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Currency Regime and Monetary Autonomy
— Empirical Evidence Using Recent and Global Data from 1990 to 2007 —

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Currency Regime and Monetary Autonomy

― Empirical Evidence Using Recent and Global Data from 1990 to 2007 ―

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Abstract

This paper analyzes the exchange rate regimes from the perspective of monetary independence through examining the sensitivity of the domestic interest rate to the international interest rate under different regimes. To be specific, by using recent and global data, we first examine co-integration relationship between domestic and international interest rates to capture the long-run transmission, and then estimate adjustment speeds in the transmission process of interest rates by using an error-correction model. Our estimation results basically support the traditional views of the "impossible trinity". The floating regime shows the less sensitivity of the domestic interest rate to the international interest rate than the fixed regimes, with the lack of co-integration relationship or the slower adjustment speed. The result implies some capacity for domestic monetary autonomy under the floating regime. The "hard peg" regime, however, does not represent the fastest adjustment speed, which might reflect the existence of the restrictions on capital flows in its sample cases.

Key words: exchange rate arrangement, monetary autonomy, co-integration, error correction analysis
JEL Classification Codes: F31, F33, C23, E52

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[1] The views expressed in this paper are those of the author and not those of the Ministry of Finance or the Policy Research Institute.

1. Introduction

The choice of the exchange rate regimes – floating, fixed, or somewhere in between – has been a recurrent question in international monetary economies. Since the postwar period, a lengthy debate has simmered over the merits of the fixed versus floating exchange rates. With the adoption of a fixed regime, domestic monetary policy is handled by the central bank of the country whose currency provides the external anchor, and the fixed rate automatically acquires all the credibility accumulated by the issuer of the anchor currency. Floating regime, in contrast, maximizes the flexibility with which the authorities can use monetary policy for economic stabilization. The debate, which is typically framed in terms of the trade-off between credibility and flexibility, has gone through several swings of the pendulum (Frankel 1999, Frankel et al. 2000).

Recently, the debates on the exchange rate regimes have become focused on whether the intermediate regimes that "soft peg" their currencies by tactics such as target zones, crawling, and basket pegs, are vanishing. In other words, the question is whether the exchange rate regimes are moving toward a corner solution with the "hard peg" approach or the "free float" one. The corner solutions hypothesis claims that, under the principle of the "impossible trinity," countries will be further forced toward more purely floating or more purely fixed regimes as capital market integration increases (Fischer 2001, Summers 1999). As a counter-argument against the corner solutions hypothesis, the "fear of floating" hypothesis justifies an intermediate exchange rate regime mainly from the viewpoint of establishing credibility in the financial markets so that the local currency will not lose value against foreign currencies, particularly among emerging market economies (Calvo and Reinhart 2000 and 2001, Williamson 2000, Kawai 2002). So far, no clear consensus has been reached.

The 1997-98 Asian financial crises have refocused on the exchange rate management within the East Asian countries. Most views expressed criticize the pre-crisis US-dollar-pegged rate regime as a cause of the crisis. It is said that this regime induced short-term external over-borrowing and caused the appreciation of real exchange rates with the loss of competitiveness (Ito 2001, etc.). The question also arises as to whether, after the crisis, the East Asian countries are simply returning to the pre-crisis US dollar standard (McKinnon 2001), or whether they have learned a lesson from the crisis and are finding another path to follow (Kawai 2002, etc.). The recent debates over the exchange rate regimes take a step further, arguing that there must be coordination in selecting an exchange rate regime among countries in the region with similar trading structures and with high intra-regional trading shares (Ogawa and Ito

2000). The possibility of an optimal currency area in East Asia has also been discussed on an empirical basis (Bayoumi, Eichengreen, and Mauro 2000).

This paper, among the debates on exchange rate regimes mentioned above, aims at assessing the relative merits of alternative exchange rate arrangements from the perspective of monetary independence. The conventional wisdom of "impossible trinity" in international macroeconomics tells us that countries can pursue two of three options – fixed exchange rates, domestic monetary autonomy and capital mobility. Thus, without restrictions on capital flows, fixing exchange rates constrains domestic monetary autonomy, while floating rates allow the authority to pursue an independent monetary policy. An alternative view of "fear of floating", represented by Calvo and Reinhart (2001 and 2002), argues that the lack of currency's credibility prevents countries from pursuing an independent monetary policy, regardless of their announced regime. This paper helps to place the ongoing debate in the context of observed facts, and provides empirical evidence using recent and global data on the relationship between the currency regimes and monetary autonomy, through examining the sensitivity of the domestic interest rate to the international interest rate under different currency regimes.

