.151 (0.000)	0.113 (0.020)	0.218 (0.001)	0.104 (0.011)	0.271 (0.000)	0.409 (0.000)	0.137 (0.003)
Developed Mkt. Avg. (9 countries)		0.074 (0.085)	0.119 (0.214)	0.045 (0.509)	0.044 (0.405)	0.006 (0.928)	-0.038 (0.500)	0.078 (0.162)	0.182 (0.163)	0.105 (0.287)
Avg.(Developed) - Avg.(Emerging)		-0.081(0.127)	-0.187 (0.072)	-0.106 (0.156)	-0.069 (0.300)	-0.212 (0.020)	-0.142 (0.041)	-0.194 (0.016)	-0.226 (0.100)	-0.033 (0.747)

Table 3: Correlation between Foreign Stock Returns and Currency Returns

This table presents pair-wise correlations between weekly returns of a destination country's stock index and its currency for 21 countries in our sample. Currency returns are based on the home currency price of the destination currency. Panel A reports the results for developed market destinations while Panel B reports the results for the emerging market destinations. Panel C reports the averages of correlations for developed and emerging market destinations as well as the differences between the two, separately for each home country in our sample. Bold letters indicate statistical significance at the 5% level, and ***, * *, and * correspond to statistical significance at the 1, 5, and 10% levels, respectively.

Panel A : Developed Market Destinations

		Destination Countries								
		Australia	Canada	Germany	Japan	Norway	Sweden	Switzerland	UK	US
Home Countries	Brazil	-0.030	**-0.191**	**-0.211**	**-0.273**	**-0.215**	**-0.193**	**-0.417**	**-0.337**	**-0.369**
	Chile	**0.142**	-0.018	**-0.115**	**-0.306**	**-0.115**	**-0.124**	**-0.439**	**-0.266**	**-0.317**
	Czech	**0.274**	**0.099**	**0.024**	**-0.168**	0.064	**0.114**	**-0.285**	-0.070	**-0.096**
	Hungary	**0.188**	0.003	-0.056	**-0.228**	-0.069	-0.005	**-0.359**	**-0.210**	**-0.227**
	Israel	**0.262**	**0.118**	-0.059	**-0.199**	0.003	0.007	**-0.337**	**-0.165**	**-0.295**
	Korea	0.009	**-0.078**	**-0.152**	**-0.318**	**-0.096**	**-0.118**	**-0.325**	**-0.255**	**-0.287**
	Mexico	**0.108**	-0.059	**-0.152**	**-0.313**	**-0.141**	**-0.143**	**-0.461**	**-0.323**	**-0.455**
	New Zealand	**0.108**	**-0.117**	**-0.136**	**-0.335**	**-0.143**	**-0.149**	**-0.417**	**-0.305**	**-0.326**
	Phillipines	**0.240**	**0.129**	-0.015	**-0.236**	0.045	0.040	**-0.260**	**-0.102**	**-0.161**
	Poland	**0.100**	**-0.078**	**-0.147**	**-0.254**	**-0.155**	**-0.133**	**-0.442**	**-0.310**	**-0.299**
	South Africa	0.041	**-0.133**	**-0.171**	**-0.248**	**-0.158**	**-0.134**	**-0.366**	**-0.295**	**-0.287**
	Turkey	0.051	**-0.091**	**-0.167**	**-0.252**	**-0.114**	**-0.158**	**-0.325**	**-0.263**	**-0.285**
	Australia		**-0.249**	**-0.198**	**-0.387**	**-0.233**	**-0.221**	**-0.500**	**-0.427**	**-0.402**
	Canada	**0.207**		**-0.116**	**-0.286**	**-0.122**	**-0.096**	**-0.423**	**-0.307**	**-0.398**
	Germany	**0.192**	0.055		**-0.076**	-0.019	0.056	**-0.155**	-0.037	-0.059
	Japan	**0.397**	**0.344**	**0.164**		**0.291**	**0.277**	-0.005	**0.184**	**0.209**
	Norway	**0.230**	**0.074**	0.010	**-0.197**		**0.145**	**-0.324**	**-0.117**	**-0.133**
	Sweden	**0.204**	0.003	-0.060	**-0.231**	-0.072		**-0.438**	**-0.205**	**-0.246**
	Switzerland	**0.391**	**0.322**	**0.168**	**-0.079**	**0.333**	**0.406**		**0.190**	**0.122**
	UK	**0.290**	**0.196**	0.023	**-0.219**	**0.090**	**0.136**	**-0.288**		**-0.109**
	US	**0.391**	**0.412**	0.048	**-0.144**	**0.187**	**0.168**	**-0.223**	0.036	

