The Asian Crisis and the Behavior of Currency Spreads

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Abstract

Using a sample of 21 emerging and developed country currencies, we evaluate the impact of the Asian crisis on currency volatility and bid-ask spreads. While the crisis had widespread and uniform volatility effects, the spread effects were not uniform across emerging and developed country currencies. For Asian emerging markets, spreads widened and spread volatility increased significantly during the crisis, while developed markets spreads narrowed and spread volatility decreased significantly. We investigate the impact of more flexible and less flexible exchange rate regimes on bid-ask spreads using panel data. In general, countries with tightly-managed regimes have significantly lower spreads than countries with more freely-floating regimes, while controlling for the influence of other factors such as volatility. Asian developing market spreads are higher than spreads of the other countries, again, after controlling for the influence of other factors.

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Abstract

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1. Brief review of Asian currency crisis

The onset of the Asian crisis typically is designated by the devaluation of the Thai baht on July 2, 1997 when the Thai government abandoned its pegged exchange rate regime and adopted a floating regime (e.g., Kamin, 1999; Kallberg, Liu, and Pasquariello, 2005). In the subsequent weeks, Indonesia, Korea, Malaysia, the Philippines, and Singapore also decided to adopt more freely floating exchange rate systems. More specific dates for noteworthy events from May 1997 to January 1999 can be found in Kallberg, Liu, and Pasquariello (2005).

Kamin (1999) shows that after six months into the crisis, Indonesia, Korea, Malaysia, the Philippines, and Thailand had declines in their nominal exchange rates of about 40%, which is similar to declines in the Mexican peso during the 1980s Latin America Debt crisis and the 1994-1995 Tequila crisis. He argues that the Asian crisis was the first financial crisis to have widespread consequences for emerging market economies and, in several respects, to have more greatly affected developed markets than previous crises. Bekaert and Harvey (2003) also examine currency crises and contagion. They explain that a devaluation or a shift to a float may occur for two main reasons: either the policies of the governments are at odds with a peg, or pure speculative behavior unexpectedly occurs. Based on these two reasons, a crisis may be contagious since the crisis draws attention to other countries with inconsistent policies or because speculators hunt for additional currencies to attack. Additionally, Glick and Rose (1999) find that trade is an important channel for contagion in currency crises and Caramazza, Ricci, and Salgado (2004) find that financial linkages to the crisis country increases the probability of currency contagion. Evidence on financial integration of some of the countries affected by the crisis, is provided by Phylaktis (1999).

Furman, Stiglitz, Bosworth, and Radelet (1998) describe the Asian crisis as unique in that it occurred in a region that had been experiencing tremendous growth. One of the many potential causes of the Asian crisis that they and others (e.g., Mishkin, 1999) address is the use of a pegged exchange rate system, which had been widely adopted by the governments in the region prior to the crisis. Furman, Stiglitz, Bosworth, and Radelet (1998), however, argue that a floating system, by itself, would not have circumvented the crisis.

The differential effect of the Asian crisis on rates of exchange for currencies of pegged versus floating exchange rate regimes is examined by Grier and Grier (2001). Using a sample of 25 developing countries, they report that the average depreciation of currencies they classified as following pegged (floating) regimes was 28.2% (20.7%) by the end of 1997. Furthermore, they argue that currencies associated with a pegged regime prior to the Asian crisis suffered greater depreciation than was justified by macroeconomic variables. Their investigation did not extend to the behavior of spreads, however.

Kallberg, Liu, and Pasquariello (2005) look for structural shifts in the equity returns-domestic currency returns and equity volatility-domestic currency volatility relationships surrounding the Asian crisis for six Asian countries.[1] Generally, they find that structural shifts in the volatility structure occurred in the fall of 1997 while the structural shifts in the returns occurred in the first half of 1998.

These prior studies imply that a number of factors may have influenced the dynamics of currency bid-ask spreads during the Asian crisis period, but they do not directly investigate such a possibility. Furthermore, no comparative study has been undertaken to evaluate the reaction of developed countries as well as non-Asian developing countries. This is an important omission to

[1] Their use of the term 'regime shift' is not associated with governments adjusting exchange rate regimes, but instead is associated with the structural changes in macroeconomic relationships.

the extent that the Asian crisis had widespread consequences for both developing and developed markets (see Kamin, 1999). Also, it is essential for policymakers and participants in the interbank market, perhaps the only truly global market, to better understand the impact of different currency regimes on currency bid-ask spreads.

This study addresses these questions and presents significant findings that contribute to the literature. More specifically, we find that while the crisis had widespread volatility effects on emerging and developed country currencies, the spread effects were not uniform. The size of spreads and the volatility of spreads for Asian-emerging markets rose, while those of developed markets fell.

Further investigation reveals that tightly-controlled (loosely-controlled) exchange rate systems are associated with smaller (larger) spreads, while controlling for volatility and other factors. We provide evidence that Asian developing market currency spreads are higher than the spreads of other countries, again after controlling for the influence of other factors.

In the next section we review the literature on spread dynamics and state in more detail the hypotheses being tested. Section 3 describes the data used and reports some preliminary findings. Section 4 presents the methodology and discusses the main findings. Lastly, Section 5 concludes this paper.

2. Currency Bid-Ask Spread Determination

Microstructure theory identifies three sources of influence on bid-ask spreads: order-processing costs, asymmetric-information costs, and inventory holding costs. Bessembinder (1994), Huang and Stoll (1997), Sarno and Taylor (2001) and others, provide a review of these components. Prior empirical studies on factors that influence bid-ask spreads link various factors to one or all three of these components. Volatility, volume, and information asymmetry have often been empirically identified as significant determinants of spreads.

Various researchers have contributed to our understanding of the empirical determinants of currency bid-ask spreads. The first prominent study of currency spreads by Glassman (1987) shows that spreads increase with trading volume, volatility, and prior to weekends and holidays. She also argues that the spreads are a function of government capital controls, and as a result spreads may vary over time. Osterberg (1992) finds that spreads are lower around periods of purported intervention, but does not find a causal relationship between interventions and spreads using the Granger causality method. In studying the dynamics of the bid-ask spread, Bollerslev and Domowitz (1993) do not find that deutsche mark trading activity reduces spreads. Bollerslev and Melvin (1994) document the spread to be positively related to the volatility of the underlying exchange rate. Bessembinder (1994) reports that spreads are greater when inventory carrying costs are greater and, similar to Hartmann (1999), shows that spreads increase (decrease) with unpredictable (predictable) trading volume. Hartmann (1998) finds some evidence that, when examined in the long run, currency spreads may decrease with volume of trading and increase with volatility. Naranjo and Nimalendran (2000) find that deutsche mark bid-ask spreads increase with unexpected government intervention, but are unaffected by expected intervention. Cheung and Wong (2000) and Cheung and Chinn (2001) surveyed foreign exchange traders located in East Asia and the U.S., respectively. In response to questions centered on the bid-ask spread, both sets of respondents indicated that the market convention is an important determinant of interbank spreads, as well as liquidity and volatility of the market. Hau, Killeen, and Moore (2002) find that euro spreads increase when euro volumes decrease, and argue that these are due to greater market transparency which adversely affected the inventory holding costs component under the currency union.