The paper summarizes as follows. Section 2 reviews previous studies and clarifies this paper's position. Section 3 presents empirical analyses introducing the methodology and data and discussing the estimate results. Section 4 summarizes the results and concludes.

2. Previous Studies, Our Position

There is a vast body of literature that studies the merits of different exchange rate regimes. However, the empirical evidence on the relationship between currency regimes and monetary autonomy has been still relatively scarce, though monetary independence has been at the heart of debate on the regimes. For the purpose of investigating whether the choice of currency regimes affects monetary autonomy in practice, the previous studies have so far estimated the sensitivity of local interest rates to changes in international interest rates, examining whether local rates are less sensitive to base interest rate changes under the floating exchange rate regime than under fixed regime. The existing studies have provided inconclusive evidence.

Hausmann et al. (1999) studied the relationship between daily movements in domestic 30-day interest rates and foreign dollar rates on sovereign bonds for Argentina, Venezuela and Mexico for the period September 1997–February 1999. It showed that movements in foreign interest rates have a maximum impact on domestic rates in Mexico (a country that floats), minimal impact in Argentina (a country with a strongly fixed regime) and intermediate effects in Venezuela (a country with limited flexibility). They also ran a similar exercise using monthly data for the 11 countries for the period from 1960 to 1998, reporting that U.S. rates affect domestic rates by 25 percent less in the countries that peg relative to other countries. Thus, they found no evidence to suggest that floating arrangements are better at insulating domestic interest rates from foreign rate movements. Frankel (1999) also reported that the coefficient on U.S. interest rates for floaters, Brazil and Mexico, seems to be higher than that for dollarizers, Panama, Argentina, and Hong Kong for the period from 1986 to 1998. This also speculated that emerging market securities might pay substantial risk premium, and these risk premium might be sensitive to the U.S. government interest rates. Both Hausmann et al. (1999) and Frankel (1999) seem to be in line with the “fear of floating” approach.

On the other hand, Borensztein et al. (2001), focusing on those countries whose regimes can be clearly defined as either currency boards or floating regimes during the period in the early to mid-1990s, found that interest rates in Hong Kong, which has a fixed exchange rate regime, react much more to US interest rates than do interest rates in Singapore, which has a floating exchange rate regime. Shambaugh (2004), by classifying countries as pegged and non-pegged based on the created de facto coding system, examined the interest rate behavior of pegged economies compared with that of non-pegged economies on a sample of over 100 developing and industrial countries from 1973 through 2000, and reported that pegs follow base country interest rates more closely than non-pegs. Kim and Lee (2008), based on the analysis for eight East Asian economies on the sample period of January 1987 to April 2002, found that the sensitivity of local interest rates to international interest rates declined in Korea and Thailand after they adopted the floating exchange rate regimes, as well as that Japan, with a floating exchange regime, has greater independence in monetary policy than a pegged economy such as Hong Kong. The evidence from Borensztein et al. (2001), Shambaugh (2004) and Kim and Lee (2008) appear to be consistent with the traditional view of the “impossible trinity”.

Frankel et al. (2004) represented the mixed outcomes in more sophisticated way through examining the long-run transmission of interest rates and their dynamic adjustment by the error-correction form, using samples of 46 countries (including 18 industrial and 28 developing countries) during the period of January 1970 to December 1999. They found that, although the transmission of international interest rates can not be rejected in the long run even for countries with floating regimes (only a couple of large industrial countries can choose their own interest rates in the long run), short-run effects differ across regimes and interest rates of countries with more flexible regimes adjust more slowly to changes in international rates implying some capacity for monetary independence.

Among the literature mentioned above, this paper extends it in several directions. First, as an estimation sample, we use a recent and global data set: the monthly data from January 1990 to December 2007, and 53 sample countries including industrial and developing ones, while the sample of most of previous studies have been limited to the period before 1990s in fewer sample countries. Second, for regime classification, we adopt de facto exchange rate arrangements recently estimated by Reinhart and Ilzetzki (2009), not the IMF arrangements that do not necessarily reflect actual arrangements though declared formally by member countries. By using the estimates of Reinhart and Ilzetzki (2009), we analyze the widest possible spectrum of regimes from freely floating to rigid pegging. Finally, for estimation technique, we first examine co-integration relationship between domestic and international interests to capture the long-run transmission, and then estimate adjustment speeds in the long-run transmission process by using error-correction model only in case that the co-integration relationship was identified. We adopt these two-step procedures for both estimations for the pooled countries and individual countries. Previous studies have often examined the sensitivity of interest rates by merely comparing the estimated coefficients not considering the adjustment toward the long-run relationship, i.e. without verifying their time series properties of co-integration (if so, spurious correlations can arise between two independent series[2]).

