Time-Varying Exchange Rate Basket in China from 2005 to 2009

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Abstract

We use the Kalman filter to estimate the structure of the secret currency basket of the renminbi based on daily data between 2005 and 2009. The currency weights of selected currencies are modeled as stochastic processes (random walks). The official announcement of the new exchange rate regime in July 2005 with the introduction of a secret currency basket was followed by a smooth appreciation against the US dollar. Other currencies did not play a major role. We show that the US dollar again received a higher weight in the Chinese exchange rate policy already before the financial crisis of 2008.

JEL-Code: G33, G21, C25.

Keywords: exchange rate regime, Kalman filter, financial crisis.

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1 Introduction

China today boasts an extensive modern industrial economy with booming urban regions. The country's high trade growth is supported by expanding exports (Bussière et. al., 2008) and large foreign direct investment (FDI) flows (Eichengreen and Tong, 2005). Not surprisingly, growth in the world's most populous country has changed the distribution of economic activities across the world. According to the OECD (2010), the share of Chinese GDP in the world economy valued at market exchange rates increased from 1.7% to 7.2% between 1980 and 2008. In terms of purchasing-power-adjusted prices, the share of Chinese output in the world economy was 11.3% as of 2008.

Corresponding to the rising importance of the Chinese economy, the country's economic developments and policies, too, are of great and increasing consequence for its trading partners. Exchange rate regimes and exchange rate levels belong to the most controversial issues in the world economy. Korhonen and Ritola (2009), for example, found 29 academic papers dealing with the misalignment (overvaluation) of the exchange rate of the renminbi.

The analysis of the exchange rate regime in China takes an important place in this discussion. Demands that China should adopt a more flexible exchange rate regime occur frequently. On July 21, 2005, the People's Bank of China (PBC) moderately revaluated the exchange rate against the US dollar by initially about 2%. At the same time, the exchange rate regime was changed from a *de facto* peg to the US dollar to a more flexible peg to a basket of currencies with narrow fluctuation bands. On the one hand, this was generally seen as a promising change of Chinese monetary policy, with important implications for the whole region and the world economy. On the other hand, the international markets observed the development rather skeptically as they believed that the old policy would be continued under the new regime. These expectations were supported by the secret structure of the currency basket and a continuing stability of the exchange rate against the US dollar, which was empirically confirmed in several papers (Frankel, 2006, and Funke and Gronwald, 2008). Moreover, deviations between *de facto* and *de jure* exchange rate regimes are in general widespread across countries (see Reinhart and Rogoff, 2002 and 2004). In particular, pursuing a more rigid exchange rate policy than announced corresponds to the so called fear-of-floating phenomenon (Calvo and Reinhart, 2002). In this vein, McKinnon (2006), and McKinnon et al. (2009)

discuss various arguments including carry trades for maintaining some degree of exchange rate stability in China.

In fact, the renminbi's exchange rate has again stabilized at about 6.8 RMB per USD (see Figure 1) in July 2008 without any official explanation of this policy change.[1] Thus the exchange rate appreciated by about 20 % between July 2005 and July 2008. In the subsequent period, the exchange rate remained largely stable. There were only moderate fluctuations in a narrow band of about ±0.5 %, which occurred mainly in the second half of 2008. This again sparked international demands for exchange rate liberalization in China. Following these demands, China announced a return to the managed float on June 19, 2010. While it is impossible to analyze the new exchange rate policy in this paper, the presented results can shed some light on the first period of the managed float in China between July 2005 and the end of 2008.

The policy change of July 2008 gave rise to several questions which were not addressed in the previous analyses. Was it the intention of the Chinese monetary authorities to appreciate the exchange rate by 20 % within three years? Did other currencies play a role at all in the determination of the Chinese exchange rate? Or was the exchange rate stabilization in July 2008 an abrupt policy change caused by the worsening state of the world economy, as argued by the People's Bank of China (PBC, 2010)? Finally, we pose the question whether the Chinese exchange rate policy was influenced by the outbreak of the financial crisis in September 2008.

