On the Identification of De Facto Currency Pegs [*]

Agnès Bénassy-Quéré[**] and Benoît Cœuré[***]

February 2003

[*] A preliminary version of this paper was circulated as the first section of "Big and Small Currencies: The Regional Connection", CEPII Working Paper N°2000-10. We are grateful to seminar participants and particularly to Barry Eichengreen for their comments. The computer code, data and complete estimation results can be provided on request to the authors.

[**] University of Paris X - Nanterre and CEPII, 9 rue Georges Pitard, 75015 Paris, France, e-mail: a.benassy@cepii.fr, tel. 332 1 53 68 55 47, fax 33 1 53 68 55 03, corresponding author.

[***] French Ministry of Economy and Finance, 75572 Paris Cedex 12, e-mail: benoit.coeure@aft.gouv.fr

ABSTRACT

We describe a currency peg on a dollar/euro/yen basket as an orthogonality condition for bilateral exchange rates vis-à-vis these currencies. This approach avoids the choice of a numeraire and allows simple testing on the composition of the peg. GMM estimation is performed before and after the 1997-1998 crises for respectively 114 and 126 currencies. We find that the number of pegs has not diminished after the crises. Intermediate regimes, defined as de facto pegs which are not reported as hard pegs by the IMF, have been declining, to the only benefit of hard pegs (not free floats), as a consequence of the launch of the euro. The dollar remains the main anchor currency.

Keywords: exchange rate regimes, generalised method of moments.

JEL: F33.

1. Introduction

In the aftermath of the 1997-1998 emerging market crises, it has been recognised that, in a world of free capital movement, conventionally fixed exchange rate regimes are excessively vulnerable. This leaves free floating regimes and hard exchange rate pegs (currency boards, full dollarization, or monetary unions) as the only sustainable exchange rate regimes (see Eichengreen, 1994; Fischer, 2001). Indeed, a "hollowing out" of intermediate regimes over the 1990s has been evidenced ex post by the IMF (1997), Camarazza and Aziz (1998), Eichengreen (1999) or Fischer (2001), although Masson (2001) has shown that the dynamics of exchange rate regime change does not lead to a convergence towards a "two-corner" international monetary system.

In the late 1990s, however, it has been increasingly recognised that official exchange-rate regimes as declared to the IMF by participating countries often differ from de facto exchange-rate regimes, which can be inferred from the behaviour of exchange rates and of official reserves. Early evidence can be found in Frankel and Wei (1993) who evidence de facto pegs on the US dollar in a number of countries which do not publicise such regimes. Calvo and Reinhart (2000) compare 39 official regimes on the basis of variables related to exchange-rate regimes, namely the volatility of: the nominal exchange rate, foreign exchange reserves, the nominal interest rate, and base money. They find that "countries that say they allow their exchange rate to float mostly do not (and) most episodes that come under the heading of floating exchange rates look more like noncredible pegs" (Calvo and Reinhart, 2000, p. 2-3). Furthermore, Bofinger and Wollmershäuser (2001) classify these official floating regimes into three sub-categories: pure floats (where the monetary authorities do not intervene on the foreign exchange market), independent float (where they intervene to stabilise the exchange rate around its market-determined trend) and managed floats (where they follow an unannounced target path for the exchange rate). Relying on monthly reserve data, they show that pure floaters are indeed a minority.

Following early work by Ghosh et al. (1997) which already made a distinction between "frequent" and "infrequent" peg adjusters, the IMF itself has revised its assessment of "official regimes" since 1999 by correcting declared regimes for the observed behaviour of nominal exchange rates and official

reserves. Using this methodology, Bubula and Ötker-Robe (2002) provide a comprehensive classification of exchange-rate regimes over the 1990-2001 period for all IMF members. They confirm the rising share (in terms of the number of countries) of flexible regimes (free floats and managed floats) and of hard pegs. The decline of soft pegs owes to the sharp drop in the number of basket pegs and is primarily due to developed countries, whereas soft pegs have remained popular amongst low developed countries. Finally, they confirm the findings by Masson (2001) that exchange rate regimes are highly persistent, and that transitions remain possible from any single regime to any other one, although the probability to keep an extreme regime may have increased in recent years.

