

Exchange Rate Dynamics: The Case of US Dollar Exchange Rates against Three Major Currencies in Asia

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Abstract

With the daily exchange rate against the U.S. dollar data, we found that the volatility of the value of Chinese Yuan is smallest when compared with the Japanese yen and Korean won during the normal period, the Asian financial crisis period and the recent global financial crisis period. During the two crisis periods, we observe a higher volatility for the Korean won compared to the Japanese yen, indicating the “flight to quality.” However, the difference in the volatility is much less during the recent global financial crisis period, implying the “flight to Japanese yen” is not as prevalent as before. We also found that the difference between cross rates and direct market rates for the won/yen rate are statistically significant during the two crisis periods. Although currency speculators and arbitrageurs may find the opportunity for profit, the size of transaction cost may matter.

I. Introduction

Exchange rate dynamics have been analyzed in many different contexts. Kim and Roubini (2000), for example, investigated exchange rate anomalies in the non-U.S. industrial countries and provided evidence that delayed undervaluation may not systematically occur. Brandt and Santa-Clara (2002) used an assumption of incomplete markets and found that exchange rate volatilities are caused by the incompleteness of the market.

Furthermore, Bacchetta and Wincoop (2000) argued that the increase and stability in trade are not influenced by the exchange rate system, hence the volatility of exchange rates. Several papers also examine the relationship between exchange rate volatility and its effects on international trade and welfare, e.g., Devereux and Engel (2002), Warnock (2003), Campa and Goldberg (2005), and Gali and Monacelli (2005). In general, they found that the empirical relationship is not convincing.

As the world has integrated economically more than ever before, the volatility of exchange rates seems to have affected the welfare of corporations and individual consumers. Specifically, while the volatility needs to be managed for hedgers such as individuals and corporations who do not want to bear foreign exchange rate risk, the same volatility tends to be exploited for speculators and arbitrageurs who are ready to assume the risk.

In that regard, in the spirit of Lustig and Verdelhan (2007) and Walker (2008), Campbell et al. (2010) found that when the stock market is bearish or the economy is in crisis, the value of the core reserve currency, such as the U.S. dollar and the euro, appreciates. They argued that portfolio investors engage in global hedging through “flight to quality” where investors dump other commodity-dependent currencies such as the Australian dollar or Canadian dollar for managing volatilities in exchange rates.

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In this paper, we examine the dynamics of the U.S. dollar exchange rate against three major currencies in Asia – the Japanese yen, Chinese Yuan, and Korean won – in the context of Campbell et al. (2010). Specifically, considering the ramifications of the Asian Financial Crisis in 1997 and the recent Global Financial Crisis triggered in 2008, we divide the full sample period into several subperiods - normal periods and two crisis periods - to see how the crises play out in volatilities of the exchange rates and to identify their implications for hedgers and speculators.

Interestingly, there exists a unique direct exchange market for the won/yen rate in Korea, reflecting the importance of economic ties between the two countries. For the won/yen exchange rates, across the subperiods, we examine whether there exists any significant difference between the direct market rates and the cross rates obtained by cancelling out the U.S. dollar. If so, we may infer the implications of the divergences: “flight to quality” or arbitrage opportunity.

According to the International Monetary Fund (IMF), the U.S., China, Japan, and Korea are ranked number 1, 2, 3, and 15, respectively, in the world by the sizes of their gross domestic product (GDP) in 2009. Thus, the largest economic bloc in the world is composed of the U.S. and its three major trading partners in Asia: Japan, China and Korea. Recently, unlike the earlier empirical findings, the volatilities of their exchange rates against the U.S. dollar seem to play a significant role in maintaining the stable growth of trade and investment for the economic bloc. In fact, all countries adopt flexible exchange regimes with the exception of China (managed float). Considering the important role played by the four countries in international trade and investment, it is worthwhile to investigate the exchange rate dynamics amongst those four major currencies.

