Stock Market Uncertainty and Uncovered Equity Parity Deviation: Evidence from Asia

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Abstract

Recently, many empirical studies document that a country's stock market performance relative to the US and its local currency units per US dollar tend to move in opposite direction over the short run, also known as the uncovered equity parity (UEP) condition. However, those studies have applied only to advanced economies to date. This study conducted the same tests to a sample of 18 Asian economies. We not only find a striking evidence that the UEP does not hold ture, but also strongly reverses its sign among Asian currencies. In addition, measures of stock market uncertainty are suggested as a potential driving force behind this UEP reversal for Asian economies. This surprising result casts doubt on the portfolio rebalancing along with incomplete foreign exchange risk hedging as the main mechanism of the UEP condition. The reasoning is that Asian foreign exchange (FX) markets are even more subject to incomplete foreign exchange risk hedging. Thus, one should expect even stronger UEP evidence from Asian currency markets if the portfolio rebalancing mechanism was indeed at play.

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1 Introduction

International finance literature has recently drawn attention to the uncovered equity parity condition (UEP), which refers to a negative relationship between relative currency and equity returns. When the home country's stock market outperforms the foreign counterpart, the home country's currency depreciates against the foreign currency in the short to medium run. This negative relationship has been empirically supported by many researchers, for example, see Hau and Rey (2006), Kim (2011), Curcuru, Thomas, Warnock, and Wongswan (2014), Jung (2017), and Djeutem and Dunbar (2018) among others.

These empirical findings for the UEP are of particular importance to researchers working in theories of foreign exchange rate (FX) determination, which by and large have failed to explain what actually drives FX movements. In particular, the failure of the so-called interest rate differential-based portfolio balance approach (PBA), also known as the uncovered interest parity, has even led to pessimism about continuing the PBA-based FX research among international finance scholars.[1]

This is why the UEP evidence can be exciting. It could potentially offer a novel solution to the aforementioned anomaly. That is the mystery of short to medium FX movements could be solved by focusing more on the behavior of international investors' equity portfolio rebalancing. Furthermore, it could also imply that the PBA-based FX determination theory may not be fundamentally flawed, but it could be merely misspecified.

Accordingly, whether the UEP evidence can be regarded as a stylized fact across many countries over long time periods has far-reaching implications for the progress of FX determination theories. Despite this importance, virtually all existing empirical studies have been based on only major advanced country currencies, not on currencies of emerging countries. By now enough emerging currency and emerging equity markets have become major investment targets for global investors. Thus, including emerging countries into the data set should provide a more reliable testing ground for the UEP.

Hence, this paper comprehensively tests for the UEP in Asian currency and equity markets for the first time to our best knowledge. We mostly use a dataset with different frequencies (daily, monthly, and quarterly) from *Datastream* on currency and equity prices of 18 Asian countries from 1980 to date. Employing linear correlation methodologies such as the Pearson correlation coefficients and ordinary least square estimates, this paper not only finds striking evidence that the UEP does not apply to Asian markets, but currency and equity returns actually exhibit strong positive correlations, which is the complete opposite

[1] Here is a direct quote from Frankel and Rose (1995): *"To repeat a central fact of life, there is remarkably little evidence that macroeconomic variables have consistent strong effects on floating exchange rates...... Such negative findings have led the profession to a certain degree of pessimism vis-a-vis exchange-rate research".*

from what the UEP expects.

The finding is imperative to the UEP literature because it could revoke the main intuition behind the UEP: portfolio rebalancing. The mechanism of the portfolio rebalancing proposed in the literature, for example, Hau and Rey (2006), is essentially risk-hedging behavior. The idea goes as follows. If foreign equity markets outperform domestic ones, domestic investors naturally expose themselves to higher relative FX exposure under the assumption that the FX market is incomplete; that is, the FX risk cannot be fully insured. As a result, domestic investors ought to repatriate some of the foreign equities to decrease FX risk. Then, the associated selling of foreign currency should cause foreign currency to depreciate.

If the aforementioned mechanism behind the UEP is correct, Asian markets should exhibit stronger empirical evidence for the UEP. It is intuitive to argue that Asian currencies are relatively more volatile, and their FX markets are even less complete in a sense that FX risk hedging demand for Asian currencies is even higher. Therefore, one might as well expect that the portfolio rebalancing channel would be stronger for Asian markets. That is the UEP evidence has to be even stronger for Asian countries. To sum up, to us the fact that the UEP deviates much for Asian countries, which presumably should exhibit the exact opposite, suggests that the portfolio-rebalancing based explanation for the UEP must be taken with caution, if not revoked.

A natural question that arises from our evidence is what could potentially overturn the UEP for Asian countries. One conjecture could be that monetary policy or inflation process is a driving force behind the UEP deviation on the grounds that Asian currencies are more prone to bouts of high inflation and higher inflation volatility. The UEP evidence among many advanced countries has been found at both real and nominal terms, for example, Jung (2017) and Jung, Jung, and Su (2020). Therefore, if our findings for Asian countries work differently for real and nominal variables, it would help one to identify whether some aspects of monetary policy or inflation process could drive such UEP deviation for Asian countries. However, our test results show that this conjecture is likely to be false. The UEP deviation detected for Asian markets turns out to work for both real and nominal variables.

Another candidate explanation for the UEP deviation is proposed by Jung (2017). The idea is based on idiosyncratic stock market volatility. When a domestic stock market experiences a higher idiosyncratic volatility, home asset prices increase through the so-called the Pastor and Veronesi (2006) effect. If a higher idiosyncratic volatility tends to dampen the level of aggregate consumption, which is empirically supported, a home currency appreciation would follow. Eventually, the UEP relationship could be reversed in this case.

In order to see whether this explanation makes sense or not, we test the marginal effect of relative stock return volatility on the UEP relationship. Specifically, we add the interaction between relative equity returns and various types of proxy variables for stock return volatility into the standard regression equation. The results are clear. The coefficients on the interaction term mostly turn out to be positive and statistically significant. That is, we find concrete evidence that the stock return volatility could be a major driving force behind the UEP reversal. Our evidence lends support to the hypothesis of Jung (2017) and suggests a new venue of research focusing more on a deep structural link between the stock market uncertainty and the UEP.

Our results are important for the growing body of international finance research on the UEP. Empirical studies on the UEP condition have become increasingly popular. They include but are not limited to the works of Kim (2011), Melvin and Prins (2015), Curcuru et al. (2014), Griffin, Nardari, and Stultz (2004), Pavlova and Rigobon (2007), Chabot, Ghysels, and Jagannathan (2014), Cenedese, Payne, Sarno, and Valente (2015), and Jung et al. (2020). However, as mentioned earlier, they all share one thing in common: sample countries include only advanced economies. Our paper, to our best knowledge, is the first to document the comprehensive evidence on the UEP condition for non-advanced countries. In addition, most existing studies do not show evidence against the UEP, except for Jung (2017) and Jung et al. (2020) who document that the UEP might well turn its sign when stock market uncertainties rise although the overall correlation between relative equity and currency returns is negative. By contrast, our results show that the UEP is violated even on average for Asian markets.

Our work is also related to recent studies that questioned the validity of the portfolio rebalancing as a main mechanism behind the UEP. For instance, Curcuru et al. (2014) find that investors reshuffle their portfolio not because of the desire to mitigate FX risk associated with foreign equities, but rather due to return-seeking motives. Jung et al. (2020) also cast doubt on the portfolio rebalancing channel. They find that the UEP condition had prevailed even before international equity flows or international portfolio rebalancing was largely restricted, for example, during the first half of the 20th century. Further, they document that a higher idiosyncratic stock market volatility, which presumably ought to strengthen the portfolio balancing channel, actually weakens the UEP condition. Our results remain in line with these studies and call for a richer explanation on the UEP.

This paper proceeds as follows. Section 2 discusses the data sample in detail. Section 3 presents the methodologies. Section 4 shows the main results on each of the 18 sample countries separately. Section 5 conducts robustness check by employing panel estimations. Section 6 concludes the paper.

2 The Data Sample

Data on spot FX rates with US dollar and stock returns for 19 economies were collected from *Datastream*. We chose to include US and 18 Asian countries that have enough observations on these two variables. Many were, therefore, ruled out. Sample Asian countries include Bangladesh, China, Hong Kong, India, Indonesia, Japan, Kazakhstan, Laos, Malaysia, Pakistan, Phiippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, and Turkey. The timespan of data differs across variables, frequencies, and countries. Each of them is shown in detail within summary statistics tables in the Appendix. Mostly, the data covers the post-1990 period.

The units of the nominal FX rate are US dollar per unit of local currency, for example, KRW/USD following the *International Organization of Standard* (IOS) notation. FX rates data are collected with three different frequencies (daily, monthly, and quarterly). For the stock returns data, major stock market indices are collected.[2] Then, they are used to compute the daily, monthly and quarterly stock returns for sample countries.

We also construct real FX rates and stock returns using the consumer price index (CPI) data, mainly collected from *Datastream*. The CPI data with daily frequency are not available; therefore, only quarterly and annual real FX and real stock returns are computed. For India and Turkey's CPI data, we add data from the *Federal Reserve Bank of St. Louis* (FRED) to the *Datastream* data. In addition, Sri Lanka's CPI data are entirely collected from the *International Monetary Fund* (IMF) due to lack of data from *Datastream*.

A proxy variable for the daily and monthly stock return volatilities are collected from *Datastream* as well. It is called a volatility close-to-close data, which is defined by *Datastream* as follows:

$$\sqrt{\frac{\tau}{N-1}\sum_{j=1}^{N}\left(ln\left(\frac{U_i}{U_{j-1}}\right)-\mu\right)^2},$$

where $\mu = 1/N \sum_{j=1}^{N} ln(U_i/U_{j-1})$, U_i is i^{th} closing price, N is the total number of observations, and $\tau = 12$ or 252 if the period frequency is monthly or daily, respectively. This measure is meant to capture price movement expressed as the standard deviation of prices for the

[2] The stock indices of Bangladesh, China, Hong Kong, India, Indonesia, Japan, Kazakhstan, Laos, Malaysia, Pakistan, Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, Turkey, Viet Nam, and the US are Dhaka stock exchange index (DSE30), Shanghai composite index (SSEC), Hang Seng index (HSI), BSE Sensex, Jakarta composite index (JKSE), Nikkei225, Kazakhstan stock exchange index (KASE), Lao securities exchange index (LSX), Kuala Lumpur composite index (KLCI), Karachi stock exchange index (KSE100), Philippine stock exchange index (PSE), FTSE Straits-times index (STI), Korea composite stock price index (KOSPI), Colombo all-share index, Taiwan stock exchange capitalization weighted stock index (TAIEX), Stock exchange of Thailand index (SET), Borsa Istanbul index (BIST100), Hochiminh City stock exchange index (VN30), and Nasdaq composite index, respectively.

underlying security over the observation period. Therefore, it should be a good complement to the standard volatility measure like a rolling standard deviation of stock returns.

3 Variables

The *nominal* stock market returns between time t and time $t+1$ for country i, $R_t^{N,i}$, are given by

$$R_t^{N,i} = ln(SI_{t+1}^i) - ln(SI_t^i) \ ,$$

where S_t^i is the stock market index of a country i at time t. The *real* stock market returns between time t and time $t+1$ for country i, that is, $R_t^{R,i}$, are then calculated as follows:

$$R_t^{R,i} = R_t^{N,i} - \{ln(CPI_{t+1}^i) - ln(CPI_t^i)\} \ ,$$

where CPI_t^i is the CPI of country i at time t. Hence, $R_t^{N,i} - R_t^{N,US}$ and $R_t^{R,i} - R_t^{R,US}$ respectively denotes nominal and real excess stock returns of a country i relative to the US counterpart. Table 8, 9, and 10 in the Appendix report the summary statistics of $R_t^{N,i} - R_t^{N,US}$, $R_t^{R,i} - R_t^{R,US}$ for each country in daily, monthly, and quarterly frequency, respectively. As witnessed from the tables, Asian countries' stock market returns fall short of their US counterpart on average both in *nominal* and *real* terms.