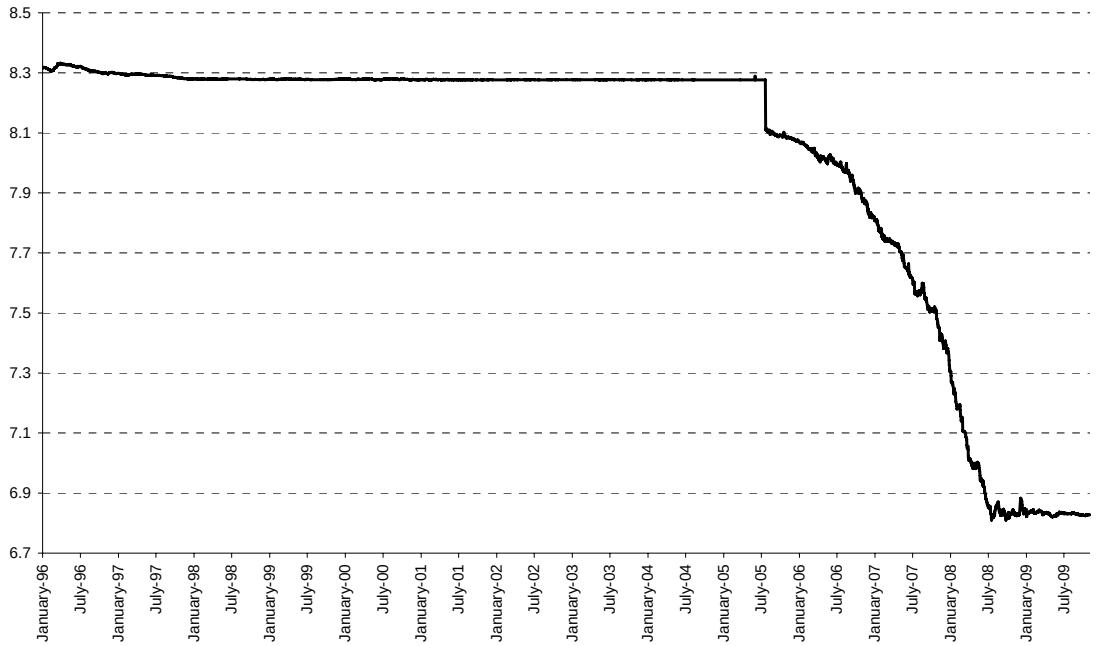
Our results indicate that the reintroduction of a fixed exchange rate policy was not an abrupt change of Chinese monetary policy. Moreover, the new policy was introduced already before the financial crisis erupted in September 2008. Notably, the return to a *de facto* fixed exchange rate allows us to determine whether we can timely detect such policy changes with high-frequency exchange rate data. We document that the standard approach to analyzing a secret currency basket (i.e. by rolling regressions with differenced data) has failed to detect the policy change of July 2008. Therefore, we propose an alternative estimation of time-varying parameters with the Kalman filter,

[1] Only later, for example in June 2010, the People's Bank of China stressed the importance of exchange rate stability for the development of the Chinese economy in the aftermath of the financial crisis.

which uses non-differenced data. This approach shows a change in parameters immediately after the exchange rate policy was changed.

The remainder of the paper is structured as follows. The next section describes methods for the estimation of time-varying exchange rate baskets. Section 3 describes the data. Sections 4 and 5 report the results of our analysis using (rolling) ordinary least squares (OLS) regressions and time-varying coefficients, respectively. Section 6 concludes the paper.

Figure 1: Exchange Rate of the Renminbi against the US Dollar, January 1996 to November 2009



Source: Datastream.

2 Estimation of the Implicit Currency Basket

According to a statement released by the People's Bank of China on August 10, 2005, the secret basket for the Chinese exchange rate policy included, above all, the US dollar (USD), the Japanese yen (JPY), the euro (EUR), and the South Korean won (KRW). Several other currencies, namely the Australian dollar (AUD), the Canadian dollar (CAD), the pound sterling (GBP), the Malaysian ringgit (MYR), the Russian ruble

(RUB), the Singapore dollar (SGD), and the Thai baht (THB), should also play some role. Moreover, the actual value of the exchange rate could fluctuate within narrow bounds. According to Funke and Gronwald (2008), the fluctuation margins were initially about ±0.15 % for the US dollar and extended to about ±0.5 % on May 18, 2007. The fluctuation bands for other currencies might be slightly larger, up to ±1.0 % according to Funke and Gronwald (2008).