3. Empirical Studies

We now proceed to the empirical analysis. We herein take two-step procedures for both estimations for the pooled and individual countries. We first conduct the unit-root tests to examine co-integration relationship in the long run between domestic interest rates and international ones. Second, we run the error-correction model to investigate adjustment speeds towards the long-run equilibrium of the interest rate differential. This section clarifies the methodology and data, then shows the estimation results and

[2] If the data in question have unit roots (interest rate data is often proved to have a unit root) and are not co-integrated, regressions on levels may generate incorrect results. Although it is true that differencing the data removes the problem of spurious correlations, a regression on differences alone would lose information regarding long-run relationship.

interprets the results.

3.1 Methodology

We here specify the model for estimation first, and then explain the estimation technique – the unit root tests for ordinary time series and panel data in detail.

Specification of Model

We now investigate the relationship between the currency regimes and monetary autonomy, through examining the sensitivity of the domestic interest rate to the international interest rate under different currency regimes. To understand how the international interest rate should affect local rates, we first represent the standard risk-augmented uncovered interest rate parity condition:

$$r = r^* + e + \rho \quad (1)$$

Where r denotes domestic interest rate, r^* denotes the international interest rate, e denotes the expected change in the exchange rate, and ρ denotes the risk premium.

In case of the fixed exchange rate regime, the expected change in the exchange rate e is supposed to be zero, thereby the interest rate differential $r - r^*$ being constant under the constant risk premium ρ. It means that the international interest rate instantaneously affects the domestic rate one-for-one, and gives no room for monetary independence under the fixed regime. In contrast, under the floating regime, the interest rate differential $r - r^*$ can not always be constant, because, even though the international interest rate r^* changes, the exchange rate is allowed to be adjusted so that the expected change in the exchange rate is equal to the created interest rate differential ($e = r - r^*$). It means that the domestic interest does not have to respond to the change in international interest rate, and can be manipulated independently for domestic economic stabilization under the floating regime. Over the long run, however, the change in exchange rate might create demand shifts (shift of the IS curve in the Mundell-Fleming), and domestic interest rate might be adjusted towards the changed international interest rate in the extreme. Thus, the interest differential $r - r^*$ might eventually revert to its steady-state level in the long run even under the floating regime.

For the purpose of estimating the above-mentioned relationships between the domestic interest rate to the international interest rate, we take the following two steps for the estimation, which are based on the method Shambaugh (2004) proposed as time series analysis. We first examine the time series properties of the interest rate differential $r - r^*$. If the series of interest rate differential $r - r^*$ indicates stationarity through unit root tests, there exists the co-integration relationship between the domestic interest rate and the international rate, i.e. the long-run transmission of the international interest rate against the domestic one. In the second place, we estimate adjustment speeds in the long run transmission process by using error-correction model only in case that the co-integration relationship was identified. Specifically, we estimate:

$$\Delta r_t = C + \alpha \Delta r^*_t + \beta(r_{t-1} - r^*_{t-1}) + \varepsilon_t \qquad (2)$$

The specification above can be interpreted in such a way that the long-run behavior of the international interest rate and the domestic interest rate converge to their cointegrating relationship of the interest rate differential of $r - r^*$ while their short-run adjustment dynamics are allowed; the deviation from long-run equilibrium is corrected through a series of partial short-run adjustments. The coefficient of the β measures the adjustment speed of the domestic interest rate towards the long-run equilibrium of the interest rate differential. A priori, we would expect negative sign in β. The larger β means the faster adjustment.