The change in *nominal* FX rates of country i's currency relative to the US dollar from t to $t+1$, that is, $\Delta q_t^{N,i}$, is calculated as

$$\Delta q_t^{N,i} = ln(FX_{t+1}^i) - ln(FX_t^i) \ ,$$

and the change in *real* FX rates, that is $\Delta q_t^{R,i}$, is calculated as

$$\Delta q_t^{R,i} = \Delta q_t^{N,i} + \{ln(CPI_{t+1}^i) - ln(CPI_t^i)\} - \{ln(CPI_{t+1}^{US}) - ln(CPI_t^{US})\} \ ,$$

where FX_t^i is the nominal US dollar price per unit of country i's currency at time t. Table 13 reports the summary statistics of $\Delta q_t^{N,i}$ and $\Delta q_t^{R,i}$ based on quarterly data for each country. Summary statistics for $\Delta q_t^{N,i}$ and $\Delta q_t^{R,i}$ based on monthly and daily data are also provided in Table 12 and Table 11.

As mentioned before, we also construct a complementary measure for the volatility of equity returns in country i at time t, $\sigma_{R_t^i}$. The latter is calculated as a rolling standard deviation of R_t^i between $t-10$ and $t+10$, which implies that the duration of rolling window is fixed to 5 years for quarterly data, almost 2 years for monthly data, and 20 days for daily data.

Table 1: Daily Correlations between Exchange rate and Stock market excess returns

$$corr[\Delta q_t^i, (R_t^i - R_t^{US})]$$

	No. of obs	**Nominal correlation**
Bangladesh	1,277	0.1443***
China	6,783	0.1926***
Hong Kong	9,556	0.2077***
India	8,777	0.2774***
Indonesia	7,032	0.5966***
Japan	9,436	0.4104***
Kazakhstan	4,601	0.1425***
Laos	1,939	0.0762***
Malaysia	9,028	0.3257***
Pakistan	5,889	0.1877***
Philippines	6,602	0.2901***
Singapore	4,986	0.0796***
South Korea	9,153	0.4599***
Sri Lanka	6,174	0.1602***
Taiwan	8,407	0.1947***
Thailand	8,961	0.4073***
Turkey	5,540	0.5016***
Viet Nam	4,526	0.0829***
Mean		0.2632
SD		0.1558
Pooled data		0.3332***

Note : Reported are correlations between the daily exchange rate return, Δq_t^i, and the stock market index excess returns (in local currency) relative to US counterpart, $(R_t^i - R_t^{US})$, in nominal and real terms. 'No. of obs' is the number of observations. The last row provides the pooled data result.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

4 Evidence by Individual Countries

A major task in this study is to test whether excess stock return differential between Asian and US stock index returns exhibits a negative relationship with the FX return, that is, if the UEP condition holds true for Asian markets. One straightforward way to do so is to look at unconditional correlations between the two variables. Tables 1, Table 2, and Table

3 produce the correlation evidence based on daily, monthly, and quarterly returns data.

Table 2: Monthly Correlations between Exchange rate and Stock market excess returns

$$corr[\Delta q_t^i, (R_t^i - R_t^{US})]$$

	No. of obs	**Nominal**	**No. of obs**	**Real**
Bangladesh	83	0.0486	83	-0.0842
China	348	0.2099***	323	0.2313***
Hong Kong	477	0.3556***	470	0.2034***
India	477	0.1919***	476	0.1224***
Indonesia	356	0.6460***	287	0.6381***
Japan	477	0.4296***	477	0.4121***
Kazakhstan	233	0.2445***	233	0.2327***
Laos	96	0.0962	96	-0.1716*
Malaysia	455	0.3817***	455	0.3624***
Pakistan	307	0.2157***	221	0.2232***
Philippines	331	0.4491***	331	0.4015***
Singapore	244	0.4062***	244	0.3319***
South Korea	464	0.4767***	464	0.4772***
Sri Lanka	318	0.3098***	118	0.1735*
Taiwan	434	0.2521***	434	0.1481***
Thailand	455	0.3428***	455	0.3074***
Turkey	275	0.5175***	274	0.5074***
Viet Nam	233	0.2077***	233	-0.0009
Mean		0.3212		0.2509
SD		0.1530		0.2071
Pooled data		0.3551***		0.3378***

Note : Reported are correlations between the monthly exchange rate return, Δq_t^i, and the stock market index excess returns (in local currency) relative to US counterpart, $(R_t^i - R_t^{US})$, in nominal and real terms. 'No. of obs' is the number of observations. The last row provides the pooled data result.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

Table 1 illustrates the daily correlation result. It clearly shows an evidence against the UEP condition for Asian countries. Every correlation coefficient turns out to be positive, and is validated at a 1% statistical significance level. The pooled data also shows the same result. This implies that a relatively higher equity return yielding Asian currency tends to appreciate relative to US dollar as opposed to what the UEP condition would have expected.

Monthly correlations are also provided in Table 2. The third column shows nominal correlations. Every country case again statistically disproves the UEP condition for Asian countries, except for Bangladesh and Laos. However, the latter two cases appear to be

Table 3: Quarterly Correlations between Exchange rate and Stock market excess returns

$$corr[\Delta q_t^i, (R_t^i - R_t^{US})]$$

	No. of obs	**Nominal**	**No. of obs**	**Real**
Bangladesh	27	0.2113	27	-0.2098
China	116	0.2276**	107	0.2286**
Hong Kong	159	0.3713***	156	0.2247***
India	159	0.0298	157	-0.0061
Indonesia	118	0.7351***	95	0.7084***
Japan	159	0.4149***	159	0.3991***
Kazakhstan	77	0.3969***	77	0.3882***
Laos	32	0.4432**	32	0.2325
Malaysia	151	0.5141***	151	0.4969***
Pakistan	102	0.2757***	73	0.3530***
Philippines	110	0.5630***	110	0.5207***
Singapore	81	0.4240***	81	0.3493***
South Korea	154	0.6231***	154	0.6022***
Sri Lanka	106	0.3191***	39	0.2392
Taiwan	144	0.2790***	144	0.1967**
Thailand	151	0.4631***	151	0.4355***
Turkey	91	0.5386***	89	0.5085***
Viet Nam	77	0.1904*	77	-0.0777
Mean		0.3900		0.3106
SD		0.1731		0.2369
Pooled data		0.4044***		0.3904***

Note : Reported are correlations between the quarterly exchange rate return, Δq_t^i, and the stock market index excess returns (in local currency) relative to their US counterpart, $(R_t^i - R_t^{US})$, in nominal and real terms. 'No. of obs' is the number of observations. The last row provides the pooled data result.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

driven by insufficient data. Results from pooled data also appear to be similar to the daily correlation evidence. In an attempt to identify whether monetary policy and/or inflation aspects of Asian countries are behind this UEP deviation, we also compute *real* monthly correlations between the two variables. The results are shown in the 5th column. Similar to the nominal correlation evidence, most countries provide strong statistical evidence against the UEP. Laos and Bangladeshi show weak support for the UEP, while Vietnam's correlation coefficient turns out to lose its statistical significance in real terms. Thus, one could conclude that this result lends a weak support to monetary factors as a driving force behind the UEP deviation observed in Asian countries.

Table 3 reports results on quarterly data. The results are again similar to the two previous cases. A strongly positive correlation between excess equity returns and FX returns is found in both nominal and real terms for most of sample countries. Furthermore, the overall correlation coefficients based on pooled data tend to increase in data frequency. Overall, our evidence strongly indicates that the UEP fails to hold, and more interestingly, reverses its sign for Asian countries. In addition, this result is also robust to whether data are denominated in real or nominal terms.

To visually support this positive correlation result, scatter plots of Δq_t^i and $(R_t^i - R_t^{US})$ for each country are illustrated in the Appendix. Figure 1 and Figure 2 show the quarterly frequency scatter plots for the two variables denominated in nominal and real values terms. Positively sloped best-fit line for every sample country from the nominal results confirm the previous positive correlation evidence, although the goodness of fit may not appear to be strong. Real scatter plots show graphical evidence consistent with correlation coefficients in Table 3. Similar evidence is found for monthly as well as daily scatter plots regardless of whether the plots are drawn using nominal or real variables, for example, Figure 3, 4, and 5. To sum up, even the most brute force examination like a simple unconditional correlation test reveals the evidence that the UEP condition, which is shown to hold true for advanced economies, may well work in a completely reverse way for Asian economies.

5 Evidence by Pooled Analysis

This section complements a preceding one by providing regression results on the relationship between excess stock returns and FX rate movements. Furthermore, we also attempt to provide more information from our data by employing a pooled country regression analysis and panel regression methods.

Table 4 summarizes our baseline regression results with various time frequencies. The second and third columns show quarterly data results. The results from the fourth and fifth columns are based on monthly data, while that from the last column is based on daily data. The second row reports standard fixed effect (FE) estimates on β which is controlling for country-specific FE, i.e. a relationship between excess stock returns over the US counterpart and changes in a country's currency value relative to the US dollar. The third row shows pooled OLS estimates on β as a comparison. As can be clearly seen, all β estimates take statistically significant and positive values regardless of frequency and price denominations (nominal or real). As a robustness check, we also include time fixed effects to control for time-trend effects. Table 14 in the Appendix shows the results, which are pretty much the same as in Table 4. All the β coefficients turn out to be positive and statistically significant.

Table 4:

$$\Delta q_t^i = \alpha_i + \beta \left[R_t^i - R_t^{US} \right] + \varepsilon_t^i$$

	Nominal	**Real**	**Nominal**	**Real**	**Nominal**
FE	0.1279***	0.1235***	0.1105***	0.1098***	0.0956***
Pooled OLS	0.1278***	0.1228***	0.1105***	0.1095***	0.0956***
No. of cross sections	18	18	18	18	18

Note : Reported are the fixed effect (FE) panel estimation results and pooled ordinary least squares (OLS) estimates of FX rate returns on the stock market excess returns. The second and third columns are nominal and real data for quarterly frequency. The fourth and fifth columns are nominal and real data for monthly frequency. The sixth column is nominal data for daily frequency. Moreover, the second and third rows are the results of FE and pooled OLS each.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

To sum up, our baseline regression results also support the striking evidence of the reversed UEP relationship for Asian markets.

In some point, one might think that the US dollar has special role in international trade that might affect the movement of Asian currencies. So, we examine same but much brief procedure with the Euro. The data on spot FX rates were collected from *ECB* and it contains 11 Asian countries.[3] Most of the data start from 1999 or 2000, which is to be expected since the Euro officially started in 2002. For Euro zone's stock market index, we use STOXX Europe 600 and also use CPI data to calculate real values, which both are from *Datastream*. We estimate same regression as Table 4 only with quarterly and monthly data, and the result is Table 5. We can see that it also shows consistent positive values of β coefficients.

In what follows, we finally examine what possibly could reverse the UEP relationship for Asian countries. First, we have already ruled out monetary policy factors given that our evidence remains much the same whether it is based on nominal terms or real terms. Thus, one would have to look for other sources of the UEP deviation for Asian countries. One usual suspect is uncertainty pertaining to less developed Asian financial markets, which in turn could pose much uncertainty risk for international investors. This could inherently affect the way global investors rebalance their portfolios in response to changes in stock and FX returns from Asian countries. In fact, Jung (2017) proposed one possible channel through which the UEP condition is reversed. If idiosyncratic stock market volatility is strong enough, the so-called Pastor and Veronesi (2006) effect in which a higher stock market uncertainty leads

[3]China, Hong Kong, India, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Thailand, Turkey.