II. Issues of the economic bloc

The U.S. has important economic issues with each of its trading partners. For example, the chronic trade surplus by Japan against the U.S. has been an ongoing issue. More importantly, during the last decade, the yen carry trade, exploiting the low value of the yen against the U.S. dollar and low interest rate in Japan, has been a standard strategy for speculators such as hedge funds, spurring the recent global liquidity crisis when speculators unwound their position.

In addition, the undervalued Chinese Yuan has been an important issue at the annual Sino-American economic forum in the context of China’s huge trade surplus against the U.S. In June 2007, the U.S. and Korea signed a landmark free trade agreement, waiting for ratification by the Congresses of each country. The volatility of the value of Korean against the U.S. dollar has been an important factor in determining the level of trade between the two countries in the context of the degree of exchange rate pass-through on domestic prices.

Furthermore, one of the most distinctive phenomena in the world economy has been multilateral trade agreements such as the World Trade Organization. As various trade barriers have been dismantled, domestic companies have tended to become more international than ever before. For example, the U.S. companies have established many foreign affiliates and subsidiaries in Asia (China, Japan and Korea) to enjoy comparative advantages and market base in the region, or vice versa. Most Fortune 500 companies now have operations in China, Japan and Korea. Consequently, their profitability is significantly affected by changes in the exchange rates against the Japanese yen, the Chinese Yuan and the Korean won. Indeed, exchange losses

may surpass profits in local currency obtained from efficient operations in the region. For the managers of the U.S. corporations, the empirical results may provide a reference when they need to decide how to hedge their economic stakes, e.g., cash flows in three major Asian currencies, against foreign exchange risk.

The considerable fluctuations in the value of the three currencies have affected all levels of economic activities and financial decisions not only for the U.S. and the three Asian countries, but also for other Asian countries and elsewhere. Traditionally, Asian countries tend to settle their international trade using either the U.S. dollar or the Japanese yen. Now, the Chinese Yuan plays a significant role as a reserve currency for some Asian countries. Thus, the alignment of the value of their currencies when compared to the yen/dollar and Yuan/dollar rates has always been an important policy issue for most Asian countries. Asian countries, therefore, closely monitor the behavior of the yen/dollar and Yuan/dollar rates to decide a favorable currency to settle their international transactions. In that regard, the results of this paper may provide some implications for those issues in the context of currency hedging and speculation for corporations and portfolio investors.

III. Data

We obtained daily exchange rate data from the FRED® (Federal Reserve Economic Data) database, published by the Federal Reserve Bank of St. Louis and daily direct market exchange rates for won/yen from the Economic Database System, published by the Bank of Korea. This study analyzes the daily exchange rate for the three major Asian countries over an extensive time period, a 29-year period between April 1981 and February 2010. The choice of this period coincides with the flexible exchange rate period.

Furthermore, in order to investigate the dynamics in three dollar-based exchange rates for the interesting time period, the sampling period is then divided into three sub-periods; normal period (January 1993 – June 1997 and January 1999 – February 2008), Asian financial crisis (July 1997 - December 1998) and the recent global financial crisis (February 2008 ~ February 2010). We follow Mitton (2002) to be consistent with the time period for the Asian financial crisis. The recent global financial crisis had been triggered with rumors of financial failure of Bear Stearns in February 2008.

IV. Results and their implications

The exchange rate's movement over the sample period is shown in Figure 1. To see the trend of the value of the three currencies, the nominal value of each currency is normalized to 100 with the base year of 1981. Over this sample period, it can be seen that the Japanese yen has gradually appreciated against the U.S. dollar, while the Korean won and the Chinese Yuan show movement in opposite directions against the U.S. dollar over the 29 years. It is obvious for the Chinese Yuan that the value is pegged to the U.S. dollar and is not moved by the market, but by government intervention. It can be noted that the Japanese yen shows more volatile movement than the other exchange rates. Interestingly, the value of Korean won has substantially depreciated over the two financial crisis periods, one near year 1998 and another around year 2008.