Because the Asian currency crisis was characterized by increases in volatility, volume of trading, and information asymmetries in the spot market, it is expected that spreads were significantly impacted, if only due to the heightened volatility given the consensus in the literature that currency spreads rise with volatility (e.g., Glassman, 1987; Bollerslev and Melvin, 1994; Hartmann, 1998; Huang and Masulis, 1999; Cheung and Wong, 2000; Cheung and Chinn, 2001). The works by Bessembinder (1994) and Hartmann (1999) suggest that currency spreads rise with unpredictable increases in trading volume and decline with predictable increases in trading volume. Since it is difficult to predict a crisis such as that experienced in Southeast Asia, the trading volume effects may be considered unexpected, putting upward pressure on spreads during the crisis period.

The model developed by Bossaerts and Hillion (1991) suggests that currency spreads increase when there are traders who are asymmetrically informed about government intervention activities. There are many ways asymmetric information can manifest itself; one way is via some traders' differential access to knowledge about government intervention or exchange rate policy. Given an environment of uncertainty surrounding future government exchange rate policies during periods such as the Asian crisis, dealers may increase currency spreads to protect themselves from potential losses.

While the link between regime and currency bid-ask spreads has yet to be examined, studies have evaluated the relationship between regime and currency volatility. Stockman (1983) and Baxter and Stockman (1989) find that currencies are more volatile during freely-floating regimes. Thus, simply based on the volatility-spread relationship, it can be argued that freely-floating regimes should have greater spreads than more tightly-controlled regimes.

In view of the findings of past studies on bid-ask spreads, the research questions addressed in the papers can be stated as follows:

First, what impact, if any, did the Asian crisis have on spot volatility of the currencies of Asian-developing countries, non-Asian developing countries and developed countries? We believe it is essential to examine a wide cross section of countries with different characteristics, given Kamin's (1999) claim that the Asian crisis appears to be the first genuinely global financial crisis.

Second, what was the impact of the crisis on currency spreads as well as the volatility of currency spreads? Was there a differential impact on currencies of developing and developed countries?

Third, what role, if any, did the various currency regimes play in the determination of currency spreads? This is a potentially important issue that has received sparse attention in the literature.

3. Data and Preliminary Findings

Bid and ask prices from January 1, 1996 through June 30, 2000 for 21 countries were gathered from Olsen and Associates for this study. In order to examine whether the spread effects of the Asian currency crisis were widespread, the currency spreads of emerging and developed countries in Asia, Latin America, Middle East, Africa, Europe, and North America are included. In a typical fashion, spreads are calculated relative to their midpoint:

$$Y_j = \frac{ask_j - bid_j}{(ask_j + bid_j)/2} \tag{1}$$

where Y_j is the spread for currency j, ask_j is the ask price in U.S. dollars for currency j, and bid_j is the bid price in U.S. dollars for currency j. Similarly, the spot rate is defined as the midpoint:

$$S_{j,t} = \frac{ask_j + bid_j}{2} \tag{2}$$

where $S_{j,t}$ is the spot rate for currency j.

Table 1 reports the mean (median) percent end of the month bid-ask spreads for Asian emerging countries, non-Asian emerging countries, and developed countries. This table shows the mean bid-ask spread for the entire examination period, and for three sub-periods. The first sub-period, January 1996 to December 1996, is a period sufficiently prior to the onset of the Asian crisis. The second sub-period, June 1997 to December 1998, reflects the crisis period. Although the Thai baht was formally released from its peg to the dollar on July 2, 1997, we use June 1, 1997 as the onset of the crisis to capture expectation formation that was occurring during this time. The third sub-period, from January 1, 1999 to June 30, 2000 is the post-crisis period.

Consistent with other studies (e.g., Bessembinder, 1994; Melvin and Tan, 1996), the developed country spreads documented in Table 1 are approximately 0.05%. There is only one other published study that reports bid-ask spreads for emerging market currencies; Melvin and Tan (1996) report average bid-ask spreads over March 1987 to August 1990 for a group of 36 emerging and developed countries. While the spreads on developed country currencies in

Melvin and Tan (1996) are similar to the spreads reported here, the spreads on emerging market currencies are often quite different. Given the political and economic variability in emerging markets over time, finding different average spreads is not surprising.

Due to economic and political risks typically associated with the currencies of developing countries, one might expect that their spreads are relatively large. Interestingly, the data in Table 1 indicate that, within the group of Asian currencies and prior to the Asian crisis period, only the mean spread of the Philippine peso is substantially larger than the developed country currency spreads. These relatively small spreads may reflect the tight exchange rate regimes adopted by these countries and a high degree of confidence by currency traders.

It can also be seen in Table 1 that the Asian countries experienced a tremendous increase in their bid-ask spreads during the Asian crisis period, yet the emerging markets outside the Asian region generally do not show a substantial increase in their spreads. Furthermore, the spreads for the five developed countries do not appear to have been affected by the Asian currency crisis. A formal statistical evaluation of the impact of the crisis on spreads is conducted in Sections 4.2 and 4.3 and the impact of regimes on spreads is conducted in Section 4.3.

We use the 13 exchange rate regimes described in Bubula and Ötker-Robe (2002) to classify countries into three different regime types. The database of regimes developed by Bubula and Ötker-Robe (2002) is based on the newer IMF approach that classifies regimes based on de facto policies, i.e., policies that are actually pursued, which can differ from stated policies. Type 1 regimes include the following five policies: another currency as legal tender, currency union, currency board, conventional fixed peg to single currency, conventional fixed peg to basket. Type 2 regimes include the following six policies: pegged within a horizontal band, forward-looking crawling peg, forward-looking crawling band, backward-looking crawling peg, backward-looking crawling band, tightly managed float. Type 3 regimes include the following two policies: other managed floating, independently floating. Thus, type 1 regimes are those with the greatest degree of control, while type 3 regimes are those with the least amount of control.

Table 2 lists the primary regime type for each country in the sample during the pre-crisis period, crisis period, and post-crisis period.[2] Table 2 shows that, of the countries in this study, only Asian countries experienced regime shifts in response to the Asian crisis. Of the Asian countries, only Hong Kong maintained their exchange rate regime through the crisis and thereafter.