Although the structure of the currency basket is secret, the implicit weights can be estimated on the basis of actual exchange rate developments of the renminbi against the list of potential target currencies. Originally this approach was proposed by Frankel and Wei (2007, 2008) and then followed in the literature. In so far as the exchange rates are generally believed to follow a random walk (see Meese and Rogoff, 1983), a simple estimation of the relationship between the currencies would likely be subject to the spurious regression problem. This is especially important for rolling or subsample (e.g. for each month) regressions with a relatively low number of observations. Therefore, the estimation of the renminbi's exchange rate basket is stated in first differences,

$$\Delta e_{rmb/cur,t} = \beta_1 + \beta_2 \Delta e_{usd/cur,t} + \beta_2 \Delta e_{eur/cur,t} + \beta_2 \Delta e_{jpy/cur,t} + \cdots + \varepsilon_t , \qquad (1)$$

where Δe is the first difference of the exchange rate log of the renminbi and selected currencies against a base currency, which is denoted by *cur*. In general, previous analyses concluded that only the US dollar, and to a much lesser extent the euro, could have significant informative value for the development of the renminbi's exchange rate.

Although equation (1) should be appropriate for estimating the currency baskets, it is also subject to possible drawbacks, which have been ignored in the previous literature. First, the relationship has to be estimated over some time period, while the weights may be subject to frequent or even continuous changes.[2] Therefore, the majority of studies estimate rolling regressions and usually use a comparatively short window. However, this often results in a relatively low number of observations despite the use of daily data. Moreover, the structural changes are then artificially smoothed and they cannot be clearly attributed to a specific date. This approach can also result in higher and correlated errors from the regression. Funke and Gronwald (2008) show that the

[2] Frankel and Xie (2010) discuss the estimation of structural changes of exchange rate policies for several countries, but excluding China.

ARCH test rejects the null of homoscedasticity of the error term in the OLS regression of (1).

Second, estimation (1) is based on differenced data, while the actual exchange rate policy is likely to consider the level of the exchange rate. This is especially important as the exchange rate of the renminbi is announced to move within a narrow fluctuation band. For the less important currencies, fluctuation bands of ±1.0 % may be sufficient to make the estimates fuzzy.

We address both points of criticism. First, we account for the possibility that coefficients are changing gradually by using an alternative estimation method. Following Harvey (1989) and Ogawa and Sakane (2006), the estimated structure of the currency basket with time-varying weights is estimated using the Kalman filter in the following form:

$$\Delta e_{rmb/cur,t} = \alpha + \omega_{usd/cur,t}\Delta e_{usd/cur,t} + \omega_{usd/cur,t}\Delta e_{eur/cur,t} + \omega_{usd/cur,t}\Delta e_{jpy/cur,t} + \cdots + \varepsilon_t \text{ , (2a)}$$

where α is the intercept and the remaining parameters are estimated as time-varying parameter processes which follow a random walk

$$\omega_{i,t} = \omega_{i,t-1} + \eta_{i,t} \text{ where } i = \textit{usd/cur, eur/cur, jpy/cur, } \ldots \quad (3)$$

Second, we use data in levels to see whether non-differenced time series are more informative on changes in implicit exchange rate policy. In this specification, we do not take logs of exchange rates, which are therefore denoted by *E*. The estimation equation can be stated as

$$E_{rmb/cur,t} = \alpha + \omega_{usd/cur,t}E_{usd/cur,t} + \omega_{usd/cur,t}E_{eur/cur,t} + \omega_{usd/cur,t}E_{jpy/cur,t} + \cdots + \varepsilon_t \text{ , } \quad (2b)$$

where time-varying coefficients ω are defined as in equation (3). In addition to selected currencies, we also included an appreciation trend to specification (2b). This variable shows whether there is an autonomous appreciation trend in the Chinese exchange rate policy. The trend is defined so that a positive value of the estimated parameter corresponds to an appreciation of the renminbi.

3 Data Description

We have daily exchange rate data for the period from January 1996 to November 2009 for the most important currencies from the list published by the People's Bank of China,

namely USD, JPY, EUR, KRW, and THB. In the empirical part we concentrate on the period with relatively variable (appreciating) exchange rates between March 2005 and January 2009. The earlier literature and our preliminary analysis on the remaining currencies showed that they are not informative for the development of the renminbi's exchange rate. All data were obtained from Datastream.

We selected the Australian dollar as a reference currency following the argument of Calvo and Reinhart (2002) that it can be considered to be a typical free floating currency of a relatively small country. We are aware that the Australian dollar is included in the list of the target currencies published by the People's Bank of China. Given that the previous analyses did not find any significant *de facto* weight for this currency, we believe that the possible bias is negligible. We do not include the Swiss franc (CHF), following Funke and Gronwald (2008), because the franc may be oriented towards the euro, especially in the more recent period. Reynard (2008) shows, for example, that the fluctuations of the Swiss franc against the euro have declined since the introduction of the euro in 1999. This could bias the results for the euro, which are particularly interesting.