Like Bubula and Ötker-Robe (2002), Reinhart and Rogoff (2002) rely on a mix of official declarations and of de facto observations. However they depart from the former by using information on dual (or multiple) exchange-rate systems and parallel markets. On the basis of their classification for 153 countries over 1946-2001, they show that floating regimes were much less frequent than usually thought during the Bretton Woods era, whereas they were more frequent than officially set afterwards. However their de facto observations are based on absolute monthly variations of exchange rates against single currencies or against the SDR, which does not allow them to identify de facto basket pegs.

Finally, Levy-Yeyati and Sturzenegger (2000) propose a classification of de facto exchange-rate regimes which does not rely on information on official regimes. Contrasting with the official picture, they find that the proportions of free floating regimes, fixed pegs and managed floats did not vary considerably during the 1990s. However they are not able to distinguish between conventional fixed pegs and hard pegs.

Most of these papers have a common limitation: they measure the stability of nominal exchange rates against a single reference currency (the US dollar), whereas in practice, regimes with limited flexibility have often taken as a reference a basket of key currencies -say, the dollar, the Deutsche mark (more recently the euro) and the yen-, or currencies whose exchange rate against the US dollar is itself not fixed.

In this paper, we derive an empirical method for identifying de facto exchange rate stability without having to chose an arbitrary numeraire. Specifically, we define an exchange-rate basket peg as any stable linear combination of the variations of bilateral exchange rates against the dollar, the euro and the yen. When significant, the coefficients can be interpreted as the implicit weights of the basket. Finally, we use official classification to distinguish hard pegs from soft pegs. The analysis is carried out for 165 currencies before and after the 1997-1998 currency crisis.

Section 2 discusses methodological pitfalls. Section 3 presents our approach. In Section 4, the results are presented, and in Section 5 they are compared to available classifications. Section 6 concludes.

2. Implicit basket pegs: methodological pitfalls

Implicit basket pegs can be identified by relating the rate of return of any given currency *i* to the return of reference currencies, usually the U.S. dollar, the DM/euro, and the yen.[1]

$$\Delta e_{ikt} = a_0 + a_1 \Delta e_{\$kt} + a_2 \Delta e_{Ekt} + a_3 \Delta e_{Ykt} + u_t \qquad (1)$$

where Δe_{ikt} denotes the log-change of currency i in terms of a so-called numeraire currency k,. a_0 captures the average rate of depreciation, e.g. in the case of a crawling peg. $a_{j\ (j>0)}$ is the weight of currency j in the implicit basket peg. If none of the coefficients is significant then i is considered as a floating currency. If one of them does not significantly differ from unity and all others do not differ significantly from zero, then i has a unitary peg to the corresponding j. In other cases, i is considered as pegged to a basket.

This method has the virtue of simplicity but it depends heavily on the choice of a numeraire currency. If the numeraire moves together with one of the currency included in the basket, then one of the exogenous variables has a small variance and may be confused with the constant term. As pointed out by Galati (1999), this prevents from using the Swiss franc (which was linked to the DM over the past),

[1] To our knowledge, Haldane and Hall (1991) were the first ones to use such methodology for studying the linkages amongst the Sterling, the US dollar and the Deutschemark. The methodology was then applied to estimating de facto basket pegs by Frankel and Wei (1993, 1995) and later by Bénassy-Quéré (1999), Frankel et al. (2001), Galati (1999) and Ohno (1999).

the pound sterling (which is partially linked to the dollar and to the DM), or else the Australian dollar (which is partially linked to the US dollar).

Thus, a given currency should be used as a numeraire only if there is a priori presumption that it is uncorrelated with all other currencies involved. Accordingly, Frankel and Wei (1994) use the Swiss franc as the numeraire to study countries which have to choose between the dollar and the yen, not the DM or the euro. Another solution is to use a basket of currencies: Special Drawing Rights in Frankel and Wei (1993) or a basket of Group of Seven currencies in Frankel et al. (2001). However, whenever reference currencies have a significant weight in this basket, it is easy to check that the right hand side of (1) can be close to zero even when *i* is not pegged to the basket. This is why Frankel (1993) chooses to express the exchange rates in terms of a common basket of goods, instead of currencies. This solves the previous problem but estimated pegs are then real pegs rather than nominal ones.