4. Methodology and Empirical Findings

4.1. Spot Rate Volatility

Given the documented link between currency spreads and currency volatility (e.g., Glassman, 1987; Bollerslev and Melvin, 1994; Hartmann, 1998); Huang and Masulis, 1999; Cheung and Wong, 2000; and Cheung and Chinn; 2001), it is useful to establish that the Asian crisis impacted currency volatility.[3] This investigation is carried out by means of a martingale model for spot rates with conditionally heteroscedastic error terms. Most studies find that spot exchange rates follow martingale processes so that the best forecast for time $t + 1$ is the value at time t (e.g., Meese and Singleton, 1982; Meese and Rogoff, 1983). Specifically, if S_t is the

[2] Given that Bubula and Ötker-Robe (2002) provide annual regime classifications in their database, there are times when the currency may fall into different classifications over the sub-period of concern. The regime that is in place the majority of the time period is used to classify the regime.
[3] There also has been a relationship identified between spreads and volume in the literature, but due to the decentralized nature of the foreign exchange market, market-level volume data are generally not available. Furthermore, proxies for volume (e.g. currency futures volumes) that past studies have used do not exist for most of the currencies included in this study. Additionally, it may be adequate to examine volatility effects since there tends to be a strong correlation between volume and volatility.

logarithm of the spot exchange rate, then $E_{t-1}(S_t) = S_{t-1}$, where E_{t-1} is the conditional expectations operator as of time t - 1. It follows then that the spot rate, S_t, follows a martingale of the form[4]:

$$S_t = \delta_s + S_{t-1} + s_t \tag{3}$$

where s_t is the innovation or unexpected change in the exchange rate and δ_s is the drift of the process. The conditional variance of s_t is defined as a GARCH(1,1) process augmented with dummies indicating the crisis and the post-crisis period, given by:

$$h_{s,t} = E_{t-1}(s^2_t) = \alpha_{s,0} + \alpha_{s,1} s^2_{t-1} + \alpha_{s,2} h_{s,t-1} + \gamma_{1,s}\, CRISIS_t + \gamma_{2,s}\, POSTCR_t, \tag{4}$$

where E_{t-1} is the conditional expectations operator. The parameters $\alpha_{s,1}$ and $\alpha_{s,2}$ measure the sensitivity of current volatility $h_{s,t}$ to past unexpected squared spot rate changes s^2_{t-1}, and past volatility $h_{s,t-1}$, respectively. The dummy variables, *CRISIS* and *POSTCR*, equal one during the crisis period of June 1, 1997 to December 31, 1998 and the post-crisis period of January 1, 1999 to June 30, 2000, respectively. $\gamma_{1,s}$ and $\gamma_{2,s}$ capture the impact of the crisis and post-crisis periods on volatility. While the Thai baht was formally released from its peg to the dollar on July 2, 1997, we use June 1, 1997 as the onset of the crisis to capture expectation formation that was occurring during this time. We assign identical pre-crisis, crisis, and post-crisis periods to all countries, where each of the subperiods are about 18 months in length.[5]

[4] See also Bollerslev and Melvin (1994)

[5] We recognize that it is likely that the effects of the crisis started, peaked, and ended at slightly different points in time for each country. It is difficult, especially for non-Asian emerging and developed market countries, to identify these points in time.

Assuming that s_t is conditionally normally distributed with zero mean and conditional variance given by equation (4), the set of parameters describing the dynamics of spot rates and spot volatility can be estimated using nonlinear numerical optimization techniques. The particular optimization method used is based on the maximum likelihood procedure of Berndt, Hall, Hall, and Hausman (1974).

The results of the model are reported in Table 3. Not surprisingly, all spot rates exhibit conditional heteroscedasticity with no exception. The parameter measuring the impact of past squared innovations $\alpha_{s,1}$ is significant across all currencies. Likewise, the parameter measuring volatility persistence $\alpha_{s,2}$ is statistically significant across all but two currencies.

As indicated by the $\gamma_{1,s}$ parameter, volatility is significantly higher for 16 of the 21 currencies during the Asian crisis. Examining the $\gamma_{2,s}$ parameter, we find that 15 out of these 16 currencies continued to have increased volatility in the post-crisis period.[6]

Both emerging markets and developed markets experienced increased currency volatility during the crisis period, which is consistent with the notion that the Asian crisis had widespread consequences for emerging and developed markets (e.g. Kamin, 1999).[7] Nevertheless, concluding that the Asian crisis is the sole reason for these emerging market volatility effects is difficult as there are potentially confounding events with localized repercussions. For example, in early 1999 the Brazilian real was devalued, which may have also affected its volatility along with the volatility of the Argentine peso in the post-crisis period.

[6] Malaysia's volatility parameters are counterintuitive. However, when we redefine the crisis period to be July 1, 1997 to August 31 1998, to better reflect Malaysia circumstances we find that $\gamma_{1,s}$ = 0.0122 with a t-statistic of 9.6773, which is more in line with the rest of the Asian emerging markets.

4.2. Spread Dynamics

The second part of the analysis focuses on whether currency spreads were significantly affected by the Asian crisis and whether these effects persisted beyond the crisis period, for each of the 21 countries in the sample. As mentioned earlier, most studies find that spreads are related to their past values as well as some measure of risk, usually proxied by the variance of the spot rate. Additional variables such as unpredictable trading volume have been found to be significant (Hartmann 1999) while others report that, empirically, the impact of these variables is ambiguous (see Galati, 2000). The difference may due to the fact that Hartmann (1999) deals with the spread of the dollar-yen exchange rate, whereas Galati (2000) deals with the currency spreads of seven emerging markets. A more practical problem for our study is the lack of data on trading volume for emerging markets.

Consequently, and based on the evidence, we model spreads as functions of their past values as well as spote rate risk, the latter being proxied by the conditional variance of the spot rate. Given that our interest is in assessing the behavior of the spread during and after the crisis we include dummies for the crisis and the post-crisis period. Most studies assume that the variance of the spread is time invariant.[8] In this study we allow the variance of the spread to be conditionally heteroscedastic as well as subject to regime change during the crisis period. As such, the model we use for the spread can be described as follows:

$$Y_t = \delta_{Y,0} + \delta_{Y,1} Y_{t-1} + \delta_{Y,2} CRISIS + \delta_{Y,3} POSTCR + \delta_{Y,4}\, h_{s,t} + \varepsilon_{Y,t} \qquad (5)$$

$$h_{Y,t} = E_{t-1}(\varepsilon^2_t) = \alpha_{Y,0} + \alpha_{Y,1}\, \varepsilon^2_{t-1} + \alpha_{Y,2} h_{Y,t-1} + \gamma_{1,s}\, CRISIS + \gamma_{2,s}\, POSTCR, \qquad (6)$$

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[7] Argentina and Saudi Arabia both display lower volatility during the crisis period, possibly because they maintained tight control and credibility in the management of their currencies (see Table 2).