Panel B : Emerging Market Destinations

		Destination Countries											
		Brazil	Chile	Czech	Hungary	Israel	Korea	Mexico	New Zealand	Phillipines	Poland	South Africa	Turkey
Home Countries	Brazil		**-0.158**	**-0.169**	-0.065	**-0.166**	**0.135**	-0.039	-0.053	-0.064	0.045	-0.011	**0.097**
	Chile	**0.170**		**-0.106**	0.014	-0.022	**0.248**	**0.149**	0.070	0.016	**0.083**	**0.089**	**0.176**
	Czech	**0.248**	**0.146**		**0.196**	**0.101**	**0.298**	**0.192**	**0.175**	**0.129**	**0.231**	**0.087**	**0.266**
	Hungary	**0.175**	0.021	**-0.157**		0.034	**0.273**	**0.092**	**0.088**	**0.082**	**0.137**	0.036	**0.205**
	Israel	**0.271**	**0.100**	-0.012	**0.094**		**0.345**	**0.246**	**0.148**	**0.205**	**0.148**	**0.155**	**0.243**
	Korea	**0.122**	-0.054	**-0.149**	-0.034	-0.054		0.021	-0.029	**-0.085**	-0.015	-0.014	**0.121**
	Mexico	**0.113**	**-0.113**	**-0.151**	**-0.082**	-0.068	**0.268**		0.006	0.035	0.037	0.054	**0.155**
	New Zealand	**0.119**	-0.071	**-0.115**	-0.014	-0.041	**0.191**	0.048		0.006	0.072	-0.009	**0.206**
	Phillipines	**0.282**	**0.096**	0.006	**0.097**	0.039	**0.331**	**0.259**	**0.100**		**0.132**	**0.134**	**0.283**
	Poland	**0.094**	-0.056	**-0.267**	**-0.089**	-0.040	**0.200**	0.003	0.070	0.061		-0.047	**0.168**
	South Africa	0.032	-0.071	**-0.191**	**-0.126**	**-0.073**	**0.187**	-0.028	0.009	-0.003	-0.071		**0.099**
	Turkey	**0.103**	-0.046	**-0.202**	**-0.078**	-0.064	**0.138**	-0.016	0.020	-0.019	-0.045	-0.013	
	Australia	**0.084**	**-0.166**	**-0.200**	**-0.093**	-0.070	**0.154**	-0.002	**-0.093**	-0.072	0.003	**-0.077**	**0.174**
	Canada	**0.193**	-0.002	**-0.096**	0.007	0.003	**0.303**	**0.150**	0.072	**0.109**	**0.110**	0.072	**0.219**
	Germany	**0.246**	**0.113**	-0.005	0.059	0.066	**0.210**	**0.244**	0.051	0.033	0.046	0.038	**0.205**
	Japan	**0.382**	**0.308**	**0.208**	**0.247**	**0.257**	**0.355**	**0.391**	**0.249**	**0.231**	**0.299**	**0.231**	**0.312**
	Norway	**0.222**	**0.082**	-0.042	**0.103**	0.065	**0.309**	**0.189**	**0.089**	**0.105**	**0.176**	0.056	**0.232**
	Sweden	**0.213**	**0.090**	**-0.082**	**0.096**	0.000	**0.280**	**0.131**	**0.077**	**0.107**	**0.153**	0.047	**0.221**
	Switzerland	**0.365**	**0.246**	**0.198**	**0.363**	**0.239**	**0.398**	**0.357**	**0.264**	**0.237**	**0.358**	**0.226**	**0.338**
	UK	**0.281**	**0.139**	0.036	**0.179**	**0.122**	**0.341**	**0.285**	**0.191**	**0.172**	**0.265**	**0.157**	**0.275**
	US	**0.380**	**0.258**	**0.121**	**0.216**	**0.232**	**0.430**	**0.485**	**0.212**	**0.351**	**0.272**	**0.253**	**0.311**

Panel C : Differences in Correlation between Developed and Emerging Destination Groups

		Destination Groups		
		Developed Market (Avg., A)	Emerging Market (Avg., B)	(A) - (B)
Home Countries	Brazil	**-0.248**	**-0.041**	-0.208***
	Chile	**-0.173**	**0.081**	-0.254***
	Czech	**-0.005**	0.188	-0.193***
	Hungary	**-0.107**	0.090	-0.197***
	Israel	**-0.074**	0.177	-0.251***
	Korea	**-0.180**	**-0.015**	-0.165***
	Mexico	**-0.216**	**0.023**	-0.239***
	New Zealand	**-0.202**	**0.036**	-0.238***
	Phillipines	**-0.036**	0.160	-0.195***
	Poland	**-0.191**	**0.009**	-0.200***
	South Africa	**-0.194**	**-0.021**	-0.173***
	Turkey	**-0.178**	**-0.020**	-0.158***
	Australia	**-0.327**	-0.030	-0.298***
	Canada	**-0.193**	**0.095**	-0.288***
	Germany	**-0.005**	0.109	-0.114**
	Japan	0.232	**0.289**	-0.057
	Norway	**-0.039**	0.132	-0.171**
	Sweden	**-0.131**	0.111	-0.242***
	Switzerland	0.232	**0.299**	-0.068
	UK	**0.015**	0.204	-0.189**
	US	0.109	0.293	-0.184*
Overall Average		-0.095	0.106	-0.201***
	t-Stat	-6.050	11.370	-10.990
	p-value	<.0001	<.0001	<.0001
Emerging Home Average		-0.150	0.055	-0.206***
	t-Stat	-9.430	5.010	-10.610
	p-value	<.0001	<.0001	<.0001
Developed Home Average		-0.012	0.167	-0.179***
	t-Stat	-0.410	12.380	-5.660
	p-value	0.680	<.0001	<.0001
Difference (emerging - developed)		-0.139	-0.112	
	t-Stat	4.230	6.400	
	p-value	<.0001	<.0001	