4 Estimation in First Differences

We start with the estimation of Frankel's and Wei's (2007 and 2008) regression of (1) in first differences using OLS (see Table 1). We compare the results for the whole period available (August 8, 2005 to January 29, 2009) with two subperiods at the beginning and the end of the sample. Thus, we can also see how the currency weights have evolved since August 2005. In particular, we take 100 observations at the beginning and the end of our sample. At first glance, the OLS performs very well for all periods, as can be seen from high test *t*-statistics and R^2 values. However, the residual statistics reveal more problems especially for the first subperiod. The residuals show significant autocorrelation in all specifications (see e.g. the Durbin-Watson statistics) and significant heteroscedasticity above all at the beginning of the sample. In general, a similar picture can be observed for several subperiods, especially those characterized by some volatile movements on international foreign exchange markets. The relatively good residual statistics at the end of the sample are rather an exception than a rule.

Table 1: Currency Weights Estimated by OLS (First Differences)

	Aug. 05 - Jan. 09		Aug 05 - Dec. 05		Sep. 08 – Jan 09	
USD	0.784	***	0.929	***	0.736	***
	(78.292)		(43.044)		(27.704)	
EUR	0.027	***	-0.005		0.021	**
	(3.677)		(-0.596)		(2.018)	
JPY	0.020	***	0.001		0.004	
	(4.632)		(0.105)		(0.469)	
KRW	0.001		0.013		0.000	
	(0.389)		(0.962)		(-0.034)	
THB	0.031	***	0.023		0.086	**
	(3.147)		(1.071)		(2.615)	
Constant	-0.020	***	-0.006		-0.001	
	(-5.052)		(-1.422)		(-0.116)	
No. of obs.	906		100		100	
Adjusted R^2	0.989		0.995		0.998	
AIC	-1.387		-3.442		-1.796	
SIC	-1.355		-3.286		-1.640	
DW	2.076		2.671		2.173	
LQ(4), RES	6.282		13.401	***	4.950	
	[0.179]		[0.009]		[0.293]	
LQ[10], RES	17.694	*	18.204	*	19.665	**
	[0.060]		[0.052]		[0.033]	
LQ[4], RES	10.269	**	21.924	***	0.1377	
	[0.036]		[0.000]		[0.998]	
LQ[10], RES	12.376		23.202	**	3.8934	
	[0.261]		[0.010]		[0.952]	
ARCH[4]	2.320	*	10.538	***	0.037	
	[0.055]		[0.000]		[0.997]	
ARCH[10]	1.106		4.848	***	0.324	
	[0.355]		[0.000]		[0.973]	

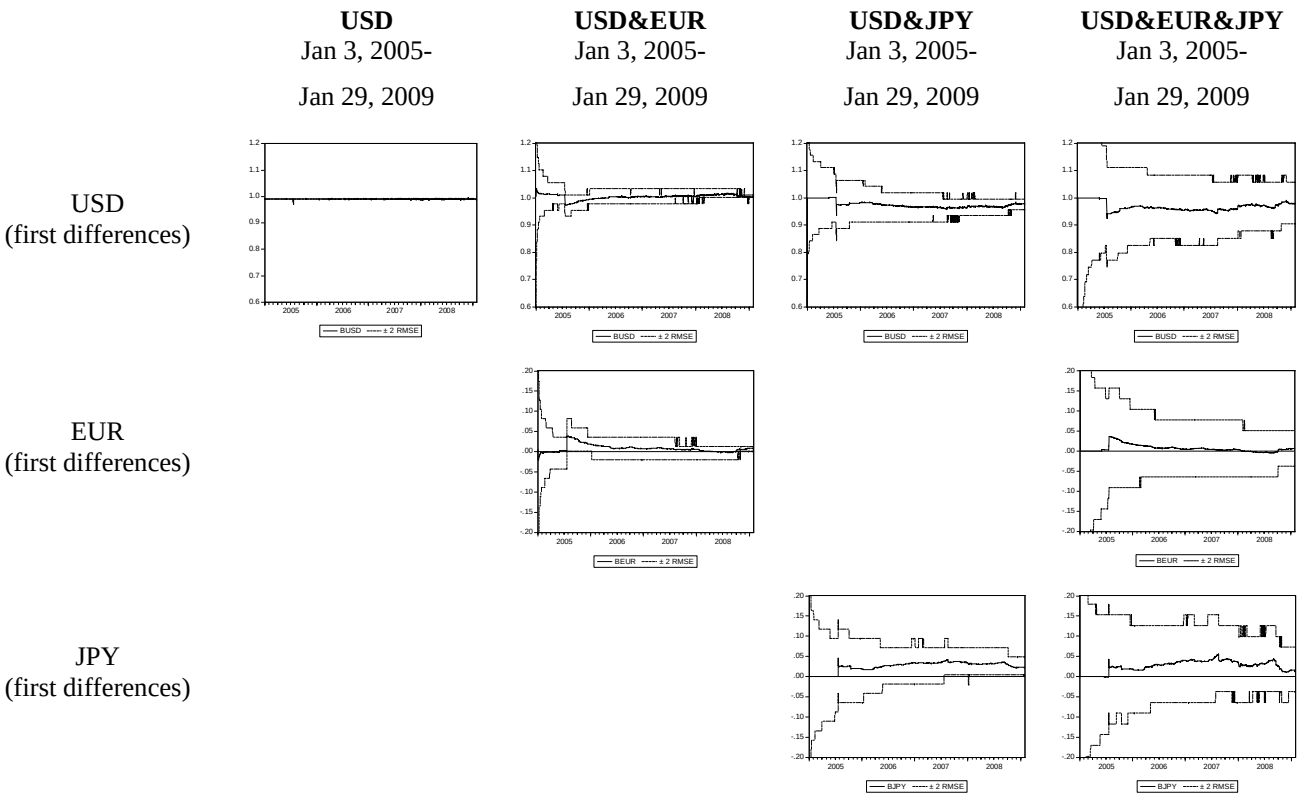
Note: *t*-statistics computed are in parentheses and *p*-values are reported in brackets. *, **, *** denote significance at the 10, 5 and 1 % level, respectively.