Figure 2 plots the trend of the normalized difference of values between a pair of exchange rates during the period including January 4, 1993 and February 19, 2010. It can be

noted that two normalized differences, i.e., yen minus Yuan and yen minus won, tend to be positive and show a similar pattern, implying that the Japanese yen has appreciated more than the other two currencies. The larger the magnitude, the more difficult it is for Japan to export its product to the region. Considering the low inflation rate in Japan due to chronic recession, compared to China and Korea, the real exchange rate of Japanese yen appears to have been seriously overvalued, hurting its economy.

Summary statistics are provided for daily changes in exchange rates among three exchange rates and the direct market rate for won/yen. Specifically, Table 1 reports the mean and the standard deviation of these variables for the three different time periods. It is distinctive that compared to Japanese yen and Korean won, the volatility of Chinese Yuan is smallest during the two crisis periods as well as during the full sample period. Since China has maintained a currency peg or managed float against the U.S. dollar up until now, the low standard deviation indicates that there exists no room for currency speculation that takes advantage of the volatilities.

Standard deviation of daily changes in exchange rate is 0.007485 for the Japanese yen during the whole sample period, and 0.009765 for the Korean won during this period. So, there is not a significant difference between the two exchange rates during this period. In contrast, however, during the Asian financial crisis, the standard deviation of the Japanese yen is 0.011227, while it is 0.025170 for the Korean won. Thus, the volatility of Korean won is more than twice as large as that of the Japanese yen. Interestingly, during the recent global financial crisis, the difference in magnitude of volatility for the two currencies has been reduced significantly: the standard deviation of daily changes for the Korean won is 0.015356 while that of the Japanese yen is 0.009356. The similar pattern is also observed for the standard deviation of daily changes for the won/dollar rate.

The pattern of the volatilities for the two currencies during the two financial crisis periods appears to be consistent with the idea of “flight to quality” or “flight to core reserve currency.” In times of economic crisis in Asia, investors tend to show “flight to Japanese yen” behavior by dumping soft currencies such as Korean won, thereby increasing the volatility of the currency.

Figure 3 shows the difference between the cross rate and direct market rate for the won/yen rate. There are two interesting observations worth noting from this graph. First, there are two large spikes during the two economic-crisis periods, i.e., Asian financial crisis and recent global financial crisis. Second, the band near the zero line shows some patterns. That is, the thickness of the band gradually increases toward two crisis periods, and then it diminishes after the crisis periods. Unlike Taylor (1987) who found no significant difference between the cross rates and the direct market rates, the visual inspection might suggest the possible opportunity for triangular arbitrage during the two crisis periods.

Next, we test whether the spikes are statistically significant by comparing the mean of differences between the won/yen cross rates and direct market rates. Table 2 shows the results of the mean t-test comparisons for the means of the different time periods. The results confirm that the means are statistically different at the 1 percent level for the normal period and the recent global financial crisis period and at the 10 percent level for the normal period and the Asian

financial crisis period. However, with respect to the two financial crisis periods, the p -value is insignificant.

The jump of variability in the difference (in Korean won) is also very noticeable: the standard deviations during the crisis periods (35.2181 and 24.3786) are at least four times as large as those during the normal period (6.3915) and the range – the difference between minimum and maximum values - is extremely large during the crisis periods (476.488 and 291.348) while the range during the normal period is relatively small (65.575).

V. Conclusion

For the last three decades, the values of three major currencies in Asia against the U.S. dollar show many interesting patterns. First, the value of the Japanese yen tended to appreciate against the U.S. dollar while the value of the Chinese Yuan and the South Korean won tended to depreciate against the U.S. dollar. The pattern provides an important implication for intra-regional trade imbalance among the four countries - the U.S., Japan, China and South Korea - with respect to chronic undervaluation of the Chinese Yuan.

Second, during the financial crisis periods, the volatility of the value of the Japanese yen and Korean won has increased significantly when compared with that of the Chinese Yuan. The increase in volatility during the crisis periods tends to provide an opportunity for speculators who are ready to take the financial risk. Furthermore, although the volatility of the Korean won is much higher than that of the Japanese yen, suggesting the possibility of “flight to quality” or “flight to reserve currency” during the Asian financial crisis period, the “flight to Japanese yen” appears to be less during the recent global financial crisis because the difference in the volatilities of the value of the two currencies is not distinctive.