Table 4: MSCI World Index Returns and Net Capital Flows

This table presents the OLS estimates of panel regressions of each country's net equity flows on MSCI world index returns. Net equity flows (in USD billion) are obtained from the Balance of Payment account of each country by subtracting the increases in equity assets from increases in equity liabilities. Relative Equity Flows are calculated as the absolute value of net equity flows over the absolute sum of net equity flows plus net debt flows. Net debt flows are obtained in a manner similar to net equity flows. The first two columns, (1) and (2), report the results for the full panel set, while the remaining columns exclude Japan. Columns (5), (6), and (7), (8) report subpanel results based on market conditions, where up (down) markets are those quarters during which MSCI world return is positive (negative). Every second column includes additional control variables; the total stock market capitalization of each country in USD trillions (Market Cap), Turnover measured by the value of shares traded divided by year-end market capitalization in percentages, and the annual GDP growth rate are in percentages. Standard errors are adjusted for clustering at the country level, and the corresponding *t*-statistics are presented in parentheses. Finally, ***, ** and, * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Table 4: MSCI World Index Returns and Capital Flows - *continued*

	Full Sample(incl. JP)		Full Sample(excl. JP)		UP Market		DOWN Market	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MSCI return	1.636	5.959	-20.342**	-15.671**	-5.191	-2.003	-52.100*	-43.314*
	(0.073)	(0.275)	(-2.500)	(-2.154)	(-0.408)	(-0.144)	(-1.994)	(-1.852)
*MSCI return * Emerging Dummy*	2.972	0.85	25.241***	22.399***	9.095	8.938	56.311**	52.694**
	(0.130)	(0.039)	(3.121)	(3.146)	(0.713)	(0.726)	(2.153)	(2.164)
Emerging Dummy	0.342	2.342*	0.809	2.719*	0.849	3.054	5.082***	5.490**
	(0.291)	(1.855)	(0.653)	(1.945)	(0.361)	(1.392)	(2.893)	(2.757)
Relative Equity flows(Abs.)	-1.533	-1.343	-2.972	-2.885	-2.084	-1.887	-3.564*	-4.285*
	(-0.533)	(-0.474)	(-1.064)	(-1.072)	(-0.451)	(-0.426)	(-1.834)	(-1.768)
Market Cap		0.370		0.318**		0.526***		-0.132
		(1.655)		(2.227)		(4.317)		(-0.552)
Turnover(%)		0.017		0.018		0.02		0.014
		(0.817)		(0.887)		(0.952)		(0.611)
GDP growth(%)		-0.036		-0.019		0.024		-0.067*
		(-0.941)		(-0.552)		(0.464)		(-2.025)
Constant	0.332	-2.738	0.424	-2.723	0.144	-4.086	-3.788*	-4.212
	(0.456)	(-1.257)	(0.532)	(-1.153)	(0.163)	(-1.488)	(-2.028)	(-1.707)
R^2	0.001	0.015	0.012	0.027	0.003	0.023	0.104	0.117
N	976	976	920	920	575	575	345	345

Table 5: Net Capital Flows and Correlation between Currency and Stock Returns

This table shows the OLS estimates of panel regressions of each country's quarterly correlations between weekly currency and stock returns on absolute values of Net Equity Flows (in USD billion), as defined in Table 4. The first two columns, (1) and (2), report the results for the full panel set, while the remaining columns exclude Japan. Columns (5), (6), and (7), (8) report subpanel results based on market conditions, where up (down) markets are those quarters during which MSCI world return is positive (negative). Every second column includes additional control variables; Foreign Exchange Market Size measured by the average daily foreign exchange market turnover, the total stock market capitalization of each country (Market Cap), changes in Foreign Reserves which proxies for foreign exchange market intervention, and the annual GDP growth rate. The level control variables are all in USD trillions. Standard errors are adjusted for clustering at the country level, and the corresponding *t*-statistics are presented in parentheses. Finally, ***, **, and * correspond to statistical significance at the 1, 5, and 10% levels, respectively.