Under the above-mentioned estimation framework, we expect the following outcomes in different currency regimes. In the first step of examining the time series properties of the interest rate differential, the co-integration relationship between the domestic interest rate and the international rate might appear in the fixed regime more clearly than in the floating regime. In the second step of conducting error-correction estimation, the adjustment speed of the domestic interest rate towards the long-run equilibrium of the interest rate differential is supposed to be faster in the fixed regime than in the floating regime. These expectations comes from the fore-mentioned theoretical presumption that the fixed regime makes the domestic interest rate react simultaneously one-for-one to the international interest rate while the floating regime does not always so at least in the short-run.[3] The intermediate exchange rate regime might produce an effect somewhere between the effect of the fixed regime and that of the floating regime. On the other hand, the "fear of floating" might bring about no significant differences in estimation results regardless of the currency regimes.

As we will state later, we construct the data set for the estimation with the monthly data from January 1990 to December 2007, and 53 sample countries including industrial

[3] As Frankel et al. (2004) suggested, we must notice that not only the currency regimes but also the degree of international business cycle synchronization affects the movement of interest rate differential; even under full monetary independence, the observed path of domestic and international interest rates might show co-movement.

and developing ones. By using the data, we conduct two kinds of estimation: the panel estimation for the pooled countries and the ordinary estimation for individual countries. We take the fore-mentioned two-step procedures for both types of estimations.

Procedures of Unit Root tests

We here clarify the estimation technique – the unit root tests in the process driving the interest rate differentials for ordinary time series of individual countries and for panel data with the pooled countries in more detail.

As for the tests for ordinary time series, we use the augmented Dickey-Fuller (ADF) test (Said and Dickey, 1984) and the Philips-Perron (PP) (1988) test. The ADF test consists of running a regression of the first difference of the series against the series lagged once, lagged difference terms as well as a constant and time trend optionally. The PP test does not include lagged difference terms. The output of each test consists of the t-statistic of the coefficient of the series lagged and critical values for the test of a zero coefficient. If the coefficient is significantly different from zero, then the hypothesis that the series contains a unit root is rejected.[4]

As for the test for panel data, we adopt the following five types of panel unit root tests, which are shown in the EViews 6 User's Guide: Levin, Lin and Chu (2002), Breitung (2000), Im, Pesaran and Shin (2003), and Fisher-type tests using ADF and PP tests (Maddala and Wu (1999) and Choi (2001)).[5] Although all the tests are characterized by the combining individual unit root tests to derive a panel-specific result, we can classify the tests on the basis of whether there are restrictions on the autoregressive process across cross-sections. One type of the tests assumes that the parameters of the series lagged are common across cross-sections. The Levin, Lin, and Chu (LLC), and Breitung tests employ this assumption. The other type allows the parameters to vary freely across cross-sections. The Im, Pesaran, and Shin, and Fisher-ADF and Fisher-PP tests are of this form. There is a comment that in the latter type of tests, the null hypothesis of a unit root means joint non-mean reversion of all of series considered, thereby the null hypothesis being violated even if only one of the

[4] As Corbae and Ouliaris (1988) suggested, the ADF test accounts for temporally dependent and heterogeneously distributed errors by including lagged innovation sequences in the fitted regression. In contrast, the PP test accounts for non-independent and identically distributed processes using a non-parametric procedure. Since the ADF relies on a parametric procedure to correct for autocorrelation and heterogeneity, the PP test is often favored over the ADF in terms of power.

[5] The description in this section is based on the EViews 6 User's Guide. The Guide includes one more test of Hadri (2000). This test is, however, said to over-reject the null of stationarity, and may yield results that directly contradict those obtained using alternative test statistics (see Hlouskova and Wagner (2006)). Therefore, we did not adopt the Hadri test here.

series exhibits mean-reverting behavior.[6] Therefore, we do not depend on the results of one type of the tests but adopt both types of the tests. The method can choose to include individual constants, or to include individual constant and trend terms.

3.2 Data

Our basic source of interest rate data is the International Financial Statistics of the International Monetary Fund (IMF). Following the previous study of Frankel et al. (2004), we work with monthly data of "Money Market Rate", the rate on short-term lending between financial institutions, as the domestic interest rate, and also use monthly data of "Treasury Bill Rate" in the United States as the international interest rate.

