IMF Staff Papers
Vol. 55, No. 3

Estimation of De Facto Exchange Rate Regimes: Synthesis of the Techniques for Inferring Flexibility and Basket Weights

JEFFREY FRANKEL and SHANG-JIN WEI*

This paper offers a new approach to estimate countries' de facto exchange rate regimes, a synthesis of two techniques. One is a technique that the authors have used in the past to estimate implicit de facto weights when the hypothesis is a basket peg with little flexibility. The second is a technique used by others to estimate the de facto degree of exchange rate flexibility when the hypothesis is an anchor to the dollar or some other single major currency, but with a possibly substantial degree of flexibility around that anchor. Because many currencies today follow variants of band-basket-crawl, it is important to have available a technique that can cover both dimensions, inferring weights and flexibility. We try out the technique on some 20 currencies over the period 1980–2007. Most are currencies that have officially used baskets as anchors for at least part of this sample period. But a few are known floaters or known simple peggers. In general, the synthesis technique seems to work as it should. [JEL F31, F41]
IMF Staff Papers (2008) **55,** 384–416. doi:10.1057/imfsp.2008.18;
published online 1 July 2008

---

*Jeffrey Frankel is the James W. Harpel Professor of Capital Formation and Growth at the John F. Kennedy School of Government at Harvard University. Shang-Jin Wei is a professor of finance and economics, and N.T. Wang Professor of Chinese Business and Economy, at the Columbia University Business School. The longer working paper version of this paper includes all tables and is available at http://www.cid.harvard.edu/cidwp/157.html. Files of data, programs, and output, to aid any replication attempts, are posted at http://ksghome.harvard.edu/~jfrankel/currentpubsspeeches.htm#On%20Exchange%20Rate%20Regimes. The print version of the longer working paper is available as NBER Working Paper 14016. The authors wish to thank Danxia Xie for excellent research assistance and Steve Kamin and other participants at the IMF Annual Research Conference for useful comments. They also thank the Mossavar-Rahmani Center of Business and Government and the Kuwait Fund of the Kennedy School of Government for support.

Exchange rate surveillance has moved back toward the top of the list of the IMF's mandates and priorities. Before one can evaluate whether a given country is following the right exchange rate regime, however, one must decide what the regime is that it is following. This seemingly simple task is far harder than one might think. Perhaps IMF staff could use some new analytical tools if it is to pursue this assignment conscientiously and persuasively. This paper proposes a technique to classify a de facto regime. It estimates simultaneously the implicit currency weights in the basket that anchors the home currency, and the degree of flexibility around that anchor.

I. De Facto vs. De Jure Classification of Exchange Rate Regimes

It is by now well-known that there is a big difference between de facto exchange rate regimes, that is, the regimes that countries follow in practice, and de jure exchange rate regimes, that is, the regimes that national governments officially claim to be following and which, at least until 1997, were reproduced by the IMF almost unquestioningly in the table at the front of *International Financial Statistics*. The discrepancy between de facto and de jure is pervasive. In the first place, most countries that claim to "fix" are not, in fact, firmly fixed. Countries declaring a peg, often abandon it. Obstfeld and Rogoff pointed out in their 1995 article "The Mirage of Fixed Rates," that only six major economies (leaving aside some with capital controls) had kept a peg longer than five years.

In the second place, most countries that claim to "float," are not in fact floating. Calvo and Reinhart (2002) coined the phrase "fear of floating." They showed that the variability of foreign exchange reserves relative to the variability of the exchange rate was not only substantial for those who claimed to be floating (one might expect zero for a true pure floater), but that it tended to be fully as great as for those who are officially pegging. Many emerging market countries that claim to float, sometimes under an official monetary rule of inflation targeting, in fact have intervened heavily in recent years to dampen the appreciation of their currencies.

In the third place, many countries that claim to be following one of the transparent intermediate regimes, namely a basket peg (or even a basket with a band), in fact do not. They keep the weights in the basket secret so that the government can surreptitiously depart from the official regime. When a country declares a basket peg with a band, it typically would take more than 100 observations for an observer to distinguish statistically whether it is in fact following this policy (Frankel, Schmukler, and Servén, 2000). The national authorities are no doubt aware of this when they decide to keep the basket weights secret.

There is no more topical illustration of this problem than the Chinese yuan. The Beijing authorities announced a change in exchange rate regime in July 2005, a switch away from a dollar peg and toward a more flexible regime with reference to a basket of 11 currencies, with a small (but cumulative) band. They did not announce what were the weights on the currencies. As with so many other basket peggers, there is reason to suspect that the secrecy is not an accidental oversight. It is there deliberately to cloak a discrepancy between de jure and de facto. That the yuan is not just another currency—but lies at the heart of the disagreement to which the United States currently chooses to give top priority in its relations with China—makes it a particularly relevant example.