	Full Sample(incl. JP)		Full Sample(excl. JP)		UP Market		DOWN Market	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Net Equity Flow	-0.001	-0.001	0.000	0.000	-0.001	-0.001	0.002	0.003
(Absolute)	(-0.978)	(-1.076)	(-0.284)	(-0.096)	(-0.859)	(-0.702)	(1.046)	(1.051)
*Net Equity Flow(Abs.) **	0.020***	0.021***	0.019***	0.019***	0.018***	0.013**	0.019**	0.018**
Emerging Dummy	(3.465)	(3.325)	(3.327)	(3.292)	(2.978)	(2.653)	(2.451)	(2.516)
Emerging Dummy	0.247***	0.251***	0.249***	0.246***	0.271***	0.267***	0.228**	0.213**
	(3.370)	(3.151)	(3.267)	(2.998)	(3.481)	(3.150)	(2.486)	(2.423)
Foreign Exchange Market Size		-0.090		-0.092		-0.118		-0.100
		(-1.346)		(-1.197)		(-1.462)		(-1.016)
Market Cap		0.009		0.008		0.013**		0.003
		(1.684)		(1.525)		(2.342)		(0.389)
⊿ Foreign Reserves		0.580		-3.269		-7.838		1.303
		(0.312)		(-0.799)		(-1.522)		(0.308)
GDP growth(%)		-0.004***		-0.004***		-0.002		-0.008***
		(-3.293)		(-3.380)		(-1.383)		(-5.108)
Constant	0.024	0.055	0.022	0.057	-0.001	0.017	0.043	0.093
	(0.398)	(0.814)	(0.347)	(0.806)	(-0.012)	(0.231)	(0.579)	(1.297)
R^2	0.143	0.170	0.134	0.163	0.163	0.178	0.097	0.184
N	976	976	920	920	575	575	345	345

Table 6: Descriptive Statistics of "Siamese Twin" Mutual Funds in Korea

This table presents the descriptive statistics of the mutual funds in our sample. The sample includes all foreign currency denominated mutual funds available in the Korean market that provide both hedging and nonhedging options for retail investors. For each fund in the sample, the table shows the type, its ID, and the number of paired weekly returns available. The next two columns present the total asset under management separately for nonhedged and hedged assets. The next column presents the currency that the fund targets to hedge (for hedged assets). The last two columns report the correlation between weekly currency return and two proxies of underlying return, respectively. The first proxy is the weekly return of the hedged portfolio, and the second is the implied underlying return defined as the nonhedged return minus the currency return divided by one plus the currency return. The sample period is from March 2007 to July 2009.

Fund Type		Fund ID (masked)	Number of Weeks	Asset under Mgmt (KRW bil)		Hedging Currency	Correlation between FX and	
				Hedged	Non-Hedged		Hedged	Implied Underlying
Regional China		1	23	1.1	0.3	HKD	-0.520	-0.896
		2	22	28.2	92.5	HKD	-0.226	-0.406
		3	19	67.9	4.7	HKD	-0.086	-0.242
		4	54	0.5	0.2	HKD	-0.590	-0.757
		5	91	22.8	1.0	HKD	-0.541	-0.643
		6	90	0.7	0.0	HKD	-0.554	-0.730
	Japan	7	123	18.4	9.7	JPY	-0.700	-0.807
		8	119	0.0	0.8	JPY	-0.530	-0.787
	Latin America	9	42	7.2	0.2	USD	-0.674	-0.693
		10	106	15.8	0.2	USD	-0.568	-0.639
		11	68	0.6	0.0	USD	-0.332	-0.752
	Emerging	12	55	5.1	0.4	USD	-0.506	-0.609
		13	82	20.5	0.5	USD	-0.560	-0.619
		14	42	2.1	3.4	Euro	-0.603	-0.648
	BRICs	15	45	2.9	1.7	USD	-0.668	-0.741
	Europe	16	118	8.7	0.2	Euro	-0.364	-0.520
	Middle East	17	66	11.4	0.7	USD	-0.291	-0.341
	Global	18	75	12.7	1.2	USD	-0.488	-0.570
Sector	Energy	19	62	1.7	0.1	USD	-0.237	-0.440
		20	105	4.91	0.0	Euro50% + USD45% + JPY5%	-0.411	-0.568
		21	42	0.51	1.3	USD	-0.599	-0.616
		22	42	19.14	0.3	USD	-0.556	-0.602
		23	117	119.11	0.5	SF + GBP + Euro; equally	-0.409	-0.911
		24	106	41.48	0.2	SF + GBP + Euro; equally	-0.241	-0.809
		25	77	5.65	0.1	USD	-0.491	-0.572
	Commodities	26	42	10.56	5.1	USD	-0.578	-0.617
		27	65	20.59	10.7	USD	-0.613	-0.704
Average			70.3	16.7	5.0		-0.479	-0.639

Table 7: Distribution of Weekly Return Volatility: Hedged vs. NonHedged

This table presents a return volatility comparison between foreign assets that hedge against the foreign currency risk and those that do not hedge. The first four columns present the type, its ID, and the number of paired weekly returns available. The next two columns present the standard deviation of the weekly returns for both hedged and nonhedged assets in each of our sample funds. The final column presents the difference in volatility between the hedged and nonhedged group. The last four rows show the means and medians as well as the corresponding test statistics. The sample period is from March 2007 to July 2009.