Third, we observe huge spikes on a graph for differences between the won/yen cross rate and the direct market rate during the two financial crisis periods. The statistical test confirms that the spikes during the crisis periods, when compared to the normal period, are indeed statistically significant. Although this implies an opportunity for triangular arbitrage during the crisis periods, the size of transaction costs will matter whether it is profitable.

Figure 1

The Fluctuation of the Nominal Value of Three Major Currencies against the U.S. dollar:
Japanese yen, Chinese Yuan, and South Korean won
The value of each currency on April 13, 1981 = 100

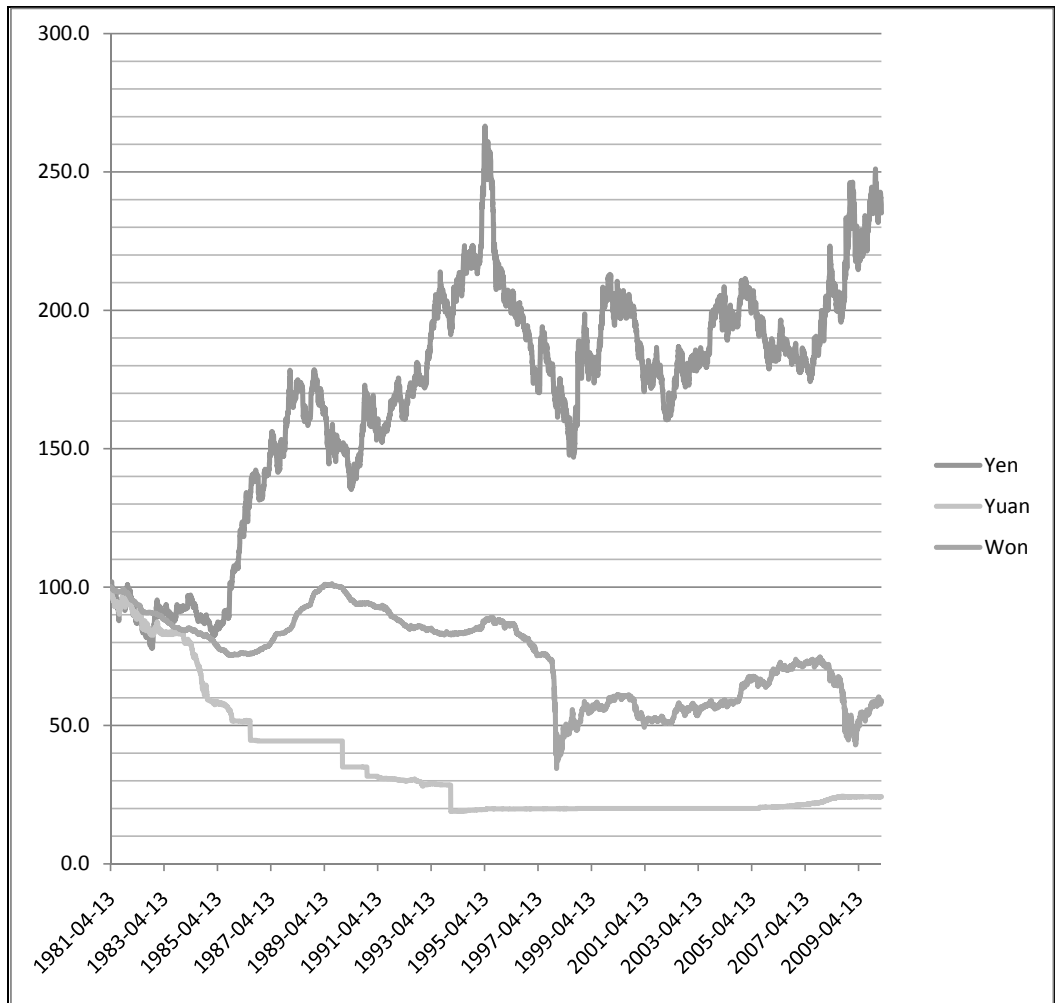


Figure 2

Normalized Difference of Values Between a Pair of Currencies:
 N(yen-Yuan), N(yen-won), and N(won-Yuan)
 Exchange rate on January 4, 1993 = 100
 (yen 125.40/\$, Yuan 5.7662/\$, won 789.20/\$)