Table 5:

$$\Delta q_t^i = \alpha_i + \beta \left[R_t^i - R_t^{EU} \right] + \varepsilon_t^i$$

	Nominal	**Real**	**Nominal**	**Real**
FE	0.0375**	0.0323**	0.0241**	0.0166*
Pooled OLS	0.0381**	0.0330**	0.0240**	0.0168*
No. of cross sections	11	11	11	11

Note : Reported are the fixed effect (FE) panel estimation results and pooled ordinary least squares (OLS) estimates of FX rate returns on the stock market excess returns. The second and third columns are nominal and real data for quarterly frequency. The fourth and fifth columns are nominal and real data for monthly frequency. Moreover, the second and third rows are the results of FE and pooled OLS each.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

to higher stock prices may well materialize. In addition, whenever the degree of idiosyncratic stock market volatility is negatively related with the level of aggregate consumption, which is again empirically supported by many, a country's currency value and equity value may well move in the same direction. Jung (2017) tests this hypothesis among advanced countries and show supporting evidence.

We also test this hypothesis to see if it works even in the context of Asian markets. First, we construct six different proxy measures for uncertainty of a country i, denoted as $X_{j,t}^i,\ j = \{1, 2, 3, 4, 5, 6\}$. $X_{1,t}^i$ is the volatility close-to-close of country i's stock market from *Datastream*. This measure potentially captures a degree of country i's stock market uncertainty. $X_{2,t}^i$ is a volatility close-to-close of the US. Then, we compute $X_{3,t}^i$, the net volatility close-to-close, by subtracting the US volatility close-to-close from country i's volatility close-to-close. We also employ our own measures of stock market uncertainty. $X_{4,t}^i$ is a rolling-window standard deviation of stock returns for a country i, that is, $\sigma_{R_t^i}$. $X_{5,t}^i$ is a US counterpart for $X_{4,t}^i$. Finally, $X_{6,t}^i$ is the net volatility of excess equity returns, that is $\sigma_{R_t^i} - \sigma_{R_t^{US}}$.

In order to examine the marginal effect of excess stock return volatility on the UEP relationship, we add the interaction between excess equity return $(R_t^i - R_t^{US})$ and 6 different uncertainty proxies, that is, $X_{j,t}^i,\ j = \{1, 2, 3, 4, 5, 6\}$, into the regression equation from Table 4. Then we estimate coefficients on the interaction term using both panel FE estimators and pooled OLS estimators. We also conducted estimation on both nominal and real terms.

Table 6 shows the estimation results for quarterly and *nominal* data. To one's surprise, all β coefficients turn out to be positive and statistically significant at the 1% level. And all γ representing country i's volatility show positive and statistically significant values and for

Table 6: Quarterly frequency

$$\Delta q_t^{N,i} = \alpha_i + \beta \left[R_t^{N,i} - R_t^{N,US}\right] + \gamma \left[R_t^{N,i} - R_t^{N,US}\right] X_{j,t}^{N,i} + \varepsilon_t^{N,i}$$

	Panel with FE			Pooled OLS		
Estimator	$\hat{\beta}$		$\hat{\gamma}$	$\hat{\beta}$		$\hat{\gamma}$
With $X_{1,t}^{N,i}$ $\equiv$ vol. ctc	0.0823***		0.0016***	0.0811***		0.0016***
No. of observations		1,833			1,833	
With $X_{2,t}^{N,i}$ $\equiv$ U.S vol. ctc	0.2550***		-0.0048***	0.2557***		-0.0049***
No. of observations		1,812			1,812	
With $X_{3,t}^{N,i}$ $\equiv$ net vol. ctc	0.1063***		0.0023***	0.1049***		0.0023***
No. of observations		1,812			1,812	
With $X_{4,t}^{N,i}$ $\equiv$ vol. of $R_t^{N,i}$	0.0342**		0.4065***	0.0331**		0.4108***
No. of observations		2,014			2,014	
With $X_{5,t}^{N,i}$ $\equiv$ vol. of $R_t^{N,US}$	0.1867***		-0.4527***	0.1879***		-0.4622***
No. of observations		2,014			2,014	
With $X_{6,t}^{N,i}$ $\equiv$ net vol. of R_t^{N}	0.0794***		0.4821***	0.0786***		0.4885***
No. of observations		2,014			2,014	

Note : Reported are the fixed effect (FE) panel and pooled ordinary least squares (OLS) estimates of quarterly FX rate returns on the quarterly stock excess returns and uncertainty interaction term in *nominal* terms. 'vol. ctc' is the volatility close-to-close. 'net vol. ctc' is the difference between home country's vol. ctc and U.S's vol. ctc. 'vol. of $R_t^{N,i}$' is $\sigma_{R_t^{N,i}}$ and 'net vol.' is a subtraction of $\sigma_{R_t^{N,i}}$ and $\sigma_{R_t^{N,US}}$.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

those representing U.S., they show negative. The meaning of γ coefficient is how the volatility term affects the value of β, so this finding implies that the reversed UEP relationship for a country i becomes even stronger when the country i's stock market uncertainty intensifies relative to the US counterpart, which is another supporting evidence for Jung (2017). Table 7 provides the quarterly estimation results in *real* term. Again, almost all coefficients are statistically significant, and the sign of them turns out to be identical to the results in Table 6. The only exception is $\hat{\beta}$ with $X_{4,t}^{N,i}$. Interestingly, all γ estimates become statistically significant and positive in real terms.

We also produce estimation results for monthly and daily data, as reported in Table 15, Table 16, and Table 17 in the Appendix. Results from those tables appear to be similar

Table 7: Quarterly frequency

$$\Delta q_t^{R,i} = \alpha_i + \beta\,[R_t^{R,i} - R_t^{R,US}] + \gamma\,[R_t^{R,i} - R_t^{R,US}]\,X_{j,t}^{R,i} + \varepsilon_t^{R,i}$$

	Panel with FE		Pooled OLS	
Estimator	$\hat{\beta}$	$\hat{\gamma}$	$\hat{\beta}$	$\hat{\gamma}$
With $X_{1,t}^{R,i}$ $\equiv$ vol. ctc	0.0857***	0.0013***	0.0859***	0.0013***
No. of obs.	1,734		1,734	
With $X_{2,t}^{R,i}$ $\equiv$ U.S vol. ctc	0.2401***	-0.0046***	0.2386***	-0.0045***
No. of obs.	1,716		1,716	
With $X_{3,t}^{R,i}$ $\equiv$ net vol. ctc	0.1026***	0.0019***	0.1023***	0.0019***
No. of obs.	1,716		1,716	
With $X_{4,t}^{R,i}$ $\equiv$ vol. of $R_t^{R,i}$	0.0097	0.4925***	0.0099	0.4881***
No. of obs.	1,879		1,879	
With $X_{5,t}^{R,i}$ $\equiv$ vol. of $R_t^{R,US}$	0.1921***	-0.5258***	0.1899***	-0.5150***
No. of obs.	1,879		1,879	
With $X_{6,t}^{R,i}$ $\equiv$ net vol. of R_t^{R}	0.0603***	0.6268***	0.0603***	0.6199***
No. of obs.	1,879		1,879	

Note : Reported are the fixed effect (FE) panel and pooled ordinary least squares (OLS) estimates of quarterly FX rate returns on the quarterly stock excess returns and uncertainty interaction term in *real* terms. 'vol. ctc' is the volatility close-to-close. 'net vol. ctc' is the difference between home country's vol. ctc and U.S's vol. ctc. 'vol. of $R_t^{R,i}$' is $\sigma_{R_t^{R,i}}$ and 'net vol.' is a subtraction of $\sigma_{R_t^{R,i}}$ and $\sigma_{R_t^{R,US}}$.
*Significant at 10%; **significant at 5%; ***significant at 1%.

with the quarterly data's result. Although coefficients happen to take different values, the signs of the coefficients are the same both in *nominal* and *real* cases. As in the baseline case, we also control for time-series trend effects by adding year-dummy variables into the regression. The results are shown is in Table 18, Table 19, Table 20, Table 21, and Table 22 in the Appendix. These tables show exactly the same signs of the coefficients expectedly.

To sum up, our panel regression analysis with interaction terms between stock market uncertainty measures and excess stock returns over the US counterpart provides concrete evidence that the stock market uncertainty might as well be a driving force behind the reversed UEP relationship among Asian countries. This finding also lends another support to the uncertainty-induced time-varying UEP relationship hypothesis proposed by Jung (2017).

6 Conclusion

Since Hau and Rey (2006) spurred the UEP literature, many researchers have focused on advanced economies to find empirical evidence on the UEP. This paper, to our best knowledge, attempts to test the UEP by employing data from 18 Asian countries for the first time. Striking evidence is found. Although correlations between excess stock returns of a country and its currency value have been found to be negative among advanced economies, consistent with what the UEP predicts, our findings show that the same relationship is not only present, but completely reversed among Asian economies.

This particular evidence has far-reaching implications for PBA-based theories of FX determination. A main proposal for the mechanism behind the UEP condition widely accepted in the literature is portfolio rebalancing with incomplete FX risk hedging. Our evidence casts huge doubt on this conventional mechanism because Asian countries should be the ones that suffer more from structural equity and FX market incompleteness than advanced economies. Thus, one should expect the UEP to hold even stronger for Asian currency and equity markets. However, our evidence points to the exact opposite. In fact, this evidence is indeed consistent with recent studies who question the validity of the portfolio balancing channel, for example, see Curcuru et al. (2014).

Obviously, an important question that remains is what could be the alternative explanation on this state-dependent UEP evidence. Our empirical results hint one potential candidate: stock market uncertainty. The latter is shown to make the UEP reversal stronger. This result is also robust to different estimation methodologies and different proxy variables for the stock market uncertainty. We believe this new evidence paves the way for promising agenda for future research. Identification of deep structural links between various measures of market uncertainty and the UEP condition should be worth exploring further for the PBA-based theories of FX determination going forward.

Appendix A Tables

Table 8: Daily summary statistics of $R_t^{N,i} - R_t^{N,US}$

Country	**Timespan**	**Obs**	**Mean**	**Min**	**Max**	**Std**	**ADF**
Bangladesh	13.01.30 - 19.12.30	1,277	-0.0006	-0.5299	0.5189	0.0250	-51.408***
China	90.12.20 - 19.12.31	6,807	0.0000	-0.4115	0.7212	0.0271	-82.517***
Hong Kong	80.03.17 - 19.12.31	9,589	-0.0001	-0.2403	0.1709	0.0193	-114.848***
India	80.03.18 - 19.12.31	8,802	-0.0001	-0.1226	0.1858	0.0202	-94.776***
Indonesia	90.04.09 - 19.12.30	7,037	-0.0003	-0.3783	0.2707	0.0245	-82.281***
Japan	80.03.17 - 19.12.30	9,445	-0.0002	-0.1945	0.1619	0.0191	-119.174***
Kazakhstan	00.07.13 - 19.12.31	4,601	0.0004	-0.5427	0.4799	0.0289	-88.644***
Laos	11.12.29 - 19.12.26	1,939	-0.0008	-0.1084	0.0922	0.0159	-48.871***
Malaysia	82.01.05 - 19.12.31	9,074	-0.0004	-0.3001	0.1597	0.0182	-101.287***
Pakistan	94.05.26 - 19.12.31	5,889	0.0000	-0.1348	0.1413	0.0214	-77.448***
Philippines	92.05.19 - 19.12.27	6,606	-0.0002	-0.1308	0.1608	0.0206	-86.430***
Singapore	99.09.01 - 19.12.31	4,986	-0.0001	-0.1470	0.1071	0.0171	-86.016***
South Korea	81.05.01 - 19.12.30	9,183	-0.0001	-0.2539	0.2557	0.0210	-101.778***
Sri Lanka	93.06.15 - 19.12.31	6,206	-0.0003	-0.1418	0.1991	0.0183	-77.024***
Taiwan	83.10.04 - 19.12.31	8,525	0.0000	-0.1408	0.1982	0.0207	-97.892***
Thailand	82.01.05 - 19.12.30	9,019	-0.0001	-0.1977	0.1640	0.0203	-99.464***
Turkey	97.01.03 - 19.12.31	5,540	-0.0002	-0.3151	0.2956	0.0286	-82.142***
Viet Nam	00.07.31 - 19.12.31	4,527	0.0002	-0.1319	0.1108	0.0206	-65.081***

Note : Reported are summary statistics of $R_t^{N,i} - R_t^{N,US}$ on daily frequency. The timespan shows the first date and the last date in the data set, which is written as 'year.month.day'. Obs. is the observation of the data within such timespan, and Std is the standard deviation of the whole timespan values. ADF test shows the (augmented) Dickey-Fuller test statistics with no lags. The null hypothesis is that there is no nonstationarity.
***Significant at 1%.