Fund Type		Fund ID	Number of Weeks	Standard Deviation of Weekly Returns		
				Hedged (A)	Non-Hedged (B)	Difference: (A)-(B)
Regional	China	1	23	2.30%	2.29%	0.01%
		2	22	2.82%	3.30%	-0.49%
		3	19	2.04%	2.69%	-0.64%
		4	54	3.78%	3.11%	0.67%
		5	91	5.18%	4.19%	1.00%
		6	90	3.30%	2.96%	0.34%
	Japan	7	123	3.90%	2.45%	1.45%
		8	119	3.92%	2.43%	1.49%
	Latin America	9	42	9.29%	7.76%	1.53%
		10	106	5.86%	5.07%	0.79%
		11	68	5.19%	4.69%	0.50%
	Emerging	12	55	4.91%	4.35%	0.56%
		13	82	4.06%	3.43%	0.63%
		14	42	8.45%	7.52%	0.93%
	BRICs	15	45	7.09%	5.94%	1.14%
	Europe	16	118	3.12%	3.05%	0.06%
	Middle East	17	66	5.16%	5.41%	-0.25%
	Global	18	75	3.74%	3.34%	0.40%
Sector	Energy	19	62	3.31%	3.67%	-0.36%
		20	105	4.11%	3.67%	0.44%
		21	42	11.69%	8.03%	3.66%
		22	42	5.78%	5.02%	0.76%
		23	117	3.85%	3.01%	0.84%
		24	106	5.41%	5.01%	0.41%
		25	77	5.97%	5.90%	0.07%
	Commodities	26	42	9.61%	8.37%	1.24%
		27	65	6.55%	5.63%	0.93%
Mean				5.20%	4.53%	0.67%
t -stat				-	-	4.16
Median				4.91%	4.19%	0.63%
p -value				-	-	0.000

Table 8: Cross-Sectional Analysis on Differences in Volatilities between Hedged and Nonhedged Funds

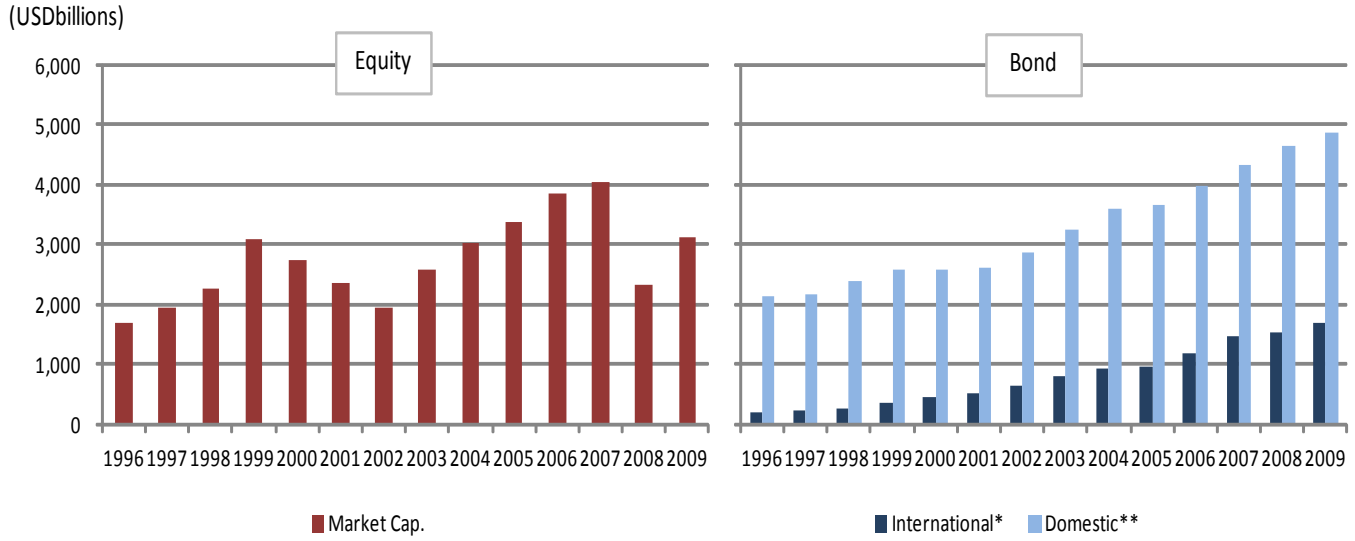
This table presents OLS regression results where the dependent variable is the difference in volatility between the hedged and nonhedged asset within each of the mutual fund pairs in our sample. The difference is measured as the standard deviation of weekly returns of the hedged portfolio minus the corresponding number of the nonhedged portfolio. Correlations between the underlying and the currency return are calculated for each mutual fund using the weekly return. The underlying return is proxied by the hedged portfolio's return. We take the natural log of assets under management (KRW million) to control for the potential size related effect. Non-USD Currency is the dummy variable set to one if the currency being hedged is other than the U.S. dollar and zero otherwise. The *t*-statistics are presented in parentheses, and ***, **, and * correspond to statistical significance at the 1, 5, and 10% levels, respectively. The sample period is from March 2007 to July 2009.