The last solution is to use a reference currency as the numeraire as in Bénassy-Quéré (1999):

$$\Delta e_{i\$} = a_0 + a_1 \Delta e_{E\$} + a_2 \Delta e_{Y\$} + u \qquad (2)$$

However, the a_i coefficients cannot then be interpreted as weights in an implicit basket peg, and the method does not allow to depart a dollar peg from a free float. It is indeed possible to use the euro or the yen as the numeraire in a second stage. But second step estimates may not be consistent with those obtained with the dollar, due to the correlation among exogenous variables and because the tests are not properly nested.

3. A method of moment approach

We define an implicit basket as a stable linear combination of bilateral exchange-rate variations. We use bilateral exchange rates against the three major currencies which are known to be floating against each other: the US dollar, the yen and the euro. Let Δe_{ij} be the first difference of the logarithm of nominal exchange rate between currency i and currency j, and let $X_{it} = (\Delta e_{i\$}, \Delta e_{i€}, \Delta e_{i¥})_t$' be the vector of these three variations between t-1 and t against the USD, the euro and the yen respectively. Currency *i*

is pegged on a dollar/euro/yen basket with weights $\alpha_i = (\alpha_{i\$},\alpha_{i€},\alpha_{i¥})'$ if and only if, for any outside numeraire *j*, the variation of *i* against *j* is a weighted average of the variations of the three reference currencies against *j*:

$$\forall t, \Delta e_{ijt} = -\alpha_i' X_{jt} + \beta_i \quad (3)$$

Substituting $\Delta e_{j\$}$ with $(\Delta e_{i\$}-\Delta e_{ij})$ leads to $(1-\alpha_{i\$}-\alpha_{i€}-\alpha_{i¥})\,\Delta e_{ijt} = -\alpha_i' X_{it} + \beta_i$ for all t, thus:

$$\forall t, \alpha_i' X_{it} = \beta_i \quad (4)$$

The left-hand side of (4) can be seen as an effective exchange rate with endogenous weights in terms of the three main currencies. A geometrical interpretation is the following: in the three-dimensional space where Cartesian coordinates are the exchange rates against the reference currencies, *i* is pegged to a basket α_i of the reference currencies if and only if the path of X_{it} over time is bound within a plan orthogonal to vector α_i. The empirical application then amounts to choosing the combination of these three currencies which tracks best the observed behaviour of currency *i*, i.e. the plan on which the path of X_{it} over time can best be projected.

INSERT FIGURE 1

In the case of a managed float, the peg does not take the form of a legal arrangement but only of an objective of monetary authorities. Equation (4) does not necessarily hold at all time, but the weekly deviation from the peg must be orthogonal to the information set of market participants. Thus the peg can be described as an orthogonality condition $E(\alpha_i' X_i-\beta_i).Z_i = 0$ where Z_i is a vector of *k* instruments belonging to the information set of market operators and monetary authorities. This suggests using a method of moment to identify the parameters (α_i,β_i). The GMM estimator $\hat{a}_i$ minimises the following criterion function:

$$J_T(\alpha,\beta) = 1/T^2\,(\Sigma_t(\alpha' X_{it}-\beta).Z_t)' W^{-1} \Sigma_t(\alpha' X_{it}-\beta).Z_t \quad (5)$$

where $\hat{a}_i$ is identified by imposing the constraint $\alpha_{i\$}+\alpha_{i€}+\alpha_{iy} = 1$. The distance matrix W which yields an asymptotically efficient estimator is the asymptotic covariance matrix of the empirical moments

(Hansen, 1982). Since high frequency exchange rates are known to be heteroskedastic and autocorrelated, we use the non-parametric estimator of Newey and West (1987)[2]. Hansen's *J* test statistic, which is equal to T times the value of the criterion at the optimum, can be used as a specification test (i.e. a test of the validity of the instruments). Under the null hypothesis $E(\alpha_i'X_i-\beta_i).Z_i = 0$, *J* is distributed as chi-squared with (k-3) degrees of freedom, since there are three independent coefficients. Note that *J* cannot be used to test the *existence* of a basket peg for two reasons: first, it also evaluates the relevance of the instruments since for the null hypothesis to hold, the currency has to be basket pegged *and* the instruments have to be valid, second, this would induce a strong bias towards pegs since the null hypothesis would then be the existence, not the absence of a peg.