Table 9: Monthly summary statistics of $R_t^{N,i} - R_t^{N,US}$, $R_t^{R,i} - R_t^{R,US}$

Country	**Timespan**	**Obs**	**Mean**	**Min**	**Max**	**Std**	**ADF**	**Timespan**	**Obs**	**Mean**	**Min**	**Max**	**Std**	**ADF**
Bangladesh	2013.Feb - 2019.Dec	83	-0.0133	-0.1583	0.1499	0.0645	-10.097***	2013.Feb - 2019.Dec	83	-0.0167	-0.1651	0.1367	0.0646	-10.145***
China	1991.Jan - 2019.Dec	348	-0.0008	-0.5148	1.0117	0.1331	-18.782***	1993.Feb - 2019.Dec	323	-0.0068	-0.5517	0.7722	0.1172	-19.828***
Hong Kong	1980.Apr - 2019.Dec	477	-0.0022	-0.3973	0.2657	0.0737	-21.214***	1980.Nov - 2019.Dec	470	-0.0040	-0.4054	0.2617	0.0738	-20.477***
India	1980.Apr - 2019.Dev	477	-0.0013	-0.2692	0.3346	0.0848	-21.465***	1980.Apr - 2019.Nov	476	-0.0051	-0.2807	0.3329	0.0860	-21.253***
Indonesia	1990.May - 2019.Dec	356	-0.0079	-0.4867	0.3866	0.1017	-15.377***	1996.Feb - 2019.Dec	287	-0.0106	-0.5038	0.3917	0.1094	-13.284***
Japan	1980.Apr - 2019.Dec	477	-0.0044	-0.2271	0.2890	0.0661	-21.483***	1980.Apr - 2019.Dec	477	-0.0027	-0.2250	0.2841	0.0662	-21.521***
Kazakhstan	2000.Aug - 2019.Dec	233	0.0055	-0.3985	0.4262	0.0991	-10.341***	2000.Aug - 2019.Dec	233	0.0008	-0.3974	0.4239	0.0996	-10.192***
Laos	2012.Jan - 2019.Dec	96	-0.0164	-0.1106	0.1316	0.0517	-10.180***	2012.Jan - 2019.Dec	96	-0.0176	-0.1201	0.1340	0.0530	-10.422***
Malaysia	1982.Feb - 2019.Dec	455	-0.0065	-0.3315	0.3059	0.0763	-19.023***	1982.Feb - 2019.Dec	455	-0.0064	-0.3324	0.2927	0.0765	-18.924***
Pakistan	1994.Jun - 2019.Dec	307	-0.0040	-0.4856	0.2694	0.0974	-17.550***	2001.Aug - 2019.Dec	221	0.0003	-0.4936	0.2697	0.0874	-14.145***
Philippines	1992.Jun - 2019.Dec	331	-0.0051	-0.3762	0.3759	0.0847	-16.917***	1992.Jun - 2019.Dec	331	-0.0073	-0.3729	0.3668	0.0854	-16.921***
Singapore	1999.Sep - 2019.Dec	244	-0.0023	-0.2196	0.2483	0.0554	-14.200***	1999.Sep - 2019.Dec	244	-0.0019	-0.2184	0.2467	0.0560	-14.073***
South Korea	1981.May - 2019.Dec	464	-0.0029	-0.4326	0.1889	0.0852	-21.233***	1981.May - 2019.Dec	464	-0.0037	-0.4588	0.4672	0.0854	-21.065***
Sri Lanka	1993.Jul - 2019.Dec	318	-0.0049	-0.2363	0.2944	0.0855	-17.455***	2010.Feb - 2019.Nov	118	-0.0137	-0.1782	0.1567	0.0609	-9.246***
Taiwan	1983.Nov - 2019.Dec	434	-0.0009	-0.3781	0.3960	0.0962	-19.625***	1983.Nov - 2019.Dec	434	0.0000	-0.3862	0.3976	0.0970	-19.470***
Thailand	1982.Feb - 2019.Dec	455	-0.0031	-0.4340	0.2939	0.0843	-18.022***	1982.Feb - 2019.Dec	455	-0.0033	-0.4324	0.2977	0.0851	-17.886***
Turkey	1997.Feb - 2019.Dec	275	-0.0054	-0.3842	0.4242	0.1124	-17.522***	1997.Feb - 2019.Nov	274	-0.0195	-0.4063	0.3942	0.1141	-16.884***
Viet Nam	2000.Aug - 2019.Dec	233	0.0038	-0.3082	0.4324	0.0992	-10.792***	2000.Aug - 2019.Dec	233	0.0001	-0.3147	0.4238	0.1005	-10.622***

Note : Reported are summary statistics of $R_t^{N,i} - R_t^{N,US}$ (left) and $R_t^{R,i} - R_t^{R,US}$ (right) on monthly frequency. The timespan shows the first month and the last month in the data set. Obs. is the observation of the data within such timespan and Std is the standard deviation of the whole timespan values. ADF test shows the (augmented) Dickey-Fuller test statistics with no lags. The null hypothesis is that there is no nonstationarity.
***Significant at 1%.

Table 10: Quarterly summary statistics of $R_t^{N,i} - R_t^{N,US}$, $R_t^{R,i} - R_t^{R,US}$

Country	**Timespan**	**Obs**	**Mean**	**Min**	**Max**	**Std**	**ADF**	**Timespan**	**Obs**	**Mean**	**Min**	**Max**	**Std**	**ADF**
Bangladesh	2013.2Q - 2019.4Q	27	-0.0360	-0.2705	0.1938	0.1070	-5.548***	2013.2Q - 2019.4Q	27	-0.0467	-0.2897	0.1738	0.1108	-5.520***
China	1991.1Q - 2019.4Q	116	-0.0025	-0.5696	1.2091	0.2271	-10.727***	1993.2Q - 2019.4Q	107	-0.1836	-0.6062	0.4667	0.1915	-9.452***
Hong Kong	1980.2Q - 2019.4Q	159	-0.0067	-0.4753	0.4199	0.1297	-12.354***	1981.1Q - 2019.4Q	156	-0.0115	-0.4783	0.4025	0.1311	-11.839***
India	1980.2Q - 2019.4Q	159	-0.0039	-0.4052	0.7734	0.1555	-12.846***	1980.2Q - 2019.2Q	157	-0.0146	-0.4104	0.7493	0.1577	-12.644***
Indonesia	1990.3Q - 2019.4Q	118	-0.0227	-0.7584	0.6852	0.2062	-9.070***	1996.2Q - 2019.4Q	95	-0.0314	-0.9204	0.7017	0.2257	-7.671***
Japan	1980.2Q - 2019.4Q	159	-0.0133	-0.3482	0.2993	0.1109	-12.571***	1980.2Q - 2019.4Q	159	-0.0080	-0.3439	0.3056	0.1107	-12.365***
Kazakhstan	2000.4Q - 2019.4Q	77	0.0164	-0.5529	0.9622	0.2217	-7.072***	2000.4Q - 2019.4Q	77	0.0024	-0.5721	0.9385	0.2228	-7.011***
Laos	2012.1Q - 2019.4Q	32	-0.0491	-0.1939	0.1810	0.0893	-5.505***	2012.1Q - 2019.4Q	32	-0.0526	-0.1998	0.1714	0.0902	-5.576***
Malaysia	1982.2Q - 2019.4Q	151	-0.0188	-0.6863	0.4030	0.1524	-11.786***	1982.2Q - 2019.4Q	151	-0.0185	-0.6869	0.4050	0.1529	-11.684***
Pakistan	1994.3Q - 2019.4Q	102	-0.0128	-0.6427	0.4364	0.1653	-9.371***	2001.4Q - 2019.4Q	73	-0.0020	-0.3924	0.4346	0.1447	-6.972***
Philippines	1992.3Q - 2019.4Q	110	-0.0167	-0.7283	0.5012	0.1652	-9.392***	1992.3Q - 2019.4Q	110	-0.0232	-0.7400	0.4914	0.1668	-9.449***
Singapore	1999.4Q - 2019.4Q	81	-0.0063	-0.3058	0.3774	0.0982	-8.523***	1999.4Q - 2019.4Q	81	-0.0048	-0.3033	0.3781	0.0990	-8.414***
South Korea	1981.3Q - 2019.4Q	154	-0.0102	-1.0899	0.4825	0.1646	-11.389***	1981.3Q - 2019.4Q	154	-0.0123	-1.1004	0.4814	0.1652	-11.116***
Sri Lanka	1993.3Q - 2019.4Q	106	-0.0148	-0.4031	0.4064	0.1653	-8.558***	2010.1Q - 2019.4Q	39	-0.0408	-0.4178	0.3546	0.1411	-6.054***
Taiwan	1984.1Q - 2019.4Q	144	-0.0029	-0.8069	0.9820	0.1930	-12.730***	1984.1Q - 2019.4Q	144	-0.0003	-0.8168	0.9748	0.1952	-12.723***
Thailand	1982.2Q - 2019.4Q	151	-0.0097	-0.6490	0.5194	0.1706	-11.199***	1982.2Q - 2019.4Q	151	-0.0103	-0.6651	0.5212	0.1726	-11.112***
Turkey	1997.2Q - 2019.4Q	91	-0.0167	-0.5133	0.3713	0.1724	-10.199***	1997.2Q - 2019.2Q	89	-0.0600	-0.6181	0.2552	0.1829	-8.963***
Viet Nam	2000.4Q - 2019.4Q	77	0.0090	-0.4377	0.9141	0.2162	-7.799***	2000.4Q - 2019.4Q	77	-0.0021	-0.5064	0.9131	0.2199	-7.577***

Note : Reported are summary statistics of $R_t^{N,i} - R_t^{N,US}$ (left) and $R_t^{R,i} - R_t^{R,US}$ (right) on quarterly frequency. The timespan shows the first quarter and the last quarter in the data set. Obs. is the observation of the data within such timespan and Std is the standard deviation of the whole timespan values. ADF test shows the (augmented) Dickey-Fuller test statistics with no lags. The null hypothesis is that there is no nonstationarity.
***Significant at 1%.