	(1)	(2)	(3)	(4)	(5)
Correlation between	-0.036***	-0.033***	-0.035***	-0.036***	-0.030***
Underlying and Currency Return	(-4.592)	(-4.051)	(-4.324)	(-4.473)	(-3.395)
ln(Asset Under Mgmt, Hedged)		-0.001			-0.001
		(-1.214)			(-1.405)
ln(Asset Under Mgmt, Unhedged)		0.001			0.001
		(0.865)			(1.208)
Non-USD Currency			-0.001		-0.003
			(-0.358)		(-0.895)
Number of Weeks				0.000	0.000
				(0.250)	(0.863)
Constant	-0.011**	-0.006	-0.010**	-0.011**	-0.007
	(-2.678)	(-0.820)	(-2.174)	(-2.371)	(-0.827)
R^2	0.458	0.496	0.460	0.459	0.521
N	27	27	27	27	27

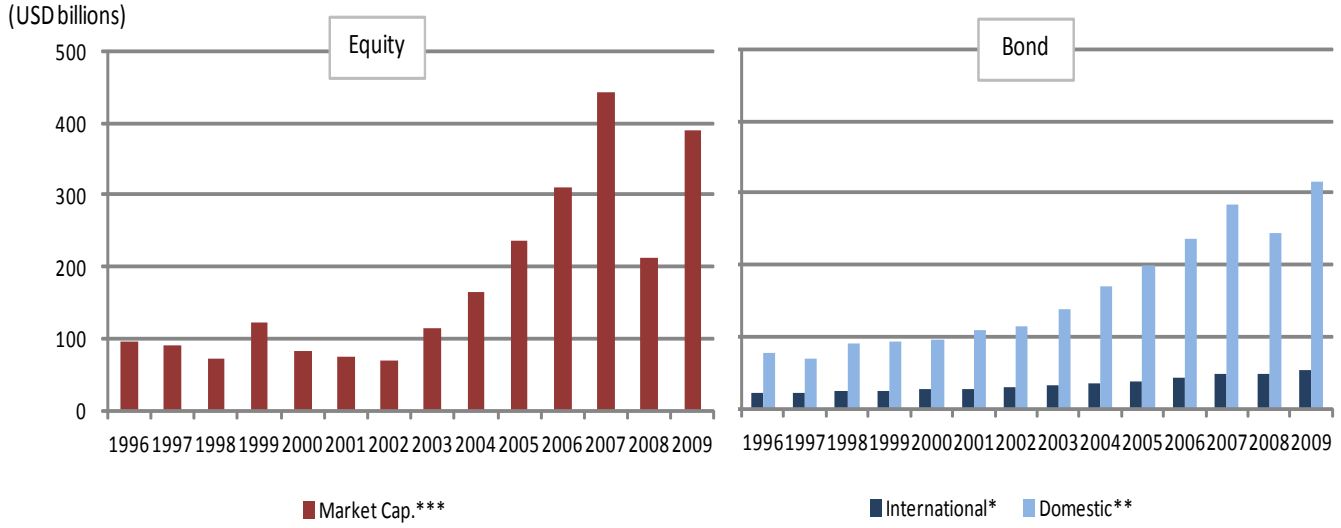
Figure 1: Market Capitalizations of Global Equity and Bond Markets over Time

This figure presents the market sizes of debt securities, both domestic and international, and stocks over the period from 1996 to 2009. Panel A shows the averages across the developed countries in our sample and Panel B the averages across the emerging countries. For Panel B, domestic bond outstanding and equity market capitalization are averaged over eight countries excluding Israel and Chile, respectively, due to data availability.