Our classification of the exchange rate regimes is based on monthly data from Reinhart and Ilzetzki (2009). The IMF represents exchange rate arrangements of the Fund members. However, its classification is often criticized as the one that does not necessarily reflect actual exchange rate arrangements, since it is based on the resume that Fund member formally announced. Many economists, therefore, have often showed their own analysis of the de facto exchange rate regimes. One of the famous and recent estimates is that of Reinhart and Ilzetzki (2009), which reclassified exchange rate regimes by employing newly complied monthly data sets on market-determined exchange rates. From their estimates, we adopt four categories of "monthly coarse classification," which is composed of six categories of exchange rate arrangements. The first category consists of "no separate legal tender," "pre-announced peg or currency board arrangement," "pre-announced horizontal band that is narrower than or equal to +/-2%" and "de facto peg," which we call "hard peg." The second one is "pre-announced crawling peg," "pre-announced crawling band that is narrower than or equal to +/-2%," "de factor crawling peg," and "de facto crawling band that is narrower than or equal to +/-2%," which we call "soft peg." The third one is "pre-announced crawling band that is wider than or equal to +/-2%," "de facto crawling band that is narrower than or equal to +/-5%," "moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)," and "managed floating," all of which we call "managed float" The fourth one is "freely floating", which we simply call "free float"

The sample period is from January 1990 to December 2007. Frankel et al. (2004) divided the sample period from 1970 to 1999 by decades for the reason that financial

[6] For example, Taylor (2003) criticizes the panel unit root tests with the null hypothesis of joint non-mean reversion.

integration increased progressively between the early 1970s and the late 1990s (most countries had liberalized their financial sectors by the beginning of the 1990s), and reported in fact that partitioning the sample does affect the results. We make the sample start after 1990s considering their outcomes above, and finished it in December 2007, the end of the estimate on regime classification by Reinhart and Ilzetzki (2009). The sample countries are 53, including industrial and developing ones. The sample coverage is dictated by the availability of data for interest rate and regime classification. We also exclude countries with population under one million and low-income countries (in which the incidence of interest rate controls seems to be widespread). We further dropped the data with country-regime possessing less than one year of consecutive monthly observation, and the data with the "soft peg" and "hard peg" to other currencies than US dollar, which appears to be less influenced by the US Treasury Bill Rate even under the fixed regime.

3.3 Estimation Results

We first see the results of the first step's estimates – unit root tests on interest rate differential for identifying co-integration relationship between the domestic interest rate and the international interest rate. As for the results of panel unit root test for the pooled countries in Table 1, all the regimes reveals the rejection of the null hypothesis of a unit root on interest rate differential in at least three types of the tests with either intercept or trend and intercept at the significant level of one, to ten percent. The results of panel unit root tests seem to support roughly the stationarity of interest rate differential, thereby co-integration relationship between the domestic interest rate and the international interest rate, regardless of the differences in the exchange rate regimes.

Table 3 reports the results of unit root tests for individual countries. We here treat the case as the one with stationarity of interest rate differential – co-integration of interest rates if the test result shows the rejection of the null hypothesis of a unit root in at least one type of test with either intercept or trend and intercept at the significant level of ten percent. Following the criteria, "free float" has 2 of 5 (40%) cases as stationary series, "managed float" has 13 of 20 (65%), "soft peg" has 15 of 21 (71%), and "hard peg" has 9 of 10 (90%). The outcomes indicate the higher ratio of stationary cases in "peg" regimes than "float" ones, implying that co-integration relationship between the domestic interest rate and the international interest rate appears more often in fixed regimes than floating regimes.

We next look at the results of the second step's estimates – error-correction estimates for investigating adjustment speed of the domestic interest rate towards the long-run equilibrium of the interest rate differential. As for the results of pooled estimates in Table 2, all the regimes have a coefficient of β showing the adjustment speed with the correct sign and significance at one percent. The estimated speed of "free float", "managed float", "soft peg" and "hard peg" are –0.0366, -0.1854, -0.2875, and -0.2530, respectively. It roughly tells us that "float" regimes have the slower speed than "peg" ones. It is noteworthy that the "free float" represents the far slowest speed, and the "hard peg" shows not so fast speed as expected from theoretical presumption.

As for the results of error-correction estimates for individual countries in Table 3, we only focus on the cases where co-integration relationship was identified. All the cases concerned have a coefficient of β with the correct sign and significance at one to five percent. The regime of "free float" shows relatively slower speed of less than -0.1 in two cases. In "managed float", except for such emerging economies as Chile, Indonesia and Paraguay who have relatively high speed of more than -0.2, the cases stay at about -0.1 or less speed of adjustment. In "soft peg", India shows the fastest speed of -0.744, and among the others emerging countries like Philippines, Sri Lanka, Russia and Indonesia show higher speed of around -0.3 and -0.4. In "hard peg", Hong Long, Thailand and Panama record fast speed of more than -0.4 as the theory presumes, while the cases with low speed still remain.