Table 11: Daily summary statistics of $\Delta q_t^{N,i}$

Country	Timespan	Obs	Mean	Min	Max	Std	ADF
Bangladesh	94.09.08 - 19.12.31	6,598	-0.0001	-0.0638	0.0544	0.0033	-110.468***
China	81.01.05 - 19.12.31	10,033	-0.0002	-0.4955	0.0243	0.0054	-99.805***
Hong Kong	80.01.03 - 19.12.31	10,330	0.0000	-0.0531	0.0411	0.0020	-111.987***
India	80.01.03 - 19.12.31	10,319	-0.0002	-0.1345	0.0463	0.0044	-105.317***
Indonesia	88.01.01 - 19.12.31	8,323	-0.0003	-0.2549	0.2703	0.0116	-83.193***
Japan	80.01.03 - 19.12.31	10,382	0.0001	-0.0622	0.0695	0.0067	-102.808***
Kazakhstan	95.04.25 - 19.12.31	6,433	-0.0003	-0.2444	0.0716	0.0063	-80.971***
Laos	94.09.08 - 19.12.31	6,593	-0.0004	-0.5861	0.3559	0.0134	-81.460***
Malaysia	80.01.03 - 19.12.31	10,303	-0.0001	-0.0834	0.0760	0.0043	-97.886***
Pakistan	92.02.05 - 19.12.31	7,272	-0.0003	-0.0835	0.0572	0.0042	-95.147***
Philippines	92.05.19 - 19.12.31	7,193	-0.0001	-0.0716	0.1512	0.0052	-85.959***
Singapore	81.01.05 - 19.12.31	10,091	0.0000	-0.0291	0.0444	0.0033	-106.033***
South Korea	81.04.14 - 19.12.31	9,985	-0.0001	-0.1450	0.1983	0.0069	-89.661***
Sri Lanka	80.01.03 - 19.12.31	9,876	0.0002	-0.0714	0.0661	0.0031	-106.215***
Taiwan	83.10.04 - 19.12.31	9,201	0.0000	-0.0391	0.0275	0.0027	-92.802***
Thailand	81.01.05 - 19.12.31	10,035	0.0000	-0.1748	0.1296	0.0085	-134.592***
Turkey	89.11.09 - 19.12.31	7,829	-0.0010	-0.3567	0.2513	0.0123	-102.636***
Viet Nam	94.08.05 - 19.12.31	6,620	-0.0001	-0.0677	0.0467	0.0022	-97.556***

Note : Reported are summary statistics of $\Delta q_t^{N,i}$ on daily frequency. The timespan shows the first date and the last date in the data set, which is written as 'year.month.day'. Obs. is the observation of the data within such timespan and Std is the standard deviation of the whole timespan values. ADF test shows the (augmented) Dickey-Fuller test statistics with no lags. The null hypothesis is that there is no nonstationarity. ***Significant at 1%.

Table 12: Monthly summary statistics of $\Delta q_t^{N,i}$, $\Delta q_t^{R,i}$

Country	Timespan	Obs	Mean	Min	Max	Std	ADF	Timespan	Obs	Mean	Min	Max	Std	ADF
Bangladesh	1994.Oct - 2019.Dec	303	-0.0024	-0.0638	0.0618	0.0103	-18.188***	1994.Oct - 2019.Dec	303	0.0009	-0.0646	0.0845	0.0138	-14.393***
China	1981.Feb - 2019.Dec	467	-0.0031	-0.4050	0.0347	0.0253	-20.697***	1993.Feb - 2019.Dec	323	0.0007	-0.3685	0.0386	0.0234	-18.104***
Hong Kong	1980.Feb - 2019.Dec	479	-0.0010	-0.0890	0.0444	0.0088	-18.039***	1980.Nov - 2019.Dec	470	0.0002	-0.0809	0.0674	0.0115	-19.966***
India	1980.Feb - 2019.Dec	479	-0.0046	-0.1990	0.0685	0.0217	-20.895***	1980.Feb - 2019.Nov	478	-0.0008	-0.1806	0.0692	0.0228	-21.644***
Indonesia	1988.Apr - 2019.Dec	384	-0.0055	-0.5960	0.3460	0.0580	-15.529***	1996.Feb - 2019.Dec	287	-0.0011	-0.5286	0.3408	0.0665	-14.243***
Japan	1980.Feb - 2019.Dec	479	0.0016	-0.0971	0.1640	0.0322	-20.974***	1980.Feb - 2019.Dec	479	-0.0001	-0.0987	0.1685	0.0327	-20.616***
Kazakhstan	1995.May - 2019.Dec	296	-0.0061	-0.2620	0.0647	0.0321	-12.311***	1998.Feb - 2019.Dec	263	-0.0014	-0.2367	0.0629	0.0323	-11.906***
Laos	1994.Oct - 2019.Dec	303	-0.0083	-0.5860	0.3560	0.0583	-17.241***	2000.Feb - 2019.Dec	239	0.0024	-0.2677	0.0536	0.0207	-15.634***
Malaysia	1980.Feb - 2019.Dec	479	-0.0013	-0.1050	0.1260	0.0199	-18.091***	1980.Feb - 2019.Dec	479	-0.0015	-0.1043	0.1391	0.0200	-18.483***
Pakistan	1992.Mar - 2019.Dec	334	-0.0055	-0.1290	0.0802	0.0188	-15.223***	2001.Aug - 2019.Dec	221	0.0008	-0.0996	0.0682	0.0159	-13.516***
Philippines	1992.Jun - 2019.Dec	331	-0.0020	-0.1440	0.0789	0.0230	-16.268***	1992.Jun - 2019.Dec	331	0.0002	-0.1376	0.0850	0.0235	-16.466***
Singapore	1981.Feb - 2019.Dec	467	0.0009	-0.0822	0.0560	0.0154	-21.032***	1981.Feb - 2019.Dec	467	0.0001	-0.0856	0.0577	0.0162	-21.330***
South Korea	1981.May - 2019.Dec	464	-0.0011	-0.3710	0.1640	0.0332	-21.035***	1981.May - 2019.Dec	464	-0.0004	-0.3449	0.1616	0.0329	-21.523***
Sri Lanka	1980.Feb - 2019.Dec	479	-0.0051	-0.0866	0.0531	0.0136	-19.400***	2010.Feb - 2019.Nov	118	-0.0013	-0.0680	0.0351	0.0164	-8.700***
Taiwan	1983.Nov - 2019.Dec	434	0.0006	-0.0690	0.0566	0.0147	-17.593***	1983.Nov - 2019.Dec	434	-0.0003	-0.0850	0.0603	0.0169	-19.350***
Thailand	1981.Feb - 2019.Dec	467	-0.0008	-0.2610	0.2110	0.0268	-18.923***	1981.Feb - 2019.Dec	467	-0.0006	-0.2558	0.2185	0.0270	-19.478***
Turkey	1989.Dec - 2019.Dec	361	-0.0218	-0.3420	0.1010	0.0507	-14.685***	1989.Dec - 2019.Nov	360	-0.0003	-0.3071	0.1791	0.0460	-17.265***
Viet Nam	1994.Sep - 2019.Dec	304	-0.0025	-0.0684	0.0163	0.0088	-17.498***	1995.Feb - 2019.Dec	299	0.0007	-0.0580	0.0412	0.0114	-14.932***

Note : Reported are summary statistics of $\Delta q_t^{N,i}$ (left) and $\Delta q_t^{R,i}$ (right) on monthly frequency. The timespan shows the first month and the last month in the data set. Obs. is the observation of the data within such timespan and Std is the standard deviation of the whole timespan values. ADF test shows the (augmented) Dickey-Fuller test statistics with no lags. The null hypothesis is that there is no nonstationarity.
***Significant at 1%.

Table 13: Quarterly summary statistics of $\Delta q_t^{N,i}$, $\Delta q_t^{R,i}$

Country	Timespan	Obs	Mean	Min	Max	Std	ADF	Timespan	Obs	Mean	Min	Max	Std	ADF
Bangladesh	1994.4Q - 2019.4Q	101	-0.0074	-0.0865	0.0433	0.0180	-10.329***	1994.4Q - 2019.4Q	101	0.0028	-0.0716	0.0575	0.0252	-9.344***
China	1981.2Q - 2019.4Q	155	-0.0094	-0.4064	0.0407	0.0456	-11.555***	1993.2Q - 2019.4Q	107	0.0018	-0.3312	0.0651	0.0396	-10.928***
Hong Kong	1980.2Q - 2019.4Q	159	-0.0027	-0.1309	0.0773	0.0179	-11.633***	1981.1Q - 2019.4Q	156	0.0008	-0.1252	0.0889	0.0217	-12.011***
India	1980.2Q - 2019.4Q	159	-0.0138	-0.1961	0.0622	0.0377	-11.462***	1980.2Q - 2019.2Q	157	-0.0022	-0.1817	0.0818	0.0380	-11.658***
Indonesia	1988.1Q - 2019.4Q	128	-0.0166	-0.5327	0.3236	0.1049	-8.370***	1996.2Q - 2019.4Q	95	-0.0032	-0.4735	0.5021	0.1167	-7.955***
Japan	1980.2Q - 2019.4Q	159	0.0052	-0.1652	0.1907	0.0620	-12.341***	1980.2Q - 2019.4Q	159	0.0000	-0.1720	0.1932	0.0633	-12.546***
Kazakhstan	1995.3Q - 2019.4Q	98	-0.0184	-0.4064	0.0808	0.0695	-7.659***	1998.2Q - 2019.4Q	87	-0.0045	-0.3742	0.0854	0.0703	-7.526***
Laos	1994.4Q - 2019.4Q	101	-0.0249	-0.5861	0.1592	0.1000	-8.423***	2000.2Q - 2019.4Q	79	-0.0069	-0.2598	0.0731	0.0360	-7.849***
Malaysia	1980.2Q - 2019.4Q	159	-0.0037	-0.2507	0.0953	0.0393	-11.128***	1980.2Q - 2019.4Q	159	-0.0041	-0.2500	0.0920	0.0391	-11.467***
Pakistan	1992.2Q - 2019.4Q	111	-0.0163	-0.1608	0.0852	0.0373	-10.390***	2001.4Q - 2019.4Q	73	0.0024	-0.1262	0.0778	0.0311	-8.750***
Philippines	1992.3Q - 2019.4Q	110	-0.0062	-0.2608	0.1156	0.0443	-8.790***	1992.3Q - 2019.4Q	110	0.0004	-0.2491	0.1276	0.0445	-8.864***
Singapore	1981.2Q - 2019.4Q	155	0.0028	-0.0951	0.0625	0.0268	-12.507***	1981.2Q - 2019.4Q	155	0.0001	-0.0959	0.0730	0.0281	-12.281***
South Korea	1981.3Q - 2019.4Q	154	-0.0034	-0.6187	0.2027	0.0655	-14.360***	1981.3Q - 2019.4Q	154	-0.0013	-0.6082	0.2513	0.0661	-15.204***
Sri Lanka	1980.2Q - 2019.4Q	159	-0.0152	-0.1478	0.0486	0.0255	-11.164***	2010.1Q - 2019.4Q	39	-0.0041	-0.1032	0.0465	0.0303	-4.702***
Taiwan	1984.1Q - 2019.4Q	144	0.0021	-0.1277	0.0973	0.0292	-10.852***	1984.1Q - 2019.4Q	144	-0.0006	-0.1426	0.0821	0.0298	-11.353***
Thailand	1981.2Q - 2019.4Q	155	-0.0024	-0.3704	0.1780	0.0520	-12.033***	1981.2Q - 2019.4Q	155	-0.0017	-0.3465	0.1983	0.0511	-12.247***
Turkey	1990.1Q - 2019.4Q	120	-0.0656	-0.4974	0.1899	0.1007	-7.187***	1990.1Q - 2019.2Q	118	-0.0015	-0.355	0.2207	0.9333	-11.304***
Viet Nam	1994.4Q - 2019.4Q	101	-0.0074	-0.0686	0.0179	0.0154	-10.500***	1995.2Q - 2019.4Q	99	0.0017	-0.0619	0.0726	0.0208	-8.710***

Note : Reported are summary statistics of $\Delta q_t^{N,i}$ (left) and $\Delta q_t^{R,i}$ (right) on quarterly frequency. The timespan shows the first quarter and the last quarter in the data set. Obs is the observation of the data within such timespan and Std is the standard deviation of the whole timespan values. ADF test shows the (augmented) Dickey-Fuller test statistics with no lags. The null hypothesis is that there is no nonstationarity.
***Significant at 1%.