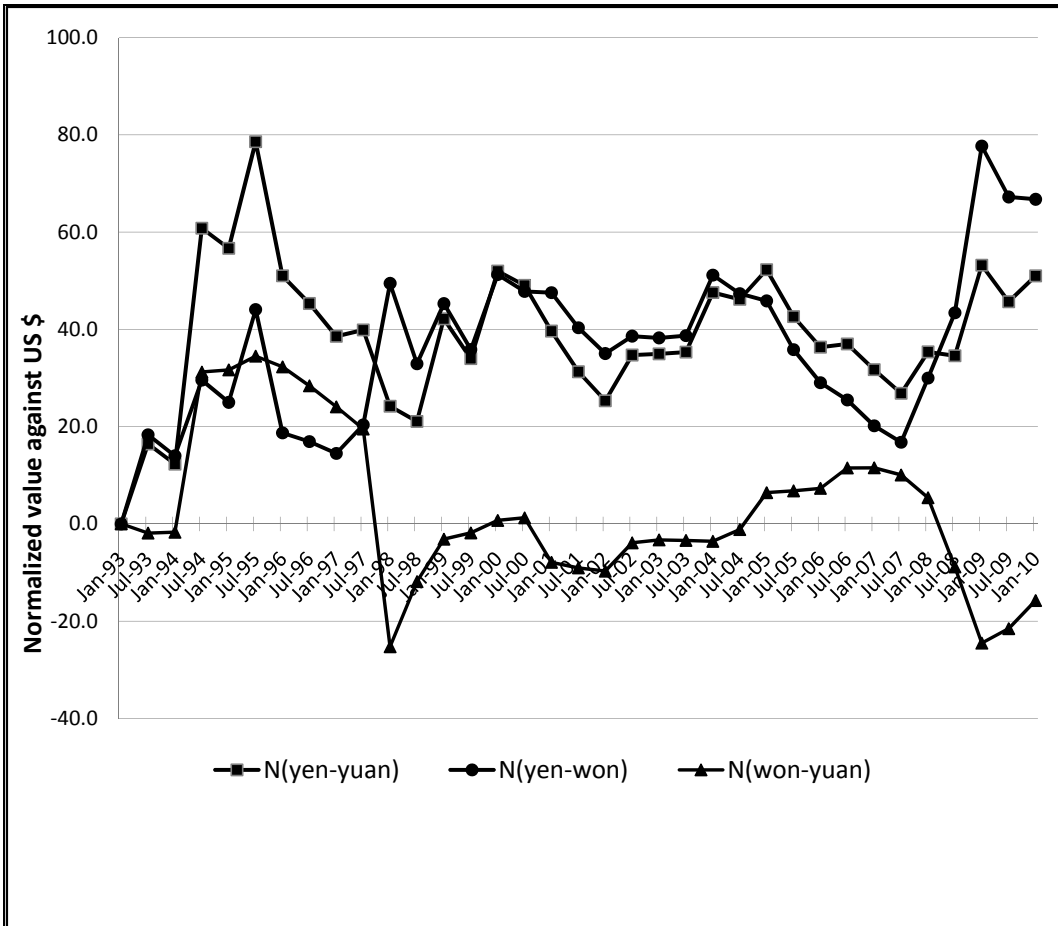


Figure 3

Difference Between Cross Rates and Market Rates: won per 100 yen
(January 4, 1993 –February 19, 2010)