[8] Bollerslev and Melvin (1994) are an obvious exception. They model the variance of the spread as a function of spote rate volatility and past spread values.

where the parameters $\delta_{Y,2}$ and $\delta_{Y,3}$ are capturing the impact of the previously defined crisis and the post-crisis periods on the size of the spreads. The volatility of the spot rate, $h_{s,t}$, is a measure of risk and its impact is captured by $\delta_{Y,4}$. Most studies find this coefficient to be positive and statistically significant. The variance, $h_{Y,t}$, of the error term in equation (5), follows GARCH(1,1) with dummies used to test for shifts during the crisis and post crisis periods. E_{t-1} is the conditional expectations operator.

Assuming that $\varepsilon_{Y,t}$ is conditionally normally distributed with zero mean and conditional variance given by equation (6), the set of parameters describing the dynamics of the spreads are estimated by maximizing the sample likelihood using the procedure of Berndt, Hall, Hall, and Hausman (1974). The values of $h_{s,t}$ which is a proxy for predicted, or anticipated risk, are obtained from the estimation of the model given by (3) and (4). Since the estimation of $h_{s,t}$ is based solely on past errors and past variances, it is a predetermined variable thereby causing no simultaneity problems. The inclusion of the lagged value Y_{t-1} is consistent with Bollerslev and Melvin (1994).

The results of the model are reported in Table 4. Panels A, B, and C display the results for the currencies for the groups of Asian emerging markets, non-Asian emerging markets, and developed markets, respectively. The lagged value of the spread is significant across all three groups. In general, the autoregressive parameter $\delta_{Y,2}$ indicates high persistence but nowhere near unit root-type behavior. This is likely due to the fact that we use percent spreads rather than absolute spreads. The volatility impact ($\delta_{Y,1}$) is positive and significant as expected with minor exceptions for the emerging markets. For the developed markets $\delta_{Y,1}$ is positive and significant with no exceptions. This is consistent with most studies that find spot volatility as a proxy for risk is an important determinant of currency spreads.

It turns out that the spreads for all three groups are conditionally heteroscedastic. This suggests that modeling of spreads, especially in high frequency data, should account for time varying variances. For the developed markets a GARCH(1,0) model was sufficient to capture volatility with the exception of Canada where a GARCH(1,1) provided a better fit.

Unlike the pervasive increase in spot volatility during the crisis period described in Table 3, increased spreads during the crisis are concentrated in the Asian countries as can be seen in Table 4, Panel A. The only exceptions are Hong Kong and Malaysia. In the case of Hong Kong, the currency board was successfully maintained throughout the crisis (see Bubula and Otker-Robe, 2002). Miller (1998) attributes this to the determination of the monetary authorities to maintain the peg and not resort to traditional Central Bank-type interest rate management. The peg, according to Miller could be defended indefinitely by issuing for example structured notes with embedded puts on Hong Kong dollars. This argument is consistent with the idea that the Hong Kong dollar market contained a low degree of information asymmetry that permitted dealers to maintain pre-crisis spread levels, even though a spot volatility effect was found in Table 3. The insignificant spread effect for Malaysia is likely due to a somewhat coarse definition of the crisis period. Unlike the other Asian countries, Malaysia reacted to the crisis by moving from a floating regime to a pegged regime in September 1998. When we revise the crisis period to end on August 31, 1998, the currency spreads in Malaysia are found to significantly increase.

Across the non-Asian emerging countries (Panel B), we find mixed results with some countries showing increased spreads and others showing decreased spreads. However, across the developed countries, we find in all instances that the currency spreads significantly dropped. The downward impact on spreads during the Asian crisis for all five developed countries likely reflects the flight to quality. A flight to quality (i.e., rebalancing portfolios to contain investments denominated in developed country currencies) response to the exodus of capital from the Southeast Asian region was likely an expected response.[9] Therefore, downward pressure on spreads due to a flight to quality may reflect a predictable increase in volume of trading for developed countries. This is further reinforced by the fact that during the crisis the volatility of the spreads went down (up) for developed (Asian-emerging) markets as can be seen by the sign and significance of $\gamma_{1,s}$.

4.3. Panel Data Analysis

The relationship of the spread to different exchange rate regimes has not been investigated thus far in the literature. To study this particular issue we use pooled data (i.e., cross-sectional combined with time-series data) over the period January 1, 1996 to June 30, 2000 for 20 currencies. Taiwan has been omitted from this analysis because of missing regime classification data. To isolate the impact of the currency regime, we control for the impact of other important variables such as, the Asian crisis period, currency volatility, and lagged spreads. We also evaluate whether Asian spreads were significantly higher during this examination period. The reason is that there is a possibility that there are greater adverse selection costs due to heightened information asymmetries in the Asian emerging currency markets. If that is true, we would expect to find significantly higher Asian currency spreads even after controlling for the regimes, crisis, volatility, and lagged spreads.

[9] Von Wincoop and Yi (2000) find that in the period 1997-1998, the most affected Asian countries experienced net capital outflows of more than $80 billion. Furthermore, the majority of the outflows found their way to Europe and

The following model is estimated using the Parks (1967) generalized least squares estimation procedure that controls for the contemporaneous correlation as well as first-order autoregressive errors:

$$Y_{jt} = \lambda_0 + \lambda_1 TIGHT_{jt} + \lambda_2 LOOSE_{jt} + \lambda_3 CRISIS_t + \lambda_4 POSTCR_t + \lambda_5 VOL_{jt} + \lambda_6 YLAG_{jt} + \lambda_7 ASIA_j + u_{jt} \quad (7)$$

where $TIGHT_{jt}$ is a dummy variable equal to one if country j follows Type 1 (i.e., tight) regime, and zero otherwise; $LOOSE_{jt}$ is a dummy variable set equal to one if country j follows Type 3 (i.e., loose) regime, and zero otherwise; CRISIS and POSTCR are dummies for the crisis and post-crisis periods as defined in section 4.1; VOL is a proxy for anticipated risk estimated using equations (3) and (4); $YLAG_j$ is the one day lagged spread for country j; $ASIA_j$ is a dummy variable equal to one for Asian emerging markets, and zero otherwise, and the remaining variables are as previously defined.[10] We also estimate this regression model for the subsets of Asian emerging, non-Asian emerging, and developed markets separately, where the Asian country dummy variable is naturally excluded.

It is not known *a priori* what the signs of λ_1 and λ_2 should be. The results of our previous findings in Table 3 indicate that both λ_3 and λ_4 should be positive for Asian countries and negative for developed countries; though the direction of influence on spreads from the crisis and the post-crisis periods is unclear overall and for the subset of non-Asian emerging market currencies. Based on earlier studies and the time series results reported in section 4.2 we expect to find positive coefficients on the volatility factor (Glassman, 1987; Bollerslev and Melvin,

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the US via offshore banks.