3.4 Summary and Interpretation

We summarize and interpret the estimation results above as follows.

First, our estimation results basically support the traditional views of the "impossible trinity". The floating regime ("free float" and "managed float") shows the less sensitivity of the domestic interest rate to the international interest rate than the fixed regimes ("soft peg" and "hard peg"), with the lack of co-integration relationship or the slower adjustment speed. The result implies some capacity for domestic monetary autonomy under the floating regime.

Second, the "free float" appears to show clearly the less sensitivity of the domestic interest rate to the international interest rate than the other regimes. In the analysis of individual countries, more than half of the cases do not allow co-integration relationship between the domestic interest rate and the international interest rate. In addition, even if there is co-integration relationship in the long run, the adjustment speed of the domestic interest rate towards the long-run relationship is definitely slower in "free float" than in other regimes, as both estimation results for the pooled countries and for individual countries describes.

Third, the "hard peg" does not represent the fastest adjustment speed in the estimation results both for the pooled countries and for individual countries (the "soft peg" shows the fastest speed), although we theoretically presume that the rigidly fixed regime makes the domestic interest rate react simultaneously one-for-one to the international interest rate. We speculate that it is because the restrictions on capital flows might allow the authority to enjoy domestic monetary autonomy even under the fixed exchange rate regime. When we recall again the framework of the "impossible trinity", countries can pursue two of three options – fixed exchange rates, domestic monetary autonomy and capital mobility. If capital mobility is given up, fixed exchange rates and domestic monetary autonomy can cohabit. Looking into the estimation results for individual countries, for example, the classification in "hard peg" includes Malaysia, whose capital flows are said to be restricted (see the indices of capital account restrictions in Miniane 2004). Kim and Yang (2009) analyzed the impacts of the US monetary shocks on East Asian countries, and found that the domestic interest rate does not respond much in the countries with the fixed exchange rate regime and capital account restrictions, such as China and Malaysia.

Finally, there are several cases with co-integration of interest rates and some speed of adjustment, even under the floating regimes of "free float" and "managed float". One of the interpretations is that international business cycle synchronization and common shock might give influence on the observed co-movements of domestic and international interest rates, implying the underestimate of the actual degree of monetary independence. Another interpretation comes from the possibility of the "fear of floating" hypothesis. Such emerging economies as Chile, Indonesia and Paraguay under the "managed float" have relatively high adjustment speed of more than -0.2. As the previous studies of Hausmann et al. (1999) and Frankel (1999) told us, emerging market might suffer from having to pay substantial risk premium (both currency premium to compensate for devaluation risk and country premium to compensate for a default risk) and these risk premium might be sensitive to the international interest rate.

4. Concluding Remarks

This paper analyzes the exchange rate regimes from the perspective of monetary independence through examining the sensitivity of the domestic interest rate to the international interest rate under different regimes. To be specific, by using recent and global data, we first examine co-integration relationship between domestic interest rates and international ones to capture the long-run transmission, and then estimate adjustment speeds in the transmission process of interest rates by using error-correction model.

Our estimation results basically support the traditional views of the “impossible trinity”. The floating regime shows the less sensitivity of the domestic interest rate to the international interest rate than the fixed regimes, with the lack of co-integration relationship or the slower adjustment speed. The result implies some capacity for domestic monetary autonomy under the floating regime. The “hard peg” regime however, does not represent the fastest adjustment speed, which might reflect the existence of the restrictions on capital flows in its sample cases.

It is necessary to notify one caveat of our analysis. Our assessment of monetary autonomy is based on the observed behavior of the domestic and international interest rates. Thus, our analysis might understate the actual degree of monetary independence in such cases as the existence of international business cycle synchronization and common shocks across the countries.

Table 1 Panel Unit Root Tests of Interest Rate Differential

		Free Float	Managed Float	Soft Peg	Hard Peg
Levin, Lin and Chu	Intercept	-2.02 **	-5.28 ***	-4.33 ***	-0.39
	Trend & Intercept	-2.16 **	-1.83 **	-4.32 ***	0.76
Breitung	Intercept	1.96	-0.16	-2.93 ***	-0.97
	Trend & Intercept	-3.40	0.86	-0.80	-0.13
Im, Pesaran and Shin	Intercept	-1.56 *	-7.04 ***	-8.09 ***	-3.85 ***
	Trend & Intercept	1.80	-4.47 ***	-8.17 ***	-1.83 **
Fisher - ADF	Intercept	21.36 **	189.52 ***	201.54 ***	94.19 ***
	Trend & Intercept	13.53	156.57 ***	195.16 ***	85.86 ***
Fisher - PP	Intercept	24.73 **	185.40 ***	257.71 ***	150.29 ***
	Trend & Intercept	10.17	145.05 ***	293.90 ***	141.84 ***
Sample		756	2,577	2,526	1,112

Note) ***, **, and * indicate rejection of the null of nonstationarity at the 1 percent, 5 percent, and 10 percent significance levels with critical values.