Table 14:

$$\Delta q_t^i = \alpha_i + \beta\,[R_t^i - R_t^{US}] + \sum_{\tau=1981}^{2019} \delta_\tau\, D_\tau + \varepsilon_t^i$$

	Nominal	**Real**	**Nominal**	**Real**	**Nominal**
FE	0.1256***	0.1251***	0.1088***	0.1096***	0.0955***
Pooled OLS	0.1252***	0.1244***	0.1087***	0.1094***	0.0955***

Note : Reported are the fixed effect (FE) panel and pooled ordinary least squares (OLS) estimates of FX rate returns on the stock market excess returns and the year-dummies. Dummy variables start from D_{1981} to D_{2019}. The second and third columns are nominal and real data for quarterly frequency. The fourth and fifth columns are nominal and real data for monthly frequency. The sixth column is the nominal data for daily frequency. Also, the second and third rows are the results of FE and pooled OLS each.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

Table 15: Monthly frequency

$$\Delta q_t^{N,i} = \alpha_i + \beta\,[R_t^{N,i} - R_t^{N,US}] + \gamma\,[R_t^{N,i} - R_t^{N,US}]\,X_{j,t}^{N,i} + \varepsilon_t^{N,i}$$

	Panel with FE			**Pooled OLS**		
Estimator	$\hat{\boldsymbol{\beta}}$		$\hat{\boldsymbol{\gamma}}$	$\hat{\boldsymbol{\beta}}$		$\hat{\boldsymbol{\gamma}}$
With $X_{1,t}^{N,i}$						
$\equiv$ vol. ctc	0.0781***		0.0009***	0.0772***		0.0009***
No. of obs.		5,801			5,801	
With $X_{2,t}^{N,i}$						
$\equiv$ U.S vol. ctc	0.1373***		-0.0014***	0.1373***		-0.0014***
No. of obs.		6,036			6,036	
With $X_{3,t}^{N,i}$						
$\equiv$ net vol. ctc	0.0915***		0.0011***	0.0910***		0.0011***
No. of obs.		5,801			5,801	
With $X_{4,t}^{N,i}$						
$\equiv$ vol. of $R_t^{N,i}$	0.0553***		0.4450***	0.0546***		0.4508***
No. of obs.		6,063			6,063	
With $X_{5,t}^{N,i}$						
$\equiv$ vol. of $R_t^{N,US}$	0.1202***		-0.1411	0.1192***		-0.1273
No. of obs.		6,063			6,063	
With $X_{6,t}^{N,i}$						
$\equiv$ net vol. of R_t^N	0.0880***		0.4047***	0.0878***		0.4083***
No. of obs.		6,063			6,063	

Note : Reported are the fixed effect (FE) panel and pooled ordinary least squares (OLS) estimates of monthly FX rate returns on the monthly stock excess returns and uncertainty interaction term in *nominal* terms. 'vol. ctc' is the volatility close-to-close. 'net vol. ctc' is the difference between home country's vol. ctc and U.S's vol. ctc. 'vol. of $R_t^{N,i}$' is $\sigma_{R_t^{N,i}}$ and 'net vol.' is a subtraction of $\sigma_{R_t^{N,i}}$ and $\sigma_{R_t^{N,US}}$.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

Table 16: Monthly frequency

$$\Delta q_t^{R,i} = \alpha_i + \beta\,[R_t^{R,i} - R_t^{R,US}] + \gamma\,[R_t^{R,i} - R_t^{R,US}]\,X_{j,t}^{R,i} + \varepsilon_t^{R,i}$$

	Panel with FE		Pooled OLS	
Estimator	$\hat{\boldsymbol{\beta}}$	$\hat{\gamma}$	$\hat{\boldsymbol{\beta}}$	$\hat{\gamma}$
With $X_{1,t}^{R,i}$				
$\equiv$ vol. ctc	0.0504***	0.0016***	0.0505***	0.0016***
No. of obs.	5,448		5,448	
With $X_{2,t}^{R,i}$				
$\equiv$ U.S vol. ctc	0.1412***	-0.0017***	0.1408***	-0.0017***
No. of obs.	5,654		5,654	
With $X_{3,t}^{R,i}$				
$\equiv$ net vol. ctc	0.0759***	0.0018***	0.0758***	0.0018***
No. of obs.	5,448		5,448	
With $X_{4,t}^{R,i}$				
$\equiv$ vol. of $R_t^{R,i}$	0.0100	0.8315***	0.0100	0.8286***
No. of obs.	5,674		5,674	
With $X_{5,t}^{N,i}$				
$\equiv$ vol. of $R_t^{R,US}$	0.1227***	-0.1883	0.1221***	-0.1841
No. of obs.	5,674		5,674	
With $X_{6,t}^{R,i}$				
$\equiv$ net vol. of R_t^{R}	0.0691***	0.7919***	0.0689***	0.7899***
No. of obs.	5,674		5,674	

Note : Reported are the fixed effect (FE) panel and pooled ordinary least squares (OLS) estimates of monthly FX rate returns on the monthly stock excess returns and uncertainty interaction term in *real* terms. 'vol. ctc' is the volatility close-to-close. 'net vol. ctc' is the difference between home country's vol. ctc and U.S's vol. ctc. 'vol. of $R_t^{R,i}$' is $\sigma_{R_t^{R,i}}$ and 'net vol.' is a subtraction of $\sigma_{R_t^{R,i}}$ and $\sigma_{R_t^{R,US}}$.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

Table 17: Daily frequency

$$\Delta q_t^{N,i} = \alpha_i + \beta\,[R_t^{N,i} - R_t^{N,US}] + \gamma\,[R_t^{N,i} - R_t^{N,US}]\,X_{j,t}^{N,i} + \varepsilon_t^{N,i}$$

	Panel with FE			Pooled OLS		
Estimator	$\hat{\boldsymbol{\beta}}$		$\hat{\boldsymbol{\gamma}}$	$\hat{\boldsymbol{\beta}}$		$\hat{\boldsymbol{\gamma}}$
With $X_{1,t}^{N,i}$						
$\equiv$ vol. ctc	0.0826***		0.0002***	0.0826***		0.0002***
No. of obs.		116,025			116,025	
With $X_{2,t}^{N,i}$						
$\equiv$ U.S vol. ctc	0.1341***		-0.0013***	0.1341***		-0.0013***
No. of obs.		118,667			118,667	
With $X_{3,t}^{N,i}$						
$\equiv$ net vol. ctc	0.0879***		0.0003***	0.0879***		0.0003***
No. of obs.		116,025			116,025	
With $X_{4,t}^{N,i}$						
$\equiv$ vol. of $R_t^{N,i}$	0.0400***		1.6984***	0.0400***		1.6990***
No. of obs.		118,666			118,666	
With $X_{5,t}^{N,i}$						
$\equiv$ vol. of $R_t^{N,US}$	0.1341***		-2.1205***	0.1341***		-2.1187***
No. of obs.		118,651			118,651	
With $X_{6,t}^{N,i}$						
$\equiv$ net vol. of R_t^{N}	0.0700***		1.7590***	0.0700***		1.7594***
No. of obs.		118,650			118,650	

Note : Reported are the fixed effect (FE) panel and pooled ordinary least squares (OLS) estimates of daily FX rate returns on the daily stock excess returns and uncertainty interaction term in *nominal* terms. 'vol. ctc' is the volatility close-to-close. 'net vol. ctc' is the difference between home country's vol. ctc and U.S's vol. ctc. 'vol. of $R_t^{N,i}$' is $\sigma_{R_t^{N,i}}$ and 'net vol.' is a subtraction of $\sigma_{R_t^{N,i}}$ and $\sigma_{R_t^{N,US}}$.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

Table 18: Quarterly frequency

$$\Delta q_t^{N,i} = \alpha_i + \beta\,[R_t^{N,i} - R_t^{N,US}] + \gamma\,[R_t^{N,i} - R_t^{N,US}]\,X_{j,t}^{N,i} + \sum_{\tau=1981}^{2019} \delta_\tau\, D_\tau + \varepsilon_t^{N,i}$$

	Panel with FE		**Pooled OLS**	
Estimator	$\hat{\boldsymbol{\beta}}$	$\hat{\boldsymbol{\gamma}}$	$\hat{\boldsymbol{\beta}}$	$\hat{\boldsymbol{\gamma}}$
With $X_{1,t}^{N,i}$ $\equiv$ vol. ctc	0.0754***	0.0016***	0.0744***	0.0016***
No. of obs.	1,833		1,833	
With $X_{2,t}^{N,i}$ $\equiv$ U.S vol. ctc	0.2523***	-0.0047***	0.2538***	-0.0048***
No. of obs.	1,812		1,812	
With $X_{3,t}^{N,i}$ $\equiv$ net vol. ctc	0.1047***	0.0021***	0.1037***	0.0022***
No. of obs.	1,812		1,812	
With $X_{4,t}^{N,i}$ $\equiv$ vol. of $R_t^{N,i}$	0.0417***	0.3557***	0.0408**	0.3578***
No. of obs.	2,014		2,014	
With $X_{5,t}^{N,i}$ $\equiv$ vol. of $R_t^{N,US}$	0.1745***	-0.3709***	0.1752***	-0.3793***
No. of obs.	2,014		2,014	
With $X_{6,t}^{N,i}$ $\equiv$ net vol. of R_t^{N}	0.0828***	0.4118***	0.0820***	0.4151***
No. of obs.	2,014		2,014	

Note : Reported are the fixed effect (FE) panel and pooled ordinary least squares (OLS) estimates of quarterly FX rate returns on the quarterly stock excess returns and uncertainty interaction term with the year-dummy variables in *nominal* terms. 'vol. ctc' is the volatility close-to-close. 'net vol. ctc' is the difference between home country's vol. ctc and U.S's vol. ctc. 'vol. of $R_t^{N,i}$' is $\sigma_{R_t^{N,i}}$ and 'net vol.' is a subtraction of $\sigma_{R_t^{N,i}}$ and $\sigma_{R_t^{N,US}}$. Dummy variables start from D_{1981} to D_{2019}.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

Table 19: Quarterly frequency

$$\Delta q_t^{R,i} = \alpha_i + \beta\,[R_t^{R,i} - R_t^{R,US}] + \gamma\,[R_t^{R,i} - R_t^{R,US}]\,X_{j,t}^{R,i} + \sum_{\tau=1981}^{2019} \delta_\tau\,D_\tau + \varepsilon_t^{R,i}$$

	Panel with FE		**Pooled OLS**	
Estimator	$\hat{\boldsymbol{\beta}}$	$\hat{\boldsymbol{\gamma}}$	$\hat{\boldsymbol{\beta}}$	$\hat{\boldsymbol{\gamma}}$
With $X_{1,t}^{R,i}$ $\equiv$ vol. ctc	0.0784***	0.0014***	0.0786***	0.0014***
No. of obs.	1,734		1,734	
With $X_{2,t}^{R,i}$ $\equiv$ U.S vol. ctc	0.2375***	-0.0044***	0.2364***	-0.0044***
No. of obs.	1,716		1,716	
With $X_{3,t}^{R,i}$ $\equiv$ net vol. ctc	0.1009***	0.0018***	0.1005***	0.0018***
No. of obs.	1,716		1,716	
With $X_{4,t}^{R,i}$ $\equiv$ vol. of $R_t^{R,i}$	0.0174	0.4602***	0.0177	0.4555***
No. of obs.	1,879		1,879	
With $X_{5,t}^{R,i}$ $\equiv$ vol. of $R_t^{R,US}$	0.1824***	-0.4318***	0.1815***	-0.4300***
No. of obs.	1,879		1,879	
With $X_{6,t}^{R,i}$ $\equiv$ net vol. of R_t^{R}	0.0674***	0.5689***	0.0673***	0.5621***
No. of obs.	1,879		1,879	