[10] See also Table 2 for the definition of currency regimes.

1994; Hartmann, 1998; Huang and Masulis, 1999) and lagged spread (Bollerslev and Melvin 1994). Lastly, if Asian currencies have larger spreads than non-Asian currencies then λ_6 should be positive and significant.

Table 5 presents the results of our pooled analyses. The first column reports the full sample that contains all the countries, the subsequent columns report the subsets of Asian emerging, non-Asian emerging, and developed markets. The full sample and each of the emerging market subsets shows that tight regimes have significantly smaller spreads and loose regimes have significantly larger spreads.

The positive coefficient on TIGHT for the sample of developed countries should be carefully interpreted. It can be seen in Table 2 that Germany is the only developed country in our sample that did not have a highly flexible regime over the sample period. As Germany prepared to move from the mark to the euro, they moved from a regime that pegged its currency within a horizontal band to an even less flexible currency union. The positive coefficient on TIGHT tells us that as Germany prepared to convert to the euro, mark spreads increased; this likely reflects the increased risk to dealers holding marks. Certainly we cannot generalize this finding of larger spreads for developed countries (or any country) with less flexible regimes.

Overall, our results suggest that the exchange rate regime significantly influences spreads, beyond the influence on spreads via the regime-volatility relationship of Stockman (1983) and Baxter and Stockman (1989). To the extent that tightly-controlled regimes have fewer instances of unexpected government intervention, our finding of smaller spreads with tightly-controlled regimes is consistent with Naranjo and Nimalendran (2000).[11]

[11] Peiers (1997) documents the existence of informed and uniformed traders in foreign exchange trading, and in the equity market literature it is widely accepted that information asymmetries affect spreads (e.g., Glosten and Milgrom (1985), O'Hara (1995), Koski and Michaely (2000), and Brockman and Chung (2003)). There have been doubts expressed over the existence of asymmetric information among foreign exchange trading since it is primarily

For the full sample, we find significantly higher spreads during the crisis and post-crisis periods. The subset results in Table 5 are consistent with the results in Table 4. Table 5 reports the currency spreads of Asian emerging markets, on average, were significantly higher during the crisis period. Currency spreads of non-Asian emerging markets, on average, were not affected by the crisis, and currency spreads of developed markets were significantly lower during the crisis and post-crisis periods. The lower bid-ask spreads of developed country currencies is predicted by the natural retreat of investors from Southeast Asia to developed markets. The work by Bessembinder (1994) and Hartmann (1999) supports reduced spreads with predictable increases in trading volume.

For the full sample and each of the subsets, the results show the volatility (VOL) and lagged spread (YLAG) factors are positive and significant. Lastly, the full model shows the ASIA indicator variable to be positive and significant. Asian emerging market currency spreads, on average, are found to be larger than the other currency spreads, even after controlling for other important variables. It is reasonable that Asian spreads are larger because of greater adverse selection costs due to heightened information asymmetries in these countries over this timeframe. It is likely that the Asian currency markets contained greater information asymmetries due to the environment of unstable economies and/or uncertain future government exchange rate policies; whereas non-Asian currency markets contained relatively low information asymmetry given their relatively stable economies and exchange rate regimes.[12] When macroeconomic conditions are stable, most often governments tend to maintain policy.

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conducted in the interbank market (e.g., Chakrabarti, 2000). It can be asserted that spreads may be smaller for tightly-controlled regimes to the extent that dealers put a great amount of faith in the governments' ability to maintain tight control over rates of exchange and liquidity is not adversely affected.

[12] Kodres and Pritsker (2002) develop a theoretical model which is able to explain why some countries are affected by crises and other countries are not affected by crises. This model emphasizes the important role of information asymmetries in contagion, as it shows the impact of portfolio rebalancing on asset prices is small in the absence of and exaggerated in the presence of information asymmetries.

Under these more stable circumstances, the knowledge possessed by informed traders about intervention or potential changes in exchange rate policy will have relatively little value.[13]

5. Summary

We use a sample of 21 emerging and developed country currencies to investigate the impact of the Asian crisis on currency volatility and currency bid-ask spreads. We find that the crisis had widespread and uniform volatility effects across the sample. The impact of the crisis on spreads, on the other hand, were not uniform. For Asian emerging markets, spreads widened and spread volatility increased significantly during the crisis. The only exception is Hong Kong, which is consistent with the idea that the Hong Kong dollar market contained a low degree of information asymmetry that permitted dealers to maintain pre-crisis spread levels. For all five of the developed markets in our sample, we find that spreads narrowed and spread volatility dropped significantly, likely due to a flight to quality.

We investigate the impact of exchange rate regimes on currency bid-ask spreads using panel data over the 1996 to 2000 time period. We find that countries with less (more) flexible exchange rate regimes have significantly lower (higher) spreads, while controlling for the influence of other factors such as volatility. To the extent that less flexible regimes have fewer instances of unexpected government intervention, our finding of smaller spreads with less flexible regimes is consistent with Naranjo and Nimalendran (2000). We also show that Asian developing market spreads are higher than spreads of the other countries, again after controlling for the influence of other factors. We argue that Asian spreads are larger because of greater

[13] Several variations of model (7) were also estimated in order to test the robustness of the results. For example, different regime classifications were used, while the risk factor VOL was omitted. The main conclusions remained unaltered.

adverse selection costs due to heightened information asymmetries in these markets over this period of time.

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Table 1
Mean (Median) Percent Bid-Ask Spreads

The spreads are calculated relative to their midpoint as $(ask_j - bid_j)/((ask_j - bid_j)/2)$, where ask_j is the ask price in U.S. dollars for currency *j* and bid_j is the bid price in U.S. dollars for currency *j*. The mean (median) end of month percent spreads are shown for the entire examination period and three subsets.