Table 2 Error Correction Estimates in The pooled countries

	Free Float	Managed Float	Soft Peg	Hard Peg
Coefficient α	0.0896	-0.2034	-0.4495	-0.3679
Standard Error	0.0765	0.3800	0.4616	0.5222
t-value	1.1706	-0.5354	-0.9737	-0.7045
Coefficient β	-0.0366 ***	-0.1854 ***	-0.2875 ***	-0.2530 ***
Standard Error	0.0037	0.0104	0.0129	0.0246
t-value	-9.6770	-17.7508	-22.1344	-10.2523
Wu-Hausman Test				
Chi-Sq.	13.8583	135.2326	167.8434	65.3941
Chi-Sq. d.f.	2	2	2	2
Prob.	0.0010	0.0000	0.0000	0.0000
Type	Fixed	Fixed	Fixed	Fixed

Note) ***, **, and * indicate rejection of the null of nonstationarity at the 1 percent, 5 percent, and 10 percent significance levels with critical values.

Table 3 Unit Root Tests and Error Correction Estimates in Individual Countries

Country	Periods	Unit Root Tests for *r-r**				Error Correcton Est. β-Coef.
		ADF int.	ADF int.&trend	PP int.	PP int.&trend	
[Free Float]						
Australia	90.01-07.12	-2.16	-4.05 ***	-4.22 ***	-3.54 **	-0.056 ***
Turkey	02.09-07.12	-3.85 ***	-0.35	-2.70 *	-0.70	-0.042 ***
Germany	90.01-98.12	-0.65	-2.13	-0.87	-2.06	-
Japan	90.01-07.12	-1.88	-1.65	-1.47	-1.46	-
South Africa	95.03-07.12	-2.04	-2.47	-1.85	-2.41	-
[Managed Float]						
Chile	99.12-07.12	-3.47 **	-4.65 ***	-3.49 **	-4.64 ***	-0.256 ***
Indonesia	99.04-07.12	-4.39 ***	-4.53 ***	-5.23 ***	-5.62 ***	-0.239 ***
Paraguay	99.07-07.12	-2.42	-2.94	-3.50 ***	-3.80 **	-0.224 ***
Korea	98.07-07.12	-1.57	-1.52	-4.15 ***	-3.83 **	-0.113 ***
Thailand	98.01-07.12	-5.77 ***	-5.29 ***	-5.19 ***	-5.11 ***	-0.108 ***
Norway	90.01-07.12	-2.83 *	-3.03	-2.78 *	-3.32 *	-0.104 ***
Singapore	90.01-07.12	-2.75 *	-2.74	-3.61 ***	-3.60 **	-0.098 ***
Latvia	94.09-01.08	-3.48 **	-3.10	-3.93 ***	-2.99	-0.097 ***
UK	90.01-07.12	-2.61 *	-2.29	-3.01 **	-2.81	-0.091 ***
Colombia	95.03-07.12	-1.61	-3.10	-2.00	-4.09 ***	-0.078 **
Mexico	96.04-07.12	-2.61 *	-3.24 *	-2.64 *	-3.55 **	-0.058 ***
Romania	01.04-07.12	-2.30	-2.69	-2.83 *	-2.33 **	-0.046 ***
Sweden	92.12-04.11	-2.34	-2.25	-3.00 **	-2.50	-0.032 ***
Brazil	99.09-07.12	-2.32	-2.63	-1.27	-1.53	-
Canada	02.06-07.12	-1.48	0.68	-0.99	-0.28	-
Czech Rep	96.03-01.12	-1.06	-1.83	-1.44	-2.34	-
Georgia	99.01-04.11	-2.46	-2.41	-2.42	-2.37	-
New Zealand	90.01-07.12	-2.42	-2.29	-2.45	-2.30	-
Poland	95.06-07.12	-1.24	-2.61	-1.34	-2.69	-
Switzerland	99.01-07.12	-1.87	-1.86	-1.49	-1.48	-
[Soft Peg]						
India	a)	-6.36 ***	-6.33 ***	-6.38 ***	-6.36 ***	-0.744 ***
Philippines	b)	0.17	-4.09 ***	-7.26 ***	-9.44 ***	-0.488 ***
Sri Lanka	90.08-07.12	-6.01 ***	-6.21 ***	-5.90 ***	-6.15 ***	-0.349 ***
Russia	99.12-07.12	-4.06 ***	-4.55 ***	-4.01 ***	-4.63 ***	-0.317 ***
Indonesia	90.01-97.07	-3.68 ***	-3.66 **	-3.66 ***	-3.64 **	-0.305 ***