We consider a currency to be considered pegged to a basket when at least one of the basket coefficients is significantly different from zero. We then test for the presence of a unitary dollar peg $\{\alpha_{i\$}=1\}$, euro peg $\{\alpha_{i€}=1\}$ or yen peg $\{\alpha_{iy}=1\}$ by estimating the model under the corresponding constraint and computing the likelihood ratio statistics, which is T times the difference between the value of the criterion J_T in the restricted and unrestricted models[3]. It is distributed as chi-squared with two degrees of freedom under the null of a unitary peg.

We believe that the assessment of exchange rate stability is made more robust by the fact it does not rely on a specific numeraire. The constraint that the basket weights should sum to one must be viewed as a mere scale factor. It is neutral to the results since both the coefficients and the standard errors are proportional to this scaling factor. It makes it possible for the coefficients to be interpreted once they are significant.

An important cave-at of our method is that this method allows to conclude on the stability of nominal exchange rates, but it does not identify whether this stability results from a deliberate exchange rate policy or from other mechanisms, e.g. a business cycle correlated with that of large economies. Hence, it should be viewed as a complement rather than a substitute to the studies reviewed in Section 1.

[2] Our aim is not to model exchange rate dynamics but to identify statistical regularities among currencies. We therefore do not want to make assumptions on the datagenerating process, hence the non-parametric approach. W_T is estimated iteratively,

4. Estimation results

Our sample comprises end-week data for 165 currencies taken from Datastream over the period 1994-2001. We define a *pre-crisis* period beginning with the devaluation of the CFA franc and ending just before the devaluation of the Thai baht (148 observations from 17 January 1994 to 30 June 1997) and a *post-crisis* period beginning after the financial market turmoil of Fall 1998 (128 observations from 12 October 1998 to 26 March 2001). Missing data leave us with 114 currencies in the first period and 126 in the second. The euro is identified with the Ecu before 1 January 1999.

Instruments include a constant and five lags of endogenous variables. Autocorrelation is corrected up to five lags. All tests are accepted at a 1% level.

The results are summarised in Table 1, with a 1% confidence level. They show that a very small proportion of countries do not have stable exchange rates against key currencies in the limited sense outlined in the previous section, and that this proportion has remained stable after the crises. Strikingly, the proportion of free floating regimes has also remained stable. The main change between the two periods is related to the launch of the euro, which has transformed many of the previous "basket pegs" into pegs on the euro (including the African CFA countries which were considered unitary peggers on the French franc but are only partial peggers on the euro). Indeed, the group EMU+CFA represents 25% of the countries over the first period, which exceeds the amount of the euro pegs increase between the two periods. Conversely, the US dollar has remained the main anchor currency, whereas the role of the yen has remained marginal.

INSERT TABLE 1

We then separate hard pegs from soft pegs. Specifically, we define intermediate regimes as those regimes evidencing a stable combination of bilateral exchange-rate changes but which were not declared as hard pegs to the IMF at the corresponding time (respectively, end 1996 and end 1999). Hard pegs include monetary unions, full dollarization, currency boards and the CFA arrangement.

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starting from the identity matrix and using the residuals of the previous stages until convergence.

Again, the proportion of intermediate regimes should be viewed as an upper estimate since it stems from an extensive definition of pegs. Figure 2 shows that this proportion did decline after the crises. However the decline can be entirely explained by the launch of European monetary union, as evidenced in Figure 3: when euro area countries have been removed from the analysis, the proportions of free floats, intermediate regimes and hard pegs remain almost the same before and after the crises.

INSERT FIGURE 2

INSERT FIGURE 3

Hence, the observed "hollowing out" of intermediate regimes after the currency crises is mainly due to the reduction in the number of basket pegs due to the creation of the euro. This finding is consistent with Bubula and Ötker-Robe (2002) who show the "hollowing out" to be due to fewer basket pegs in developed countries.