Country	Full Period: 1/96-6/00	First Sub period 1/96-12/96	Second Sub period (Crisis Period) 6/97-12/98	Third Sub period 1/99-6/00
Asia Emerging:				
Hong Kong	0.0187	0.0064	0.0245	0.0129
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Indonesia	0.7572	0.0486	1.4042	0.7368
	(0.6211)	(0.0467)	(1.2151)	(0.6700)
Korea	0.1256	0.0204	0.2506	0.0887
	(0.0792)	(0.0000)	(0.2495)	(0.0698)
Malaysia	0.0972	0.0378	0.2200	0.0232
	(0.0380)	(0.0377)	(0.2590)	(0.0380)
Philippines	0.3610	0.1048	0.6481	0.3188
	(0.1683)	(0.0525)	(0.3339)	(0.3797)
Singapore	0.0926	0.0669	0.1338	0.0735
	(0.0705)	(0.0705)	(0.1191)	(0.0518)
Taiwan	0.2297	0.0459	0.3202	0.3145
	(0.1159)	(0.0275)	(0.1034)	(0.3207)
Thailand	0.2723	0.0338	0.5549	0.1556
	(0.1512)	(0.0255)	(0.4323)	(0.1478)
Non-Asia Emerging:				
Argentina	0.0256	0.0233	0.0368	0.0139
	(0.0200)	(0.0150)	(0.0200)	(0.0100)
Brazil	0.0943	0.0235	0.0174	0.2423
	(0.0238)	(0.0205)	(0.0119)	(0.1295)
Greece	0.0503	0.0423	0.0631	0.0443
	(0.0485)	(0.0477)	(0.0573)	(0.0353)
Israel	0.2379	0.1680	0.2949	0.2362
	(0.2116)	(0.1587)	(0.2477)	(0.2422)
Mexico	0.1450	0.1396	0.1739	0.1321
	(0.0989)	(0.1495)	(0.1564)	(0.0949)
Portugal	0.1008	0.0670	0.1713	0.0516
	(0.0627)	(0.0627)	(0.0881)	(0.0483)
Saudi Arabia	0.0160	0.0094	0.0178	0.0208
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
South Africa	0.1547	0.1478	0.1610	0.1733
	(0.1255)	(0.1369)	(0.0970)	(0.1378)
Developed:				
Canada	0.0499	0.0478	0.0439	0.0616
	(0.0439)	(0.0410)	(0.0430)	(0.0603)
Germany	0.0437	0.0440	0.0408	0.0492
	(0.0401)	(0.0445)	(0.0363)	(0.0530)
Japan	0.0646	0.0701	0.0638	0.0636
	(0.0630)	(0.0750)	(0.0661)	(0.0606)
Switzerland	0.0628	0.0680	0.0618	0.0593
	(0.0609)	(0.0697)	(0.0597)	(0.0607)
U.K.	0.0526	0.0526	0.0540	0.0495
	(0.0537)	(0.0521)	(0.0541)	(0.0521)

Table 2

Types of Exchange Rate Systems

The thirteen exchange rate systems described in Bubula and Ötker-Robe (2002) are classified into three different categories. Type 1 includes the following systems: another currency as legal tender, currency union, currency board, conventional fixed peg to single currency, conventional fixed peg to basket. Type 2 includes the following systems: pegged within a horizontal band, forward-looking crawling peg, forward-looking crawling band, backward-looking crawling peg, backward-looking crawling band, tightly managed float. Type 3 includes the following systems: other managed floating, independently floating. Type 1 systems are those with the greatest degree of control, while type 3 systems are those with the least amount of control. na means not available.

Country	Pre-Crisis 1/96-5/97	Crisis 6/97-12/98	Post-Crisis 1/99-6/00
Asia Emerging:			
Hong Kong	1	1	1
Indonesia	2	3	3
Korea	2	3	3
Malaysia	2	3	1
Philippines	1	3	3
Singapore	2	3	3
Taiwan	na	na	na
Thailand	1	3	3
Non-Asia Emerging:			
Argentina	1	1	1
Brazil	2	2	3
Greece	2	2	2
Israel	2	2	2
Mexico	3	3	3
Portugal	2	2	1
Saudi Arabia	1	1	1
South Africa	3	3	3
Developed:			
Canada	3	3	3
Germany	2	2	1
Japan	3	3	3
Switzerland	3	3	3
U.K.	3	3	3

Table 3
Impact of Asian Crisis on Volatility

The impact on currency volatility is investigated for each of the following 21 currencies using daily data from 1/1/96 to 6/30/00. S_t is the spot rate (midpoint), $h_{s,t}$ is conditional spot rate volatility, $CRISIS_t$ is equal to 1 from 6/1/97 to 12/31/98, and $POSTCR_t$ is equal to 1 from 1/1/99 to 6/30/00. * and ** indicates significant at the 5% and 1% levels, respectively.

$$S_t = \delta_s + S_{t-1} + s_t \text{ and } h_{s,t} = E_{t-1}(s^2_t) = \alpha_{s,0} + \alpha_{s,1}s^2_{t-1} + \alpha_{s,2}h_{s,t-1} + \gamma_{1,s}\, CRISIS_t + \gamma_{2,s}\, POSTCR_t,$$

Country	δ_s	$\alpha_{s,0}$	$\alpha_{s,1}$	$\alpha_{s,2}$	$\gamma_{1,s}$	$\gamma_{2,s}$
Asia Emerging:						
Hong Kong	-0.00032	0.00002	0.24405	0.77171	0.00051	-0.00008
	(-0.99)	(26.39)**	(24.64)**	(136.06)**	(9.34)**	(-12.45)**
Indonesia	-0.01285	0.00108	0.11771	0.79744	0.61931	0.28934
	(-3.95)**	(15.62)**	(10.86)**	(65.80)**	(14.74)**	(15.32)**
Korea	-0.01144	0.00072	0.11954	0.88167	0.00154	0.00494
	(-1.62)	(10.74)**	(27.21)**	(255.57)**	(12.77)**	(14.36)**
Malaysia	0.00022	0.00141	0.55558	0.63604	-0.00141	0.00462
	(0.12)	(56.42)**	(25.98)**	(84.75)**	(-57.51)**	(28.88)**
Philippines	0.00118	0.00034	0.22012	0.66253	0.16156	0.01098
	(0.64)	(11.60)**	(13.95)**	(31.35)**	(12.06)**	(9.35)**
Singapore	-0.00704	0.00382	0.27037	0.45842	0.06423	0.01119
	(-1.77)	(9.97)**	(12.32)**	(11.79)**	(10.72)*	(8.95)**
Taiwan	0.00044	0.00096	0.28943	0.49902	0.09501	0.02449
	(0.17)	(13.78)**	(10.47)**	(15.88)**	(15.81)**	(13.88)**
Thailand	-0.00758	0.00034	0.33247	0.68101	0.06243	0.02305
	(-3.10)**	(5.74)**	(19.49)**	(53.34)**	(8.55)**	(17.47)**
Non-Asia Emerging:						
Argentina	0.00015	0.00001	0.06504	0.86891	-0.00000	0.00014
	(0.66)	(13.17)**	(12.88)**	(113.44)**	(-7.51)**	(17.18)**
Brazil	-0.02016	0.00037	0.14019	0.76649	-0.00002	0.11394
	(-13.21)**	(11.57)**	(11.81)**	(63.02)**	(-0.48)	(20.78)**
Greece	0.00372	0.08125	0.62857	-0.00477	0.13818	0.13811
	(0.36)	(16.81)**	(19.87)**	(-0.27)	(8.48)**	(10.84)**
Israel	0.00194	0.00444	0.16447	0.75157	0.00312	0.01376
	(0.32)	(11.45)**	(14.86)**	(64.08)**	(10.09)**	(17.37)**
Mexico	0.01534	0.00758	0.22625	0.71161	0.00601	0.02110
	(1.89)	(8.02)**	(20.78)**	(60.16)**	(5.07)**	(13.57)**
Portugal	-0.01991	0.00270	0.01920	0.95667	0.00234	0.00434
	(-1.92)*	(2.87)**	(4.25)**	(79.77)**	(2.52)**	(2.61)**
Saudi Arabia	0.00024	0.00001	0.34354	0.62267	-0.00000	0.00001
	(1.59)	(16.49)**	(14.11)**	(42.21)**	(-3.65)**	(12.53)**
South Africa	-0.02321	0.00288	0.25972	0.79432	-0.00061	-0.00012
	(-3.46)**	(11.70)**	(17.86)**	(108.45)**	(-1.49)	(-0.15)
Developed:						
Canada	-0.00442	0.00059	0.04150	0.93791	0.00067	0.00110
	(-0.88)	(5.08)**	(9.32)**	(138.47)**	(3.50)**	(3.77)**
Germany	-0.02195	0.00266	0.01859	0.96101	0.00136	0.00338
	(-2.03)*	(2.37)*	(3.89)**	(78.81)**	(1.94)*	(2.34)*
Japan	-0.03090	0.02160	0.10002	0.76353	0.05529	0.03842
	(-2.36)*	(5.88)**	(8.53)**	(25.54)**	(6.65)**	(5.80)**
Switzerland	-0.02624	0.15905	0.10137	0.08211	0.05403	0.09347
	(-2.07)*	(8.48)**	(4.54)**	(0.86)	(4.26)**	(5.67)**
U.K.	0.00549	0.00711	0.06399	0.85844	0.00484	0.00590
	(0.62)	(5.00)**	(7.06)**	(39.23)**	(3.52)**	(4.23)**