Table 2: Time-Varying Weights (Final States Estimates) Estimated by Kalman Filter in First Differences

	USD	**USD&EUR**	**USD&JPY**	**USD&EUR&JPY**
	Jan 3, 2005-	Jan: 3, 2005-	Jan 3, 2002-	Jan. 3, 2005-
	Jan 29, 2009	Jan. 29, 2009	Jan: 29, 2009	Jan. 29, 2009
USD, first differences	0.991***	1.003***	0.977***	0.979***
	(686.235)	(155.894)	(71.195)	(23.571)
EUR, first differences		0.009		0.007
		(1.502)		(0.298)
JPY, first differences			0.022*	0.014
			(1.744)	(0.439)
Log-Likelihood	5438.537	5382.645	4748.961	4386.135
AIC	-10.21905	-10.112	-8.923	-8.239
SIC	-10.20971	-10.098	-8.914	-8.225
No of obs.	1064	1064	1064	1064

Notes: *z*-statistics are in parentheses.

Figure 2: Time-Varying Structure of the Currency Basket in China Estimated by Kalman Filter in First Differences



The estimation shows that the coefficient of the US dollar has declined from 1 to about 0.74. Thus, its role remains still comparably high. The last available subperiods show also a positive coefficient for the euro and the Thai baht, but both coefficients are very small. There is mixed evidence on the appreciation trend, which is significant for the whole period, but insignificant for the subperiods. According to the OLS results, both the Japanese yen and the Korean won are insignificant.

However, the results for the end of the sample (September 2008 to January 2009) are rather surprising. While a visual inspection of Figure 1 reveals clearly that there was a return to the *de facto* exchange rate peg, this is not confirmed in the corresponding regression. Actually, the US dollar coefficient is surprisingly low, while the coefficients for the euro and the Thai baht are significant. Frankel (2009) presents the same finding for the euro in the second half of 2008. Thus, the standard methodology based on differenced data fails to reveal the policy change, because it puts too much weight on relatively negligible fluctuations of the exchange rate around the new implicit target.

The autocorrelation of residuals revealed in Table 1 may be caused by structural changes during the estimation period. Therefore, we estimate time-varying weights for different currencies as specified in equation (2a) using the Kalman filter. However, this approach also confirms the previous results (see Table 2 and Figure 2).[3] The estimation of the US dollar peg without reflecting other currencies (see first column in Figure 2) reveals nearly no change in the estimated weights for the dollar. Actually, we can see that the coefficient was close to unity over the whole period analyzed, with the exception of the exchange rate appreciation on July 21. The results are similar if we include also the euro or the Japanese yen. In these specifications, we can see a slight decline of the US dollar's weight and a corresponding increase in the weight of other currencies, especially the Japanese yen. These results are similar to the earlier finding by Ogawa and Sakane (2006). However, the estimated currency basket returns to a US dollar peg as early as 2006. Finally, the estimated results do not indicate any change of exchange rate policy in the second half of 2008. We consider this failure to reveal the

[3] Figure 2 presents the results in a table where each column shows one specification with one or several currencies which are possibly included in the currency basket of the renminbi. The presentation thus largely corresponds to a standard table with regression results. However, each time-varying coefficient is shown as a figure including standard confidence bands.

policy change in the second half of 2008 a major drawback of using differenced data in the estimation of an implicit exchange rate basket.