5. Comparisons with other classifications

Here we compare our regime classification (BQC thereafter) with other existing classifications.

From IMF classifications, it is easy to aggregate official regimes in three groups: hard pegs, free floats and intermediate regimes. This can be done by grouping together monetary unions, fully dollarized regimes, currency boards and the CFA arrangement on the one side (hard pegs), and conventional fixed pegs, crawling pegs, regimes with bands and managed floats on the other side (intermediate regimes). Here we use the official IMF classification, correcting 1999 data for keeping the same methodology than in 1996.

Levy-Yeyati and Sturzenegger (LYS thereafter) provide a classification of de facto regimes in three groups. However the divide is between dirty float and fixed regimes, not between soft pegs and hard pegs. After removing "inconclusive regimes" from their analysis, we group dirty floats in LYS sense with fixed pegs, but we exclude hard pegs (identified through official declarations) from this grouping.

[3] Both estimations use the efficient distance matrix of the unconstrained model so that the *J*s can be compared.

This correction allows us to compare the LYS classification with ours (BQC) and with official regimes (IMF).

Finally, we add the de facto classification provided by Bubula and Ötker-Robe (2002), noted BOR hereafter. This classification consists in correcting the official IMF classification with miscellaneous information ranging from the behaviour of official reserves to official reports and speeches. We aggregate the 13-item classification into three groups in order to match our own divide.

In Table 2, we report the coefficients of correlation of the eight classifications (four methods, two periods). The various classifications are closer to each other in the second period due to the rising share of hard pegs which are not ambiguous regimes. The BQC classification is closer to the IMF than is the LYS classification: the coefficient of correlation is 0.7 (1^{st} period) and 0.8 (2^{nd} period) in the former case, whereas it is 0.3 (1^{st} period) and 0.5 (2^{nd} period) in the latter case. This result is somewhat puzzling in the sense that the LYS classification, which accounts for official reserves changes, should be closer to official regimes. It may be argued that the various coefficients of correlation are not calculated on the same sample of countries. However restricting the sample to countries which are studied by all four sources also leads to higher correlation between BQC and IMF than between LYS and IMF (although the discrepancies are then substantially reduced). The BOR classification produces the same feature as the IMF one; accordingly, it is closer to BQC than to LYS.

In brief, the BQC classification seems to lie in between the LYS classification and the IMF/BOR ones, with relatively low correlation (around 0.5) between BQC and LYS. This exercise illustrates the difficulty to identify exchange-rate regimes.

INSERT TABLE 2

Finally, for the sake of analysis of our results, a country-by-country comparison between our classification and official regimes is proposed in Table 3 for a sub-sample of countries in East Asia, Latin America and Central and Eastern Europe. From this table, it is clear that, with the exceptions of

Brazil and Indonesia, the move of official regimes towards self-reported "free floats" has not been accompanied by de facto currency independence.

Two opposite interpretations could be drawn from this result. The first interpretation is the "fear-of-floating" syndrom identified by Calvo and Reinhart (2000): countries with high exchange rate pass-through to domestic prices, and dollar-denominated liabilities and foreign trade are reluctant to let their exchange rate float freely against the dollar. This could be the case for instance in Korea (see Park, Wang and Chung, 1999). The second interpretation is that higher economic integration lead to more stable exchange rates (or more regular exchange-rate changes) due to the higher correlation between shocks hitting the domestic economy and shocks to large, developed economies. Exchange rate stability comes as a consequence. This is the thesis advocated by CEEC countries such as Poland: in this line of reasoning, a stable exchange rate against the euro would come as a result of economic convergence towards the rest of the EU, without constraining nominal exchange policy (e.g. by joining the European exchange-rate mechanism). The same story could be told in the case of Mexico and the United States.

INSERT TABLE 3

6. Conclusion

In this paper, we have presented a new method to identify exchange rate basket pegs without relying on a specific numeraire currency. Comparing such de facto pegs with official IMF classifications allows to conclude that intermediate regimes have been declining after 1997-1998 crises, but to the only benefit of hard pegs, not of free floating regimes. Furthermore, this shift can be explained entirely by the launch of the euro. Indeed, free floating currencies seem to be very few in practice. This can be explained either by "fear-of-floating" or as the endogenous outcome of higher economic integration with large developed economies. The "two-corner" approach to exchange rate regime choice has failed to explain the survival of de facto intermediate regimes despite high capital mobility: this could well be related to the increasing number of such "de facto managed floats".