Note : Reported are the fixed effect (FE) panel and pooled ordinary least squares (OLS) estimates of quarterly FX rate returns on the quarterly stock excess returns and uncertainty interaction term with the year-dummy variables in *real* terms. 'vol. ctc' is the volatility close-to-close. 'net vol. ctc' is the difference between home country's vol. ctc and U.S's vol. ctc. 'vol. of $R_t^{R,i}$' is $\sigma_{R_t^{R,i}}$ and 'net vol.' is a subtraction of $\sigma_{R_t^{R,i}}$ and $\sigma_{R_t^{R,US}}$. Dummy variables start from D_{1981} to D_{2019}.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

Table 20: Monthly frequency

$$\Delta q_t^{N,i} = \alpha_i + \beta\, [R_t^{N,i} - R_t^{N,US}] + \gamma\, [R_t^{N,i} - R_t^{N,US}]\, X_{j,t}^{N,i} + \sum_{\tau=1981}^{2019} \delta_\tau\, D_\tau + \varepsilon_t^{N,i}$$

	Panel with FE		**Pooled OLS**	
Estimator	$\hat{\boldsymbol{\beta}}$	$\hat{\boldsymbol{\gamma}}$	$\hat{\boldsymbol{\beta}}$	$\hat{\boldsymbol{\gamma}}$
With $X_{1,t}^{N,i}$ $\equiv$ vol. ctc	0.0752***	0.0009***	0.0743***	0.0009***
No. of obs.	5,801		5,801	
With $X_{2,t}^{N,i}$ $\equiv$ U.S vol. ctc	0.1329***	-0.0013***	0.1327***	-0.0013***
No. of obs.	6,036		6,036	
With $X_{3,t}^{N,i}$ $\equiv$ net vol. ctc	0.0895***	0.0010***	0.0890***	0.0011***
No. of obs.	5,801		5,801	
With $X_{4,t}^{N,i}$ $\equiv$ vol. of $R_t^{N,i}$	0.0501***	0.4692***	0.0492***	0.4752***
No. of obs.	6,063		6,063	
With $X_{5,t}^{N,i}$ $\equiv$ vol. of $R_t^{N,US}$	0.1134***	-0.0664	0.1124***	-0.0546
No. of obs.	6,063		6,063	
With $X_{6,t}^{N,i}$ $\equiv$ net vol. of R_t^{N}	0.0856***	0.4113***	0.0852***	0.4150***
No. of obs.	6,063		6,063	

Note : Reported are the fixed effect (FE) panel and pooled ordinary least squares (OLS) estimates of monthly FX rate returns on the monthly stock excess returns and uncertainty interaction term with the year-dummy variables in *nominal* terms. 'vol. ctc' is the volatility close-to-close. 'net vol. ctc' is the difference between home country's vol. ctc and U.S's vol. ctc. 'vol. of $R_t^{N,i}$' is $\sigma_{R_t^{N,i}}$ and 'net vol.' is a subtraction of $\sigma_{R_t^{N,i}}$ and $\sigma_{R_t^{N,US}}$. Dummy variables start from D_{1981} to D_{2019}.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

Table 21: Monthly frequency

$$\Delta q_t^{R,i} = \alpha_i + \beta\,[R_t^{R,i} - R_t^{R,US}] + \gamma\,[R_t^{R,i} - R_t^{R,US}]\,X_{j,t}^{R,i} + \sum_{\tau=1981}^{2019} \delta_\tau\,D_\tau + \varepsilon_t^{R,i}$$

	Panel with FE			Pooled OLS		
Estimator	$\hat{\boldsymbol{\beta}}$		$\hat{\gamma}$	$\hat{\boldsymbol{\beta}}$		$\hat{\gamma}$
With $X_{1,t}^{R,i}$						
$\equiv$ vol. ctc	0.0473***		0.0016***	0.0474***		0.0016***
No. of obs.		5,448			5,448	
With $X_{2,t}^{R,i}$						
$\equiv$ U.S vol. ctc	0.1379***		-0.0015***	0.1377***		-0.0015***
No. of obs.		5,654			5,654	
With $X_{3,t}^{R,i}$						
$\equiv$ net vol. ctc	0.0749***		0.0018***	0.0748***		0.0018***
No. of obs.		5,448			5,448	
With $X_{4,t}^{R,i}$						
$\equiv$ vol. of $R_t^{R,i}$	0.0018		0.8955***	0.0020		0.8918***
No. of obs.		5,674			5,674	
With $X_{5,t}^{R,i}$						
$\equiv$ vol. of $R_t^{R,US}$	0.1170***		-0.1064	0.1167***		-0.1051
No. of obs.		5,674			5,674	
With $X_{6,t}^{R,i}$						
$\equiv$ net vol. of R_t^R	0.0670***		0.8299***	0.0669***		0.8267***
No. of obs.		5,674			5,674	

Note : Reported are the fixed effect (FE) panel and pooled ordinary least squares (OLS) estimates of monthly FX rate returns on the monthly stock excess returns and uncertainty interaction term with the year-dummy variables in *real* terms. 'vol. ctc' is the volatility close-to-close. 'net vol. ctc' is the difference between home country's vol. ctc and U.S's vol. ctc. 'vol. of $R_t^{R,i}$' is $\sigma_{R_t^{R,i}}$ and 'net vol.' is a subtraction of $\sigma_{R_t^{R,i}}$ and $\sigma_{R_t^{R,US}}$. Dummy variables start from D_{1981} to D_{2019}.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

Table 22: Daily frequency

$$\Delta q_t^{N,i} = \alpha_i + \beta\,[R_t^{N,i} - R_t^{N,US}] + \gamma\,[R_t^{N,i} - R_t^{N,US}]\,X_{j,t}^{N,i} + \sum_{\tau=1981}^{2019} \delta_\tau\, D_\tau + \varepsilon_t^{N,i}$$

	Panel with FE		**Pooled OLS**	
Estimator	$\hat{\boldsymbol{\beta}}$	$\hat{\gamma}$	$\hat{\boldsymbol{\beta}}$	$\hat{\gamma}$
With $X_{1,t}^{N,i}$				
$\equiv$ vol. ctc	0.0825***	0.0002***	0.0825***	0.0002***
No. of obs.	116,025		116,025	
With $X_{2,t}^{N,i}$				
$\equiv$ U.S vol. ctc	0.1341***	-0.0013***	0.1341***	-0.0013***
No. of obs.	118,667		118,667	
With $X_{3,t}^{N,i}$				
$\equiv$ net vol. ctc	0.0878***	0.0003***	0.0878***	0.0003***
No. of obs.	116,025		116,025	
With $X_{4,t}^{N,i}$				
$\equiv$ vol. of $R_t^{N,i}$	0.0399***	1.6978***	0.0399***	1.6984***
No. of obs.	118,666		118,666	
With $X_{5,t}^{N,i}$				
$\equiv$ vol. of $R_t^{N,US}$	0.1340***	-2.1151***	0.1340***	-2.1129***
No. of obs.	118,651		118,651	
With $X_{6,t}^{N,i}$				
$\equiv$ net vol. of R_t^{N}	0.0699***	1.7574***	0.0699***	1.7576***
No. of obs.	118,650		118,650	

Note : Reported are the fixed effect (FE) panel and pooled ordinary least squares (OLS) estimates of daily FX rate returns on the daily stock excess returns and uncertainty interaction term with the year-dummy variables in *nominal* terms. 'vol. ctc' is the volatility close-to-close. 'net vol. ctc' is the difference between home country's vol. ctc and U.S's vol. ctc. 'vol. of $R_t^{N,i}$' is $\sigma_{R_t^{N,i}}$ and 'net vol.' is a subtraction of $\sigma_{R_t^{N,i}}$ and $\sigma_{R_t^{N,US}}$. Dummy variables start from D_{1981} to D_{2019}.
*,**, and *** denote significance at 10%, 5%, and 1% level, respectively.