5 Time-Varying Approach in Levels

So far, the estimation of the implicit currency basket has provided rather mixed results. On the one hand, we can see that the exchange rate policy was oriented mainly towards the US dollar, also during the relatively flexible period between July 2005 and summer 2008. On the other hand, we get confusing results for the estimation in the last period (September 2008 to January 2009), when the policy returned to a *de facto* exchange rate peg.

We address this issue by estimating implicit currency weights using the Kalman filter in levels. The Kalman filter is appropriate for the estimation of the relationship between integrated variables. Therefore, we estimate specification (2b) with time-varying coefficients using the Kalman filter (see Table 3 and Figure 3). We start with a simple specification for the US dollar as the single explanatory currency of the renminbi's exchange rate. The results are highly robust. The development pattern of estimated coefficients corresponds closely to the announced policy changes. So the first break in the coefficient of the US dollar is on July 21, 2005, which corresponds to the revaluation of the currency. According to our estimation, the parameter changed from 0.997 to 0.922. Furthermore, the parameter stabilized at a new level of 0.82 (reflecting the appreciation by approximately 20 %) already in mid-July 2008.

Next, we include the euro or the Japanese yen[4] to (1). The estimated parameter for the US dollar remains robust, but the confidence bands expand if another currency and a trend are included. The results reveal that the euro and the Japanese yen have positive but low weights when included separately in the estimation. It seems that the yen was more important than the euro. Nevertheless, the final state estimates (Table 3) show that the overall impact of these variables on the renminbi's exchange rate remained low between 2005 and 2008.

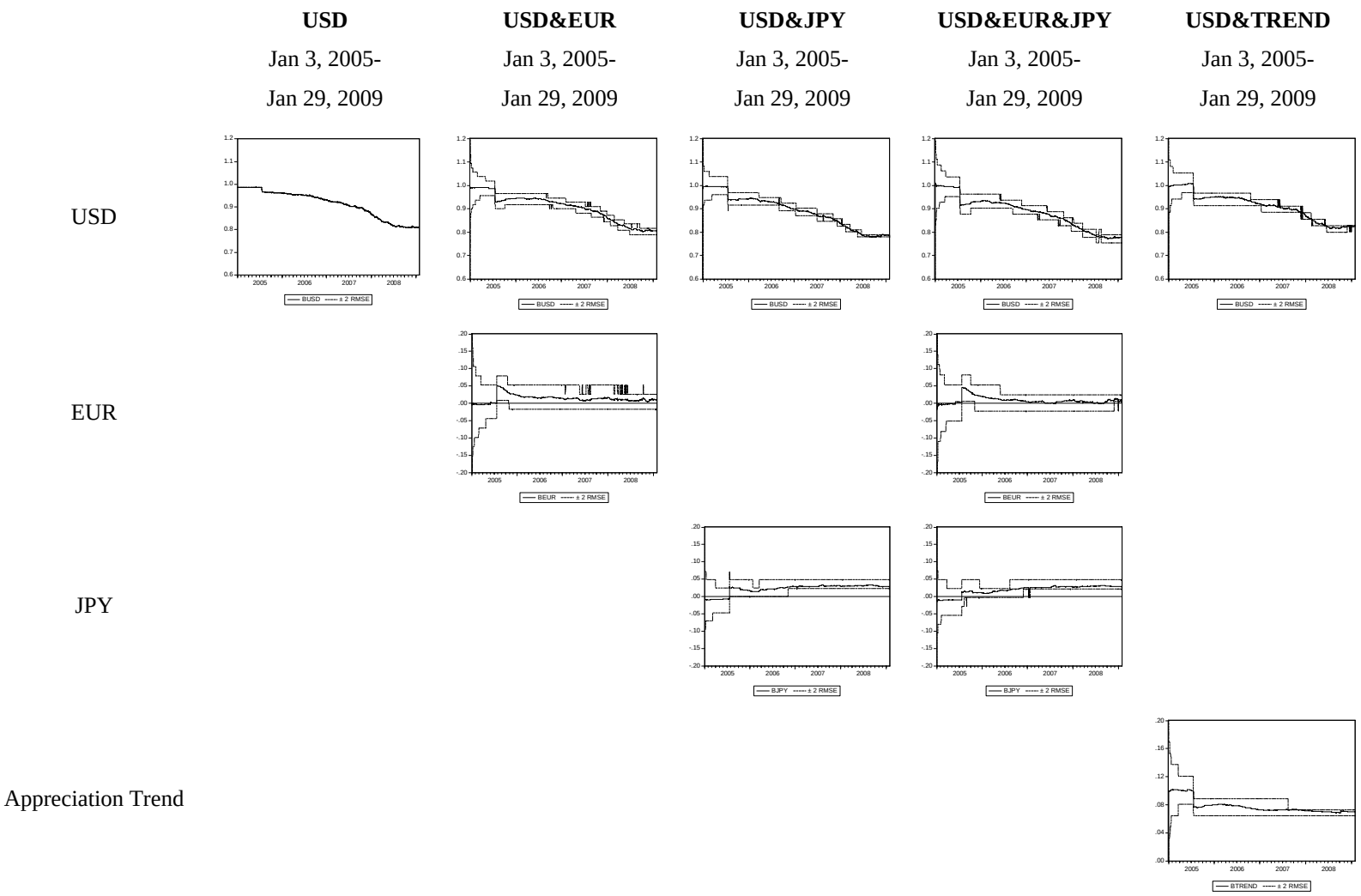
[4] The results for other currencies are available upon request from the author.