Country	Periods	Unit Root Tests for *r*-*r**				Error Correcton Est. β-Coef.
		ADF int.	ADF int.&trend	PP int.	PP int.&trend	
[Soft Peg] continued						
Armenia	95.12-06.06	-2.43	-4.14 ***	-4.80 ***	-9.20 ***	-0.287 ***
Paraguay	91.02-99.06	-3.89 ***	-3.87 **	-3.94 ***	-3.92 **	-0.273 ***
Guatemala	97.01-06.04	-2.56	-2.41	-4.00 ***	-4.09 ***	-0.272 ***
Venezuela	96.07-03.01	-3.01 **	-3.54 **	-2.91 **	-3.51 **	-0.233 ***
Uruguay	c)	-3.34 **	-5.11 ***	-2.74 *	-5.05 ***	-0.228 ***
Peru	95.10-07.12	-3.69 ***	-5.54	-3.72 ***	-5.49 ***	-0.179 ***
Jamaica	98.01-07.12	-2.13	-2.76	-2.91 **	-4.05 ***	-0.152 ***
Korea	90.01-97.11	-2.94 **	-3.28 *	-2.96 **	-3.24 *	-0.150 ***
Moldova	00.03-07.12	-3.09 **	-2.69	-3.10 **	-2.69	-0.120 ***
Kuwait	d)	-4.50 ***	-4.14 ***	-4.51 ***	-4.14 ***	-0.059 ***
Argentina	03.02-07.12	-2.06	-2.82	-1.76	-2.60	-
Bolivia	95.01-07.12	-1.62	-2.42	-1.60	-2.51	-
Canada	90.01-02.05	-2.33	-2.12	-2.07	-1.92	-
Dominican Re	96.01-03.10	0.75	-0.53	1.14	-0.25	-
Malaysia	e)	-1.44	-1.58	-1.23	-1.53	-
Mauritius	93.02-07.12	-2.30	-2.54	-2.22	-2.56	-
[Hard Peg]						
Hong Kong	93.12-07.12	-5.17 ***	-5.79 ***	-8.95 ***	-9.58 ***	-0.588 ***
Thailand	90.01-97.06	-4.48 ***	-4.43 ***	-4.49 ***	-4.45 ***	-0.435 ***
Panama	02.01-07.12	-2.11	-2.08	-3.13 **	-3.12	-0.422 ***
Ukraine	00.04-07.12	-3.33 **	-5.35 ***	-4.22 ***	-5.83 ***	-0.339 ***
El Salvador	97.01-04.06	-2.25	-2.79	-3.82 ***	-4.29 ***	-0.326 ***
Argentina	91.04-01.11	-0.68	0.31	-3.22 **	-2.71	-0.325 ***
Jordan	99.01.07.12	-3.20 **	-2.76	-3.64 ***	-3.75 **	-0.209 ***
Kuwait	03.01-07.12	-2.81 *	-2.86	-2.19	-2.21	-0.166 **
Lithuania	95.04-02.12	-2.53	-2.26	-2.64 *	-1.95	-0.068 **
Malaysia	98.10-05.07	-1.33	-1.80	-1.55	-2.37	-

a) 90.01-91.07, 95.07-98.05, 06.05-07.12
b) 90.01-93.04, 99.12-07.12
c) 95.10-01.12, 05.06-07.12
d) 90.01-90.07, 92.11-02.12
e) 90.01-97.07, 05.08-07.12

Note 1) ***, **, and * indicate rejection of the null of nonstationarity at the 1 percent, 5 percent, and 10 percent significance levels with critical values.

2) The cases are limited to the ones posessing the data period with more than five years.

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