Appendix B Figures

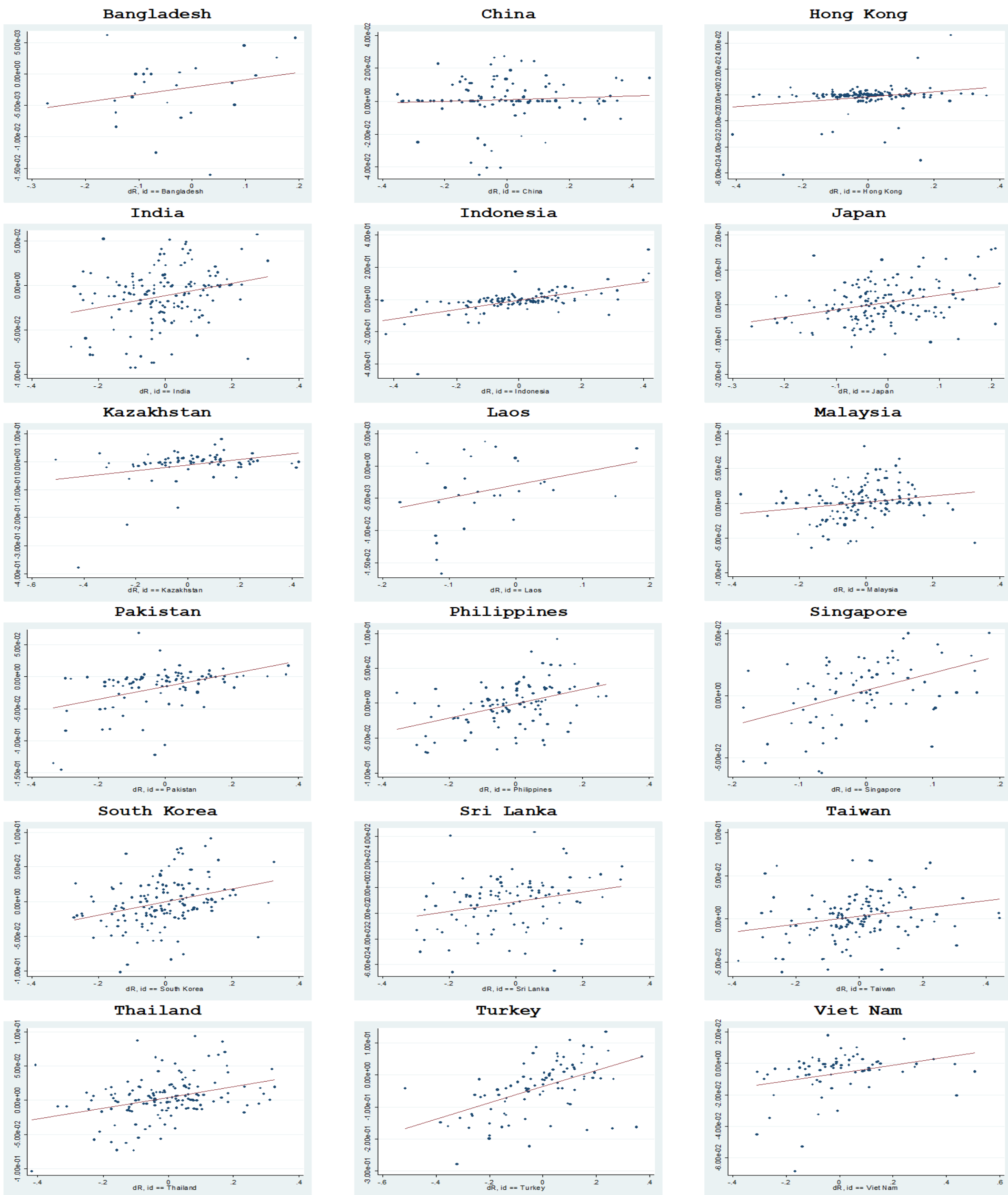

Figure 1: Quarterly nominal scatter plots

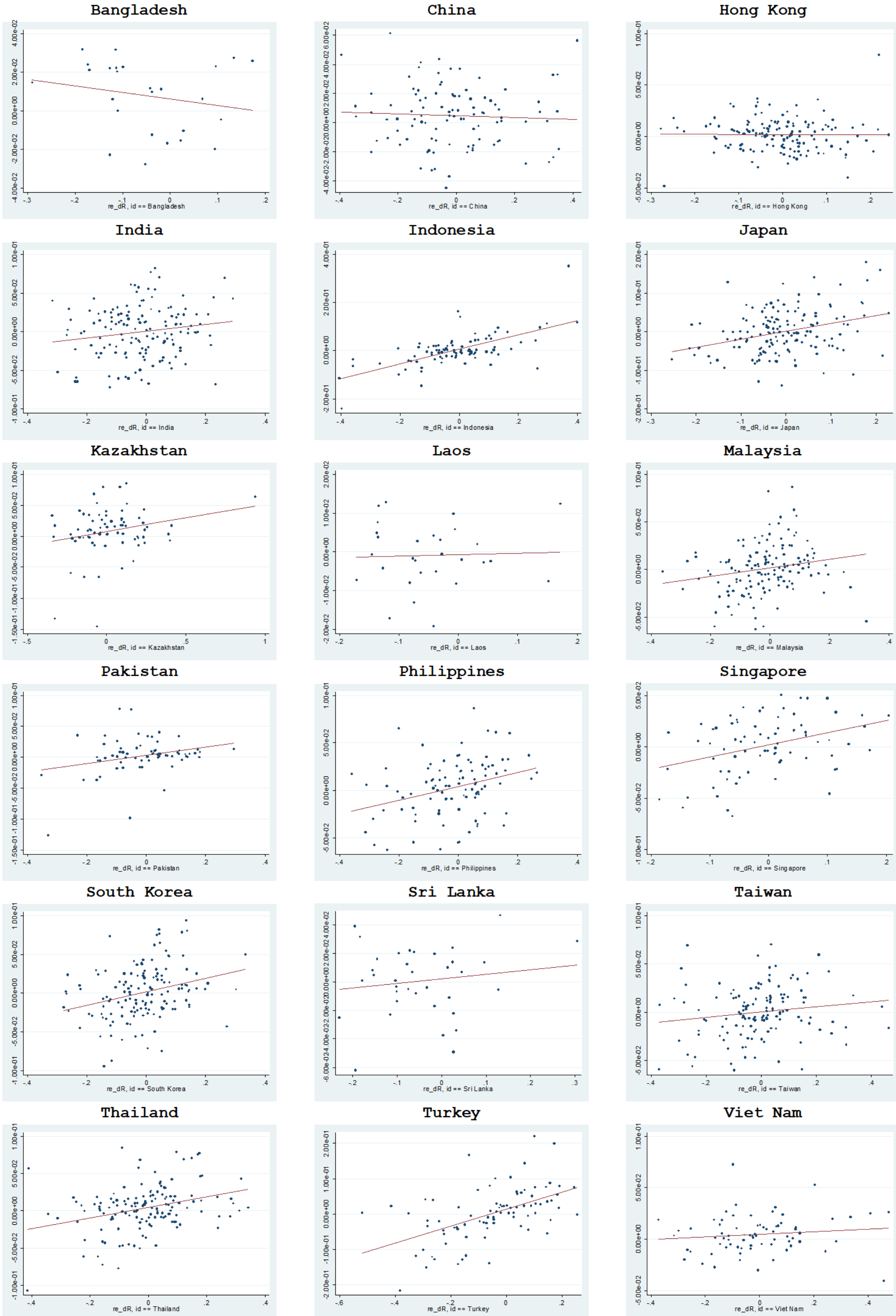

Figure 2: Quarterly real scatter plots

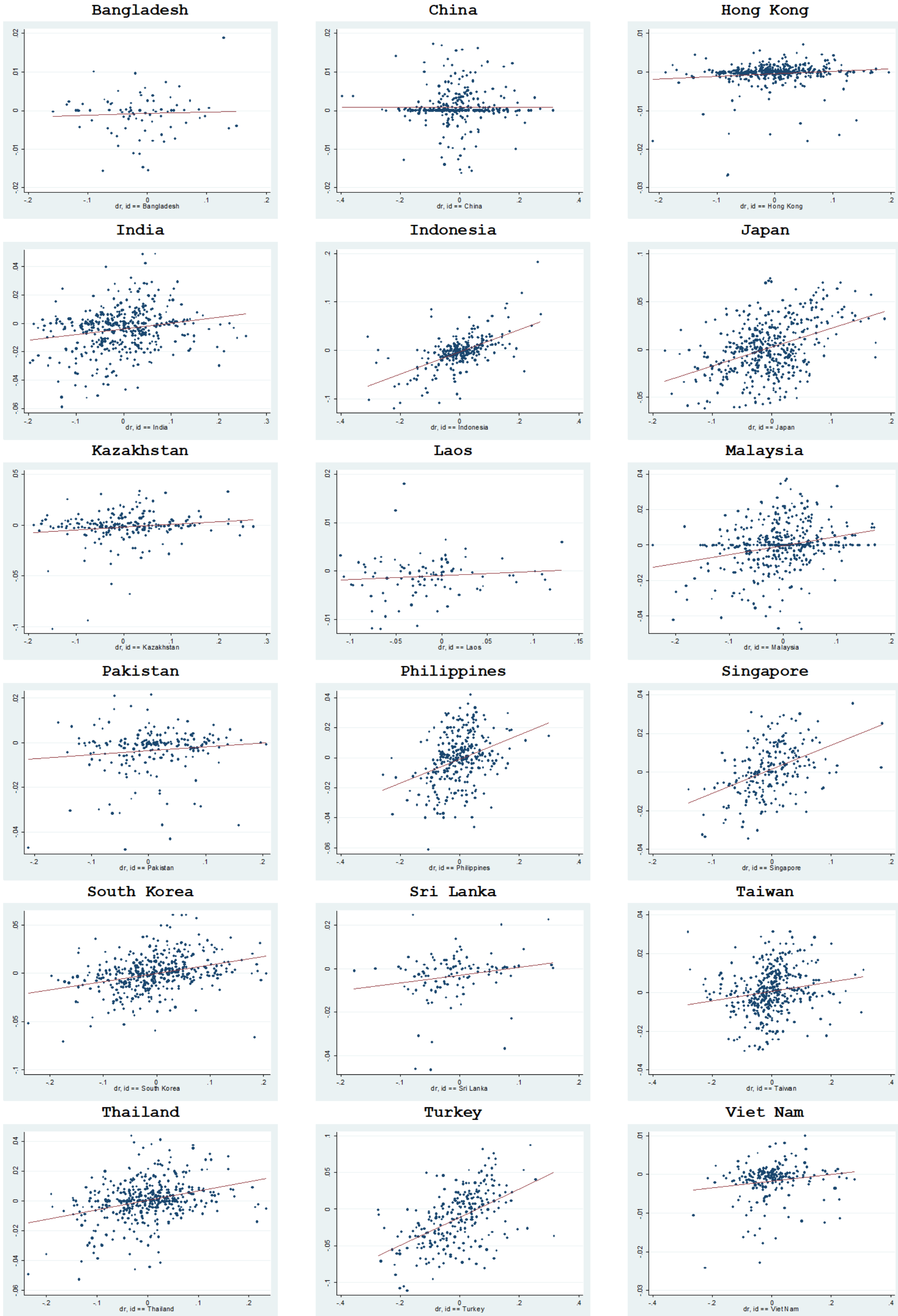

Figure 3: Monthly nominal scatter plots

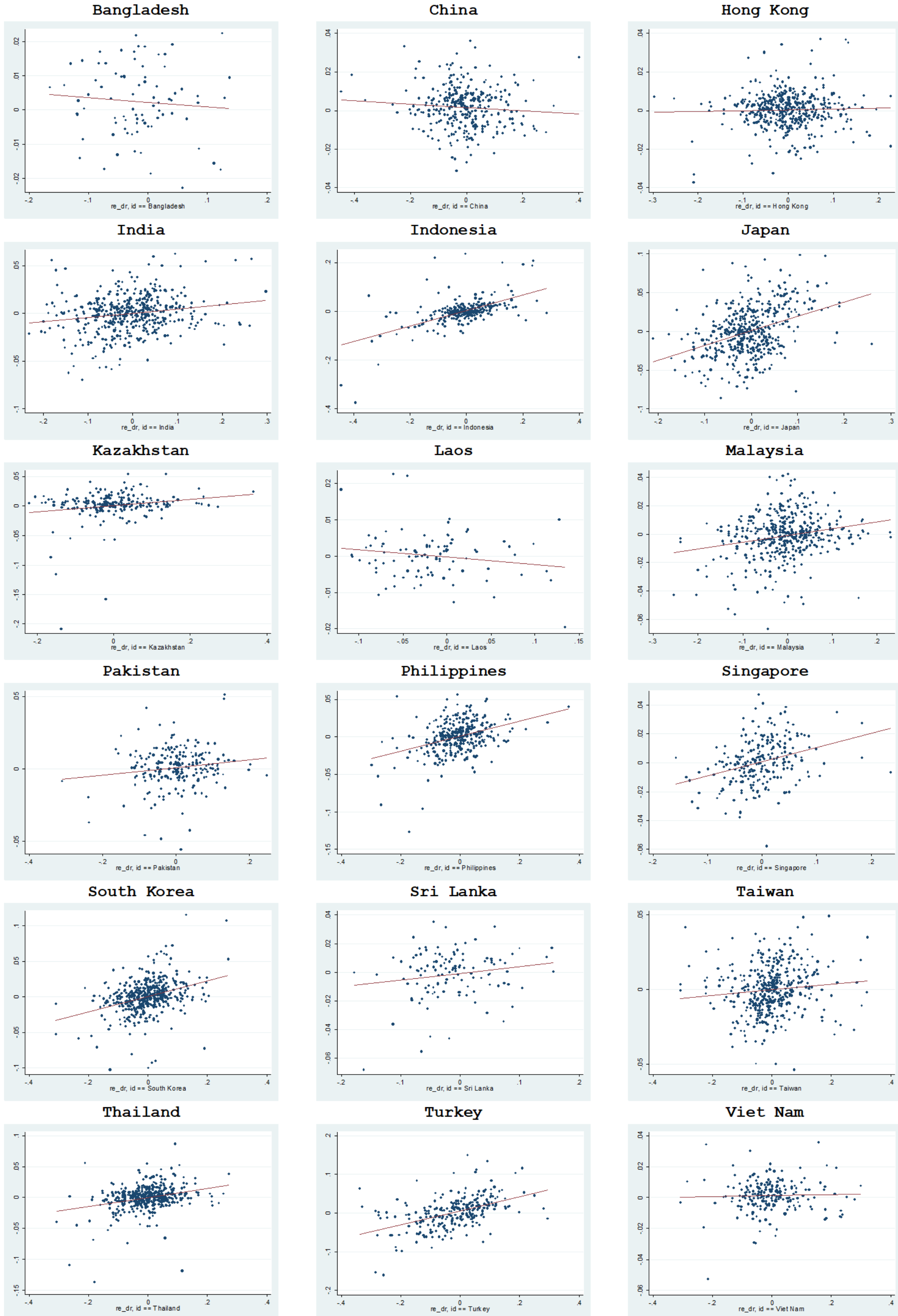

Figure 4: Monthly real scatter plots

Figure 5: Daily nominal scatter plots

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