Table 3: Time-Varying Weights (Final States Estimates) Estimated by Kalman Filter in Levels

	USD	**USD&EUR**	**USD&JPY**	**USD&EUR&JPY**	**USD&TREND**
	Jan 3, 2005-	Jan: 3, 2005-	Jan 3, 2002-	Jan. 3, 2005-	Jan. 3, 2005-
	Jan 29, 2009	Jan. 29, 2009	Jan: 29, 2009	Jan. 29, 2009	Jan. 29, 2009
USD	0.811***	0.806***	0.787***	0.778***	0.825
	(846.152)	(120.575)	(204.208)	(108.486)	(182.506)
EUR		0.010		0.009	
		(1.006)		(1.055)	
JPY			0.029***	0.029***	
			(6.411)	(6.911)	
Appreciation Trend					0.070
					(48.079)
Constant	1.770	1.573	1.790	2.093	24.057
	(5.265)	(4.009)	(2.231)	(0.694)	(3.773)
Log likelihood	639.823	633.505	651.0939	645.222	606.704
AIC	-1.199	-1.185	-1.218	-1.205	-1.135
SIC	-1.190	-1.171	-1.204	-1.187	-1.121
No of obs.	1064	1064	1064	1064	1064

Notes: *z*-statistics are in parentheses.

Figure 3: Time-Varying Structure of the Currency Basket in China Estimated by Kalman Filter in Levels



Then we include the US dollar and two selected currencies to the specification. The estimated weights for the Japanese yen remain positive also in this broader specification, while euro becomes insignificant.

While these results are largely similar to the previous findings using differenced data, it is important to note that time-varying coefficients show a stabilization of the US dollar already after July 2008. This result is more consistent with our expectations based on exchange rate developments in Figure 1. At the same time, the estimation still attributes some weight to the euro and the Japanese yen.[5] Our approach based on the Kalman filter and the use of data in levels perform significantly better than the standard approach using regressions with differenced data.

Finally, we consider an appreciation trend in our estimations. It can be seen that the specification based on the US dollar and an appreciation trend is comparably robust. The results reveal that the appreciation trend received continuously lower weights during the analyzed period. This would imply that China's exchange rate policy can be described reasonably well as a fixed exchange rate policy with a predetermined appreciation trend. However, the information criteria reported in Table 3 favor the specification with the US dollar and the Japanese yen, but the statistics are only slightly better than the parsimonious specification including only the US dollar.

6 Conclusions

Economic policy announcements often differ from the perceived *de facto* policy. There are numerous examples among developed and developing countries or emerging economies. The Chinese exchange rate policy belongs to those cases which attracted significant attention in economic research and policy. The exchange rate of the renminbi is declared to be pegged to a basket of currencies, but several papers found evidence only for a peg to the US dollar. It was argued that other currencies are not actually used in the determination of the exchange rate in China.