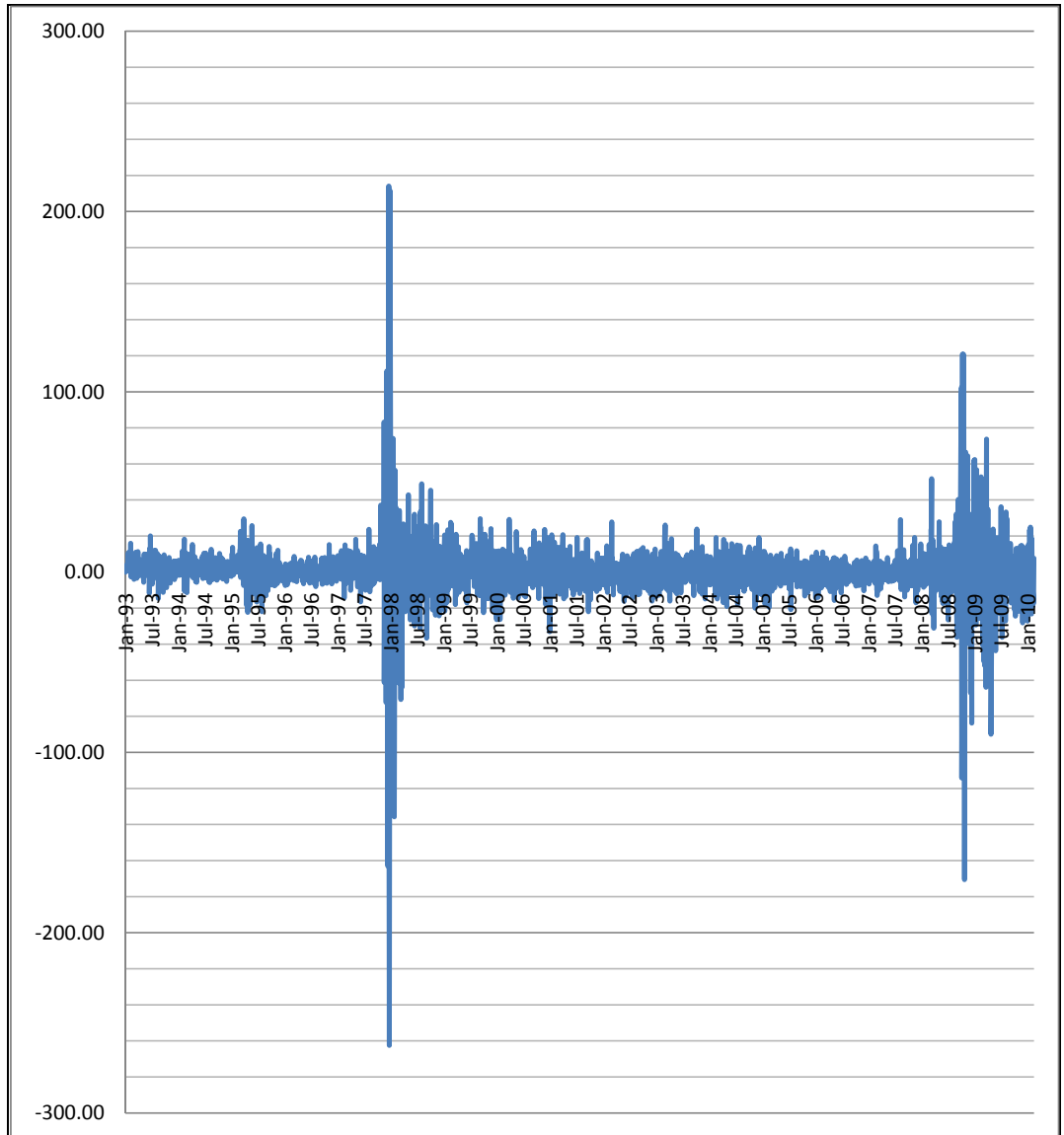


Table 1

Changes in the value of three currencies against the U.S. dollar
(Daily and annual)