Panel A: Trend of Debt Outstanding and Stock Market Capitalization for the Developed Countries



Panel B: Trend of Debt Outstanding and Stock Market Capitalization for Emerging Countries

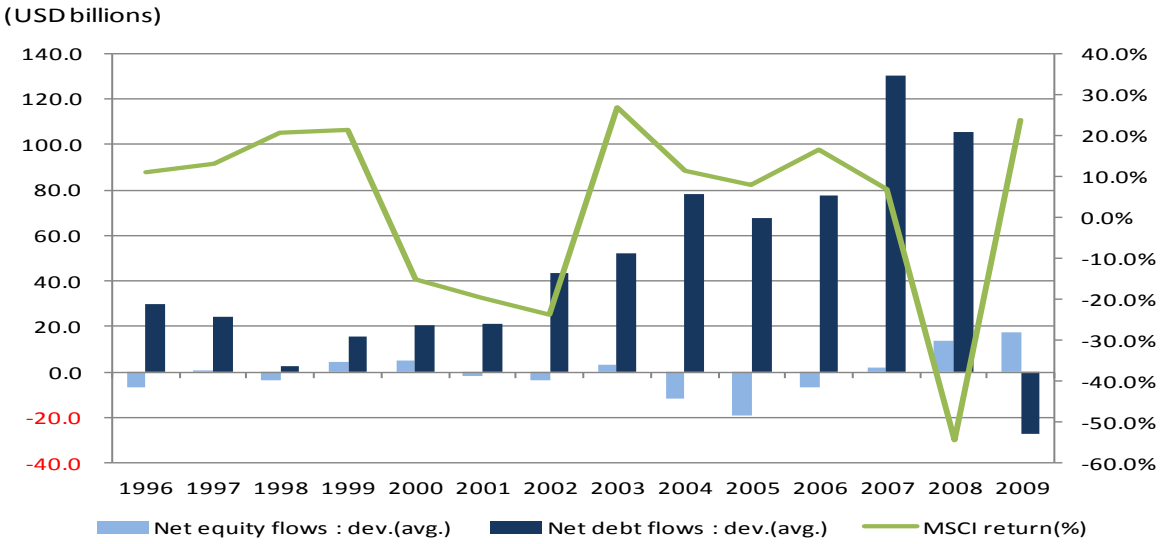


* by nationality of issuer ** by residence of issuer *** emerging market average excluding Chile

Figure 2: International Net Capital Flows for Equity and Debt over Time

This figure presents the trends in international net capital flows for foreign equity and debt during the sample period. Net capital flows for stocks (bonds) are obtained by subtracting increases in equity (debt) assets from increases in equity (debt) liabilities from each country's Balance of Payment account. The net capital flows for equity and debt are averaged across the nine developed countries in Panel A, and 12 emerging countries in Panel B. We also plot MSCI world index returns to proxy for general stock market conditions.

Panel A: Trend in International Net Capital Flows for Equity and Debt for Nine Developed Countries



Panel B: Trend in International Net Capital Flows for Equity and Debt for 12 Emerging Countries

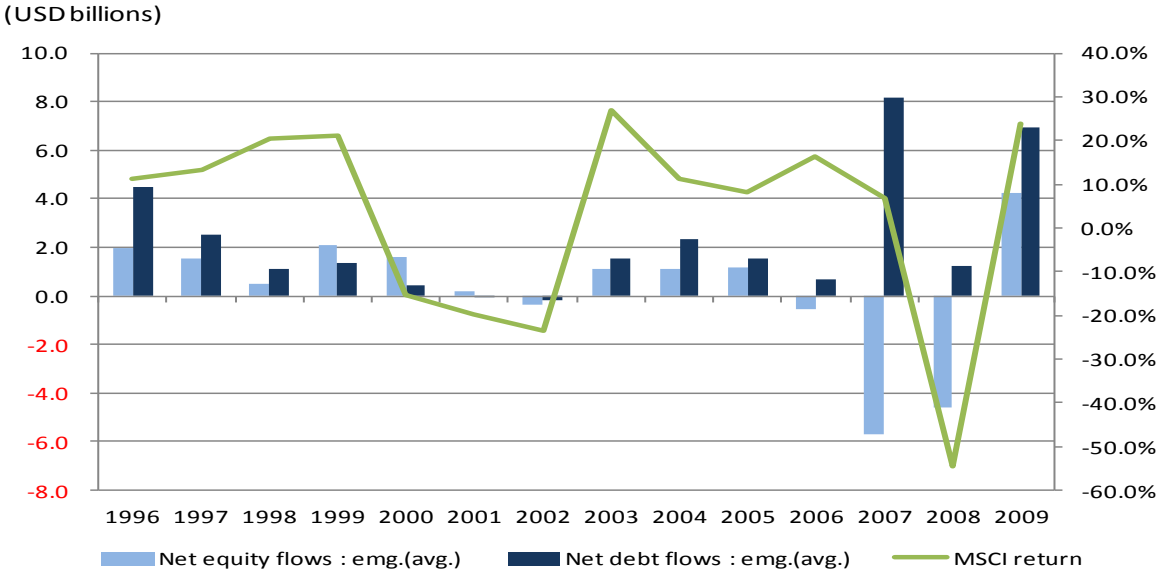


Figure 3: Relationship between Differences in Volatility (Hedged vs. Nonhedged) and Return Correlation (Underlying vs. Currency)