We review these papers and argue that earlier studies had several drawbacks. First, they are based on differenced data and therefore cannot use information on any

[5] The coefficients for the euro and the Japanese yen become insignificant if the estimation period is extended to 2009.

movements behind instantaneous changes. Second, the results may be biased because of unexplained autocorrelation of the residuals. Indeed, we demonstrate that the standard approach fails to identify the policy change in the second half of 2008.

We propose an alternative estimation methodology with time-varying coefficients using the Kalman filter and data in levels. We show that this method yields excellent results. We confirm the previous findings on the continuing importance of the US dollar during the *de jure* floating period. We find only limited evidence that other currencies have played a role in the determination of the renminbi's exchange rate. In contrast, we can see an appreciation trend which continuously lost in importance during the period analyzed. These results indicate that the exchange rate of the renminbi was never freely floating. Finally, this approach reveals correctly the implicit change of the Chinese exchange rate policy in July 2008, which was implemented already before the outbreak of the financial crisis. While we analyzed only the period between July 2005 and the end of 2009, this approach can be used for the analysis of future changes of Chinese exchange rate policy, which were announced in June 2010.

References

Bussière, Matthieu, Fidrmuc, Jarko and Bernd Schnatz 2008: EU enlargement and trade integration: Lessons from a gravity model, *Review of Development Economics* 12, 501-515.

Calvo, Guillermo A. and Carmen M. Reinhart 2002: Fear of Floating. *Quarterly Journal of Economics* 117(2), 379-408.

Eichengreen, Barry and Hui Tong 2005: Is China's FDI coming at the expense of other countries, Working Paper No. 11335, NBER, Cambridge.

Frankel, Jeffrey A. 2006: On the Yuan: The Choice between Adjustment under a Fixed Exchange Rate and Adjustment under a Flexible Rate. *CESifo Economic Studies* 52(2), 246-275.

Frankel, Jeffrey A. 2009: New Estimation of China's Exchange Rate Regime. *Pacific Economic Review* 14 (3), 346-360.

Frankel, Jeffrey A., and Shang-Jin Wei 2007: *Assessing China's Exchange Rate Regime.* Working Papers 13100, National Bureau of Economic Research.

Frankel, Jeffrey A., and Shang-Jin Wei 2008: Estimation of De Facto Exchange Rate Regimes: Synthesis of the Techniques for Inferring Flexibility and Basket Weights. *IMF Staff Papers* 55(3), 384-416.

Frankel, Jeffrey A., and Daniel Xie (2010): Estimation of De Facto Flexibility Parameter and Basket Weights in Evolving Exchange Rate Regimes, *American Economic Review* 100(2), 568-572.

Funke, Michael and Marc Gronwald 2008: The Undisclosed Renminbi Basket: Are the Markets Telling Us Something about Where the Renminbi-US Dollar Exchange Rate is Going? *World Economy* 31(12), 1581-1598.

Harvey, Andrew C. 1989: *Forecasting, Structural Time Series Models and the Kalman Filter*. Cambridge: Cambridge University Press.

Korhonen, Iikka, and Maria Ritola 2009: Renminbi Misaligned - Results from Meta-Regressions. Discussion Papers No. 13/2009, Bank of Finland, Institute for Economies in Transition (BOFIT), Helsinki.

Meese, Richard. A. and Kenneth S. Rogoff 1983: Empirical Exchange Rate Models of the Seventies, *Journal of International Economics*, 14, pp. 3-24.

McKinnon, Ronald 2006: China's Exchange Rate Trap: Japan Redux? *American Economic Review*, 96(2), 427-431.

McKinnon, Ronald, Lee, Brian, and Wang, Yi David 2009: The Global Credit Crisis and China's Exchange Rate. Working Paper No. 391, SCID.

OECD 2010: OECD Economic Survey China, OECD, Paris.

Ogawa, Eiji, and Maichiru Sakane 2006: Chinese Yuan after Chinese Exchange Rate System Reform. *China & World Economy* 14 (6), 39-57.

PBC 2010: Further Reform the RMB Exchange Rate Regime and Enhance the RMB Exchange Rate Flexibility. News of People's Bank of China, June 19, 2010, Beijing.

Reinhart, Carmen M., and Kenneth S. Rogoff 2002: The Modern History of Exchange Rate Arrangements: A Reinterpretation. Working Paper No. 8963, NBER, Cambridge

Reinhart, Carmen M., and Kenneth S. Rogoff 2004: The Modern History of Exchange Rate Arrangements: A Reinterpretation, *Quarterly Journal of Economics* 129, 1-48.

Reynard, Samuel 2008: What Drives the Swiss Franc? Working Paper No. 2008-14, Swiss National Bank.

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