		Yen	Yuan	won	won/yen
(a) Full Sample Period (January 4, 1993 – February 19, 2010)					
Mean	Daily	0.000104	-2.35E-05	-4.53E-05	-9.07E-05
	Annual	0.037862	-0.008594	-0.016533	-0.033101
Standard Deviation	Daily	0.007485	0.005268	0.009765	0.012363
	Annual	2.731879	1.922823	3.564175	4.512363
(b) Asian Financial Crisis (July 1, 1997 – December 31, 1998)					
Mean	Daily	9.96E-05	1.46E-05	-0.000539	-0.000438
	Annual	0.036349	0.005320	-0.196822	-0.160011
Standard Deviation	Daily	0.011227	0.000730	0.025170	0.029018
	Annual	4.097773	0.266279	9.187016	10.59155
(c) Global Financial Crisis (February 20, 2008 – February 19, 2010)					
Mean	Daily	0.000362	0.000104	-0.000290	-0.000574
	Annual	0.132115	0.038022	-0.105974	-0.209542
Standard Deviation	Daily	0.009356	0.001335	0.015356	0.017499
	Annual	3.414811	0.487388	5.604951	6.387173

Table 2

Comparative Analysis on the Difference between the Cross Rate and the Direct Market Rate
(Unit: Korean won)

	(1)	(2)	(3)	Mean T-test		
	Normal Period	Asian Financial Crisis	Global Financial Crisis	(1) vs. (2)	(1) vs. (3)	(2) vs. (3)
Mean	0.71124	2.04673	-0.71702	-1.90 (0.058)	2.77 (0.0057)	1.35 (0.1773)
Std. Dev.	6.3915	35.2181	24.3786			
Minimum	-33.007	-262.446	-170.509			
Maximum	29.565	214.042	120.839			
Range (Max-Min)	62.572	476.488	291.348			
N (# of Days)	3245	357	491			

Notes: T-test comparisons for means were utilized to test for significant different between different sub-sample periods. T-stats are reported along with *p*-values shown in parentheses. Normal period: January 4, 1993 – June 30, 1997 & January 4, 1999 – February 19, 2008; Asian financial crisis period: July 1, 1997 – December 31, 1998; Global financial crisis period: February 20, 2008 – February 19, 2010. Number of observations indicates number of days in exchange rates trading days.

References

- Bacchetta, Philippe, and Wincoop, Eric: Does exchange-rate stability increase trade and welfare? *The American Economic Review*, 90 (2000): 1093-1109.
- Broeck, Mark, and Slok, Torsten: Interpreting real exchange rate movements in transition countries. *Journal of International Economics*, 68 (2006): 368-383.
- Campa, Jose, and Goldberg, Linda: Exchange rate pass-through into import prices. *The review of Economics and Statistics*, 87 (2005): 679-690.
- Campbell, John Y., Karine Serfaty-De Medeiros, and Luis M. Viceira: Global Currency Hedging. *The Journal of Finance*, 65 (2010): 87-121.
- Devereux, Michael, and Engel, Charles: Exchange rate pass-through, exchange rate volatility, and exchange rate disconnect. *Journal of Monetary Economics*, 49 (2002): 913-940.
- Gali, Jordi and Monacelli, Tommaso: Monetary policy and exchange rate volatility in a small open economy. *Review of Economic Studies*, 72 (2005): 707-734.
- Kim, Soyoun, and Roubini, Nouriel: Exchange rate anomalies in the industrial countries: A solution with a structural VAR approach, *Journal of Monetary Economics*, 45 (2000): 561-586.
- Lustig, Hano N., and Adrien Verdelhan: The Cross-section of foreign currency risk premia and consumption growth risk. *American Economic Review*, 97 (2007): 89-117.
- Meese, Richard A.: Testing for bubbles in exchange markets: A case of sparkling rates. *Journal of Political Economy*, 94 (1986): 345-373.
- Mitton, Todd: A cross-firm analysis of the impact of corporate governance on the East Asian financial crisis. *Journal of Financial Economics*, 64 (2002): 215-241.
- Taylor, Mark P.: Covered interest parity: a high-frequency, high-quality data study, *Economica*, 54 (1987): 429-438.
- Walker, Eduardo: Strategic currency hedging and global portfolio investments upside down, *Journal of Business Research*, 61 (2008): 657-668.
- Warnock, Francis E.: Exchange rate dynamics and welfare effects of monetary policy in a two-country model with home-product bias. *Journal of International Money and Finance*, 22 (2003): 343-363.