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FIGURE 1. The exchange rate path in the dollar/euro/yen space in the case of a basket peg

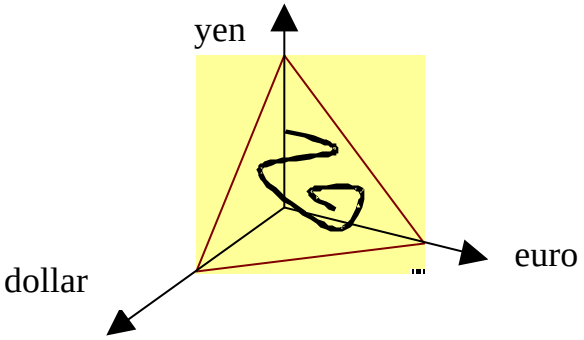

FIGURE 2. Intermediate regimes before and after the crises: all countries

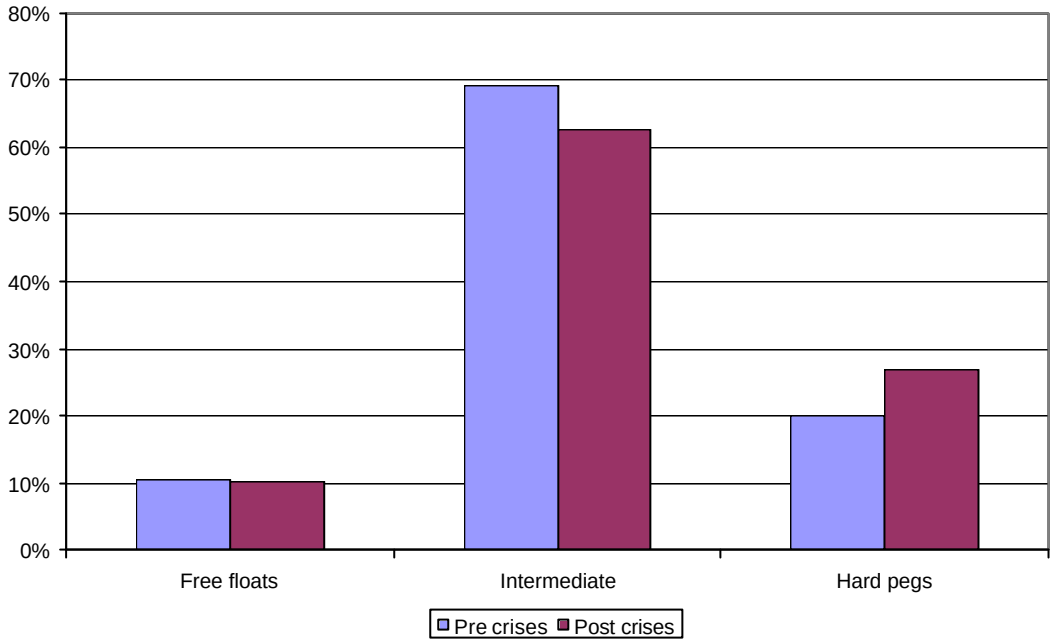

FIGURE 3. Intermediate regimes before and after the crises: all but euro area countries.