Table 4
Impact of Asian Crisis on Currency Bid-Ask Spreads

The impact on currency spreads is investigated for each of the following 21 currencies using daily data from 1/1/96 to 6/30/00. This regression is analyzed for currency j over 1/1/96 to 6/30/00. Y_t is the spread, $CRISIS_t$ is equal to 1 from 6/1/97 to 12/31/98 and 0 otherwise, and $POSTCR_t$ is equal to 1 from 1//1/99 to 6/30/00 and 0 otherwise, $h_{s,t}$ is conditional spot rate volatility, and $h_{Y,t}$ is conditional spread volatility. * and ** indicates significant at the 5% and 1% levels, respectively.

$$Y_t = \delta_{Y,0} + \delta_{Y,1} Y_{t-1} + \delta_{Y,2} CRISIS + \delta_{Y,3} POSTCR + \delta_{Y,4} h_{s,t} + \varepsilon_{Y,t}$$
$$h_{Y,t} = E_{t-1}(\varepsilon^2_t) = \alpha_{Y,0} + \alpha_{Y,1} \varepsilon^2_{t-1} + \alpha_{Y,2} h_{Y,t-1} + \gamma_{1,s} CRISIS + \gamma_{2,s} POSTCR$$

Panel A: Asia Emerging

Country	$\delta_{Y,0}$	$\delta_{Y,1}$	$\delta_{Y,2}$	$\delta_{Y,3}$	$\delta_{Y,4}$	$\alpha_{Y,0}$	$\alpha_{Y,1}$	$\alpha_{Y,2}$	$\gamma_{1,s}$	$\gamma_{2,s}$
Hong Kong	0.00966	0.34659	0.00748	0.003850	0.08949	0.00039	0.11805	0.67473	-0.00006	-0.00003
	(1.14)	(5.44)**	(1.00)	(0.42)	(0.22)	(3.22)**	(2.84)**	(9.32)**	(-0.80)	(-0.35)
Indonesia	0.01576	0.69331	0.04721	0.12762	0.01743	0.00003	0.09797	0.89873	0.00151	0.00118
	(8.54)**	(41.72)**	(3.09)**	(9.39)**	(13.28)**	(10.51)**	(11.84)**	(139.54)**	(4.21)**	(8.02)**
Korea	-0.00665	0.54384	0.10879	0.03482	0.00527	0.00312	0.92496	0.27175	0.00232	-0.00249
	(-2.39)*	(31.03)**	(22.20)**	(11.02)**	(12.23)**	(11.08)**	(14.74)**	(8.90)**	(7.12)**	(-9.410)**
Malaysia	0.00684	0.81986	0.00023	-0.00157	0.00421	0.00000	0.19167	0.84614	0.00000	0.00001
	(7.07)**	(51.12)**	(0.12)	(-1.66)	(4.23)**	(1.10)	(29.69)**	(446.87)**	(0.26)	(3.51)**
Philippines	0.05512	0.37230	0.09679	0.12248	0.07805	0.00017	0.03148	0.95230	0.00310	0.00035
	(8.64)**	(16.81)**	(4.05)**	(12.35)**	(12.15)**	(6.04)**	(7.67)**	(190.27)**	(5.12)**	(2.25)*
Singapore	0.03308	0.50403	0.02466	-0.00300	0.02330	0.00009	0.58107	0.054600	0.00168	0.00017
	(19.30)**	(20.42)**	(9.62)**	(-3.52)**	(5.24)**	(24.24)**	(22.45)**	(2.02)*	(13.50)**	(17.12)**
Taiwan	0.01423	0.53513	0.05658	0.12927	0.01139	0.00008	0.11744	0.81740	0.00235	0.00102
	(9.56)**	(23.66)**	(7.73)**	(16.45)**	(1.75)	(16.58)**	(12.44)**	(104.95)**	(16.59)**	(12.11)**
Thailand	0.01708	0.44475	0.16118	0.05796	0.02957	0.00007	0.19303	0.79416	0.00232	0.00007
	(12.00)**	(18.78)**	(13.40)**	(15.79)**	(21.60)**	(12.27)**	(19.13)**	(81.58)**	(5.46)**	(4.44)**