The Y-axis represents differences in standard deviations between hedged and nonhedged assets using the weekly returns for each of the Siamese Twin mutual funds in the sample. In Panel A, the X-axis represents the correlation between the underlying (proxied by hedged portfolio return) and currency return for each of the mutual funds in our sample. In Panel B, the underlying return is inferred as the nonhedged return minus the currency return divided by one plus the currency return. Each dot in the figure represents one mutual fund. The sample period is from March 2007 to July 2009.

Panel A: Underlying Proxied by Hedged Portfolio

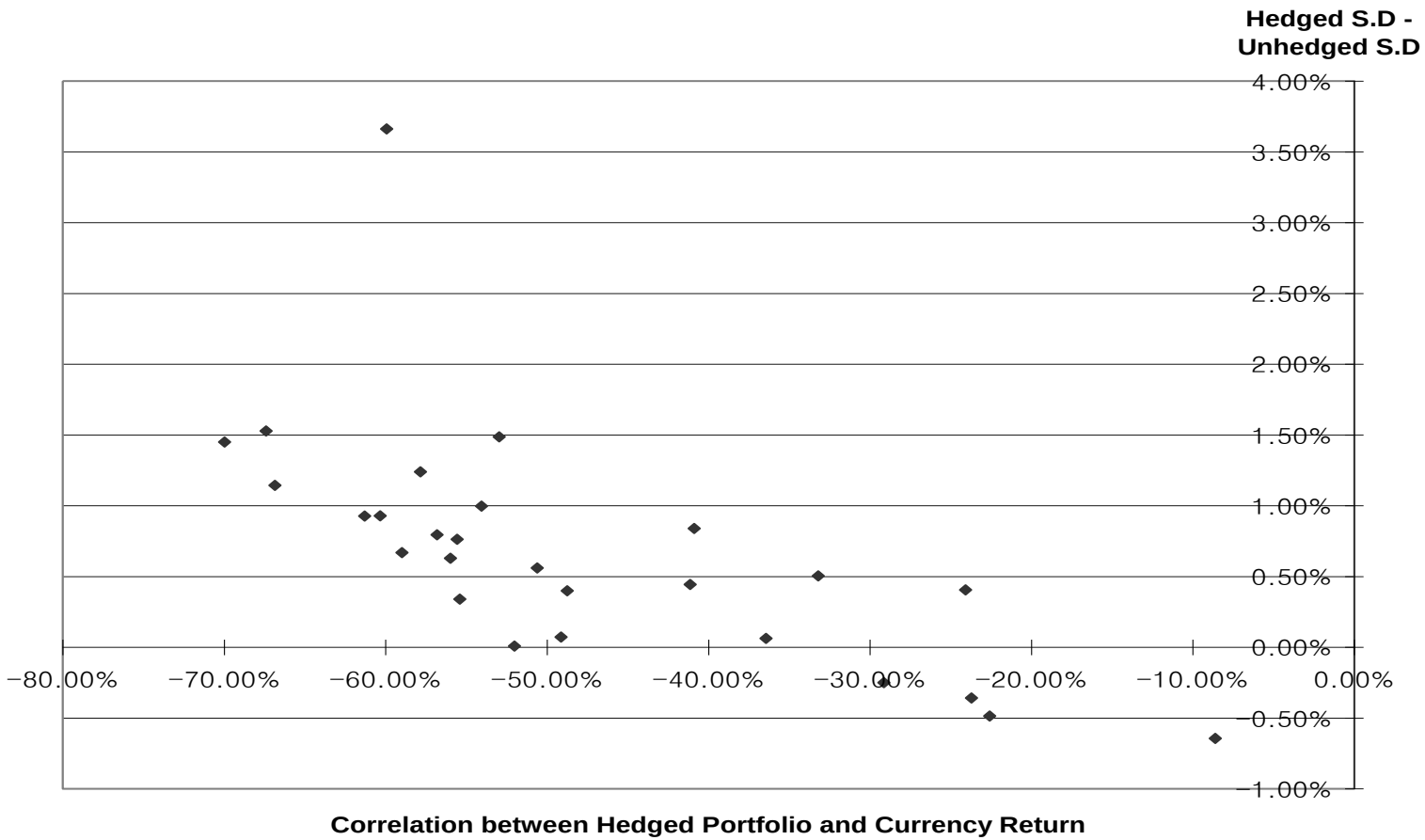


Figure 2 - *continued*

Panel B: Implied Underlying