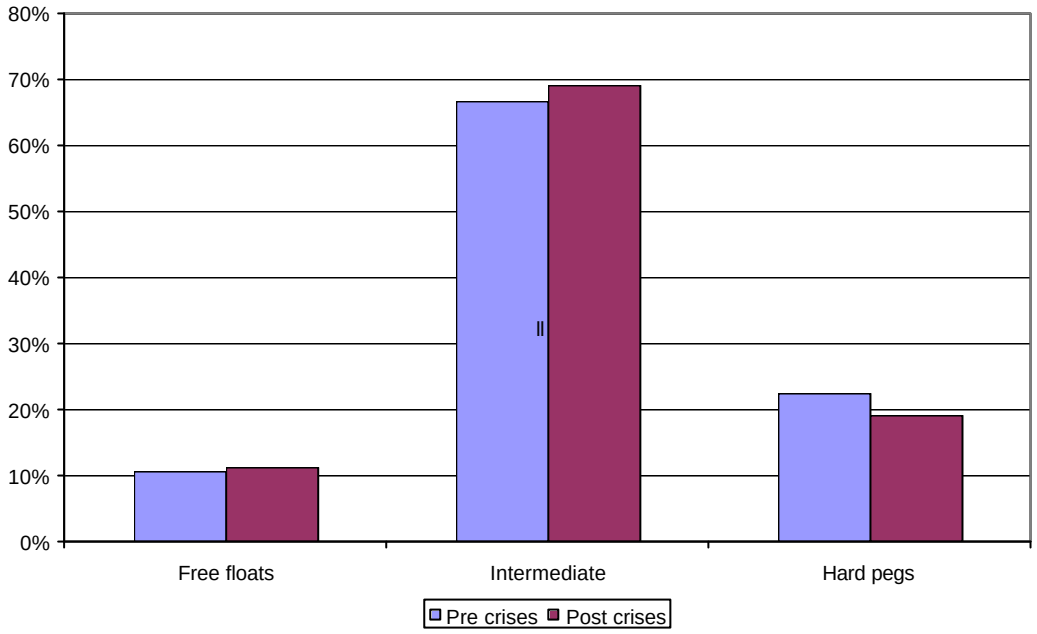

Table 1: GMM summary results

	Nb of currencies	Floating regimes	Pegged regimes	*of which*			
				USD	EUR	YEN	BASKET
Pre crises	114	11%	891%	39%	9%	0%	41%
Post crises	126	10%	90%	38%	29%	0%	22%

Source: author's calculations.

Table 2. Coefficients of correlation between 3-item regime classifications.

		Pre crises				Post crises			
		BQC	LYS	IMF	BOR	BQC	LYS	IMF	BOR
Pre crises	BQC	1							
	LYS	0.44	1						
	IMF	0.73	0.27	1					
	BOR	0.67	0.29	0.77	1				
Post crises	BQC	0.60	0.36	0.62	0.63	1			
	LYS	0.48	0.70	0.39	0.32	0.54	1		
	IMF	0.60	0.34	0.74	0.68	0.82	0.51	1	
	BOR	0.58	0.34	0.70	0.73	0.81	0.53	0.92	1

Table 3. Country-by-country comparison between BQC and IMF classifications.

	Pre crises		Post crises	
	IMF	BQC	IMF	BQC
East Asia				
China	Intermediate	Peg on dollar	Intermediate	Peg on basket
Indonesia	Intermediate	Peg on dollar	Free float	No peg
Korea	Intermediate	Peg on dollar	Free float	Peg on dollar
Malaysia	Intermediate	Peg on dollar	Intermediate	Peg on dollar
Philippines	Intermediate	Peg on dollar	Free float	Peg on dollar
Singapore	Intermediate	Peg on basket	Intermediate	Peg on dollar
Thailand	Intermediate	Peg on basket	Free float	Peg on dollar
Latin America				
Argentina	Hard peg	Peg on dollar	Hard peg	Peg on dollar
Bolivia	Intermediate	Peg on dollar	Intermediate	Peg on dollar
Brazil	Intermediate	Peg on dollar	Free float	No peg
Colombia	Intermediate	Peg on dollar	Free float	Peg on dollar
Chile	Intermediate	No peg	Free float	Peg on dollar
Mexico	Free float	Peg on dollar	Free float	Peg on dollar
Uruguay	Intermediate	Peg on basket	Intermediate	Peg on dollar
Venezuela	Intermediate	Peg on dollar	Intermediate	Peg on dollar
CEEC				
Czech rep.	Intermediate	Peg on basket	Intermediate	Peg on euro
Hungary	Intermediate	Peg on basket	Intermediate	Peg on basket
Poland	Intermediate	Peg on basket	Free float	Peg on euro
Slovak Rep.	Intermediate	Peg on dollar	Intermediate	Peg on euro