Panel B: Non-Asia Emerging

Country	$\delta_{Y,0}$	$\delta_{Y,1}$	$\delta_{Y,2}$	$\delta_{Y,3}$	$\delta_{Y,4}$	$\alpha_{Y,0}$	$\alpha_{Y,1}$	$\alpha_{Y,2}$	$\gamma_{1,s}$	$\gamma_{2,s}$
Argentina	0.00099	0.91915	0.00107	0.00062	-0.13888	0.00000	0.05423	0.94796	0.00000	-0.00000
	(6.00)**	(221.14)**	(4.97)**	(3.56)**	(-1.75)	(15.31)**	(25.30)**	(748.13)**	(33.14)**	(-4.87)**
Brazil	0.01441	0.32460	-0.00334	0.03996	0.04896	0.00002	0.42948	0.51532	0.00001	0.00070
	(25.43)**	(16.17)**	(-6.39)**	(15.37)**	(19.00)**	(10.25)**	(18.08)**	(25.38)**	(2.92)**	(8.20)**
Greece	0.03720	0.15452	0.00389	0.00841	0.00055	0.00004	0.17875	0.80293	-0.00001	0.00000
	(22.63)**	(6.07)**	(2.47)**	(5.40)**	(4.76)**	(24.05)**	(17.59)**	(127.00)**	(-2.27)*	(0.30)
Israel	0.03717	0.77049	0.01567	0.00736	0.06494	0.00015	0.32135	0.57536	0.00016	0.00011
	(14.32)**	(53.02)**	(7.77)**	(4.33)**	(8.58)**	(7.12)**	(13.33)**	(20.55)**	(6.59)**	(4.80)**
Mexico	0.05727	0.39917	-0.00280	0.00343	0.09127	0.00036	0.18097	0.67636	0.00043	0.00046
	(16.65)**	(14.87)**	(-0.84)	(0.92)	(15.21)**	(6.21)**	(9.54)**	(22.12)**	(6.72)**	(7.09)**
Portugal	0.04740	0.27994	0.01134	-0.02251	0.03919	0.00005	0.20394	0.77191	0.00020	-0.00004
	(20.10)**	(9.44)**	(3.86)**	(-11.13)**	(4.60)**	(6.90)**	(10.44)**	(62.79)**	(5.54)**	(-4.64)**
Saudi Arabia	0.00287	0.54046	-0.00112	0.002773	3.14275	0.00001	0.23680	0.74537	0.00001	0.00000
	(2.47)**	(20.31)**	(-0.92)	(2.41)*	(2.33)*	(4.65)**	(14.14)**	(70.45)**	(3.30)**	(0.76)
South Africa	0.04069	0.56695	-0.01201	0.01926	0.04174	0.00007	0.16726	0.85073	-0.00000	0.00002
	(14.84)**	(29.37)**	(-4.09)**	(6.40)**	(29.73)**	(4.16)**	(26.82)**	(292.90)**	(-0.19)	(0.77)

Panel C: Developed Markets

Country	$\delta_{Y,0}$	$\delta_{Y,1}$	$\delta_{Y,2}$	$\delta_{Y,3}$	$\delta_{Y,4}$	$\alpha_{Y,0}$	$\alpha_{Y,1}$	$\alpha_{Y,2}$	$\gamma_{1,s}$	$\gamma_{2,s}$
Canada	0.02797	0.31422	-0.00480	0.00993	0.06810	0.00004	0.06448	0.80993	-0.00003	-0.00002
	(18.40)**	(12.17)**	(-3.97)**	(7.60)**	(9.12)**	(4.30)**	(4.82)**	(20.23)**	(-4.44)**	(-4.13)**
Germany	0.03886	0.03443	-0.00754	0.00465	0.01422	0.00011	0.06807	—	-0.00002	0.00008
	(25.80)**	(1.28)	(-9.15)**	(3.35)**	(2.07)*	(15.75)**	(3.34)**		(2.01)*	(6.56)**
Japan	0.05096	0.23576	-0.00578	-0.00591	0.00238	0.00017	0.16119	—	-0.00002	0.00003
	(25.84)**	(8.51)**	(-6.16)**	(-6.25)**	(2.71)**	(28.59)**	(4.50)**		(-2.35)*	(2.04)*
Switzerland	0.05626	0.20739	-0.00300	-0.00890	-0.00722	0.00017	0.13463	—	-0.00007	-0.00003
	(25.58)**	(7.22)**	(-3.70)**	(-8.64)**	(-1.52)	(21.03)**	(4.88)**		(-7.46)**	(-3.13)**
U.K.	0.04606	0.12173	-000215	-0.00647	0.02112	0.00007	0.24070	—	0.00002	-0.00001
	(24.30)**	(3.54)**	(-4.31)**	(-11.73)**	(5.58)**	(31.06)**	(8.48)**		(5.56)**	(-2.21)*

Table 5

Results of Regression Analysis of Currency Spreads over January 1996 – June 2000

$$Y_{jt} = \lambda_0 + \lambda_1 TIGHT_{jt} + \lambda_2 LOOSE_{jt} + \lambda_3 CRISIS_t + \lambda_4 POSTCR_t + \lambda_5 VOL_{jt} + \lambda_6 YLAG_{jt} + \lambda_7 ASIA_j + u_{jt}$$

The dependent variable Y_{jt} is the daily spread, $TIGHT_{jt}$ is equal to 1 for Type 1 regimes and 0 otherwise, $LOOSE_{jt}$ is equal to 1 for Type 3 regimes and 0 otherwise, $CRISIS_t$ is equal to 1 from 6/1/97 to 12/31/98 and 0 otherwise, $POSTCR_t$ is equal to 1 from 1/1/99 to 6/30/00 and 0 otherwise, VOL_{jt} is the daily predicted volatility of the spot exchange rate, $YLAG_{jt}$ is the one day lagged spread, and $ASIA_j$ is equal to 1 for the Asia emerging markets and 0 otherwise. The exchange rate systems are classified according to Bubula and Ötker-Robe (2002) as summarized in Table 2. The GLS estimation procedure of Parks (1967) that controls for the contemporaneous correlation and autoregressive errors is used. ** indicates significance at least at the 1% level.

Variable	Full Sample	Asia Emerging	Non-Asia Emerging	Developed
Intercept (λ_0)	0.0090	0.0083	0.0113	0.0220
	(14.32)**	(3.15)**	(15.26)**	(43.13)**
TIGHT (λ_1)	-0.0084	-0.0080	-0.0090	0.0068
	(-14.38)**	(-2.89)**	(-13.23)**	(12.36)**
LOOSE (λ_2)	0.0080	0.0130	0.0085	0.0104
	(12.80)**	(4.05)**	(7.74)**	(29.06)**
CRISIS (λ_3)	0.0044	0.0211	0.0008	-0.0033
	(6.06)**	(8.68)**	(1.48)	(-9.32)**
POSTCR (λ_4)	0.0037	0.0045	0.0001	-0.0034
	(4.99)**	(1.89)	(0.17)	(-8.64)**
VOL (λ_5)	0.0040	0.0047	0.0015	0.0141
	(18.50)**	(14.35)**	(4.46)**	(11.16)**
YLAG (λ_6)	0.7848	0.7911	0.8605	0.4253
	(223.84)**	(134.45)**	(192.17)**	(42.53)**
ASIA (λ_7)	0.0097	—	—	—
	(12.42)**			
R-square	0.7124	0.7435	0.8343	0.4354
Countries	20	7	8	5
Time Series	1,641	1,641	1,641	1,641
# Observations	32,820	11,487	13,128	8,205