There are by now many attempts to discern the true "de facto" exchange rate regimes that countries actually follow. Some of the more prominent include Ghosh, Gulde, and Wolf (2002); Levy-Yeyati and Sturzenegger (2003); Reinhart and Rogoff (2004); and Shambaugh (2004). Most of these classification schemes depart from the official classification in the direction of counting as de facto floating a country that has high variability of the exchange rate (or of the change in the exchange rate), relative to variability of reserves, and counting as fixed a country that has low variability of the exchange rate relative to reserves. A recent survey by Tavlas, Dellas, and Stockman (2006) that covers 11 studies divides them into two categories, viewed as

- "Pure de facto classifications because…assignment of regimes is based solely on statistical algorithms and/or econometric estimation" vs.
- "Mixed de jure-de facto classifications, because the self-declared regimes are adjusted by the devisers for anomalies." One of the latter is the official product of the IMF's former Monetary and Exchange Affairs Department (Bubula and Ötker-Robe, 2003) where the adjustment is accomplished both by consulting IMF economists and by looking at movements in reserves and exchange rates.

Although the discrepancy between the de jure regimes and any given attempt to determine de facto regime is well-known, it is less widely recognized that the various systems for classifying de facto regimes do not agree with each other. Calculations of correlations or correspondence across different classification schemes show that the de facto schemes hardly correspond any more closely to each other than to the official classification.[1]

There are various explanations for the variation in conclusions reached by the different classification schemes: differences in methodology, different choices as to where to draw the line between regimes, differences in timing of the data, and so forth. But perhaps the best way of summarizing the problem is that, apart from a relatively small number of countries that peg firmly (for example, countries with institutional commitments in the form of currency boards) and the handful that float freely (for example, the United States), most follow some messy intermediate regime that is not easily identified or

[1]See Table 1 in the working paper version of this paper, which also reports analogous tables. Computed by Shambaugh (2004) and Bénassy-Quéré, Coeuré, and Mignon (2006).

unambiguously classified. This flies in the face of the famous ''corners hypothesis'' that rapidly became the conventional wisdom in the late 1990s, and has subsequently declined almost as rapidly. The corners hypothesis claimed that countries were abandoning the intermediate regimes in favor of the two corners: exchange rates fixed institutionally, as through a currency board, vs. freely floating exchange rates. But it is a fact that a majority of countries continue to follow some regime in between firm fixing and free floating (Masson, 2001).

One intermediate regime is the basket peg. Often it comes combined with a managed float that ''leans against the wind'' to push the current exchange rate back in the direction of the central parity when it wanders afield, or more specifically with an announced band (target zone).[2] In any case, the weights in the basket are often kept secret, as already noted. There exists a branch of the de facto classification literature that is different from and smaller than the research on flexibility vs. fixity cited above. The second approach applies especially to countries that are thought possibly to use baskets, for example because they say they do. This approach discerns from actual data the implicit weights placed on the constituent foreign currencies of the basket. The simple methodology was first developed in the early 1990s to test whether a country that announces a basket peg but does not reveal the exact weighting of the component currencies is acting in a manner consistent with its words: Frankel (1993) and Frankel and Wei (1994, 1995). The approach has since been used by others, including Bénassy-Quéré (1999); Ohno (1999); Frankel, Schmukler, and Servén (2000); Frankel and others (2001); and Bénassy-Quéré, Coeuré, and Mignon (2006).[3]

These two branches of the literature have hitherto remained separate, in splendid isolation. It could be argued that each has its own place. If one is confident that a country is following a basket peg, and is unsure only of the weights, one should then use the weight-inference technique. If one is confident of the major anchor currency (dollar, euro, etc.) in terms of which a government defines the value of its own currency, and is unsure only of the strength of the effort to stabilize, then one should use one of the methods of the larger branch of the literature, such as comparing the variability of the exchange rate (vis-à-vis the dollar or euro, etc.) to the variability of reserves. The problem is that some countries do define a central parity in terms of weights but then allow variation around that parity. China since 2005 is a good example of a country that claims to be doing this, and Chile in the 1990s is a good example of a country that actually did it. And even if one suspects that a country is in truth following a simple peg, it is always better to have a meaningful alternative hypothesis within which the null hypothesis is

[2]Williamson (2001) proposes that many Asian countries should adopt combinations of baskets and bands (and perhaps crawls).

[3]More recently, it has been applied to China's yuan: Eichengreen (2006); Shah, Zeileis, and Patnaik (2005); Yamazaki (2006, p. 8); and Frankel and Wei (2007).

nested. Thus we want to estimate basket weights, rather than presuming we know the anchor currency, but at the same time to allow for some variation around the central parity, as in a target zone or managed floating. Hence our proposal for a synthesis of the two types of techniques in use for estimating de facto regimes.

II. Inferring the De Facto Degree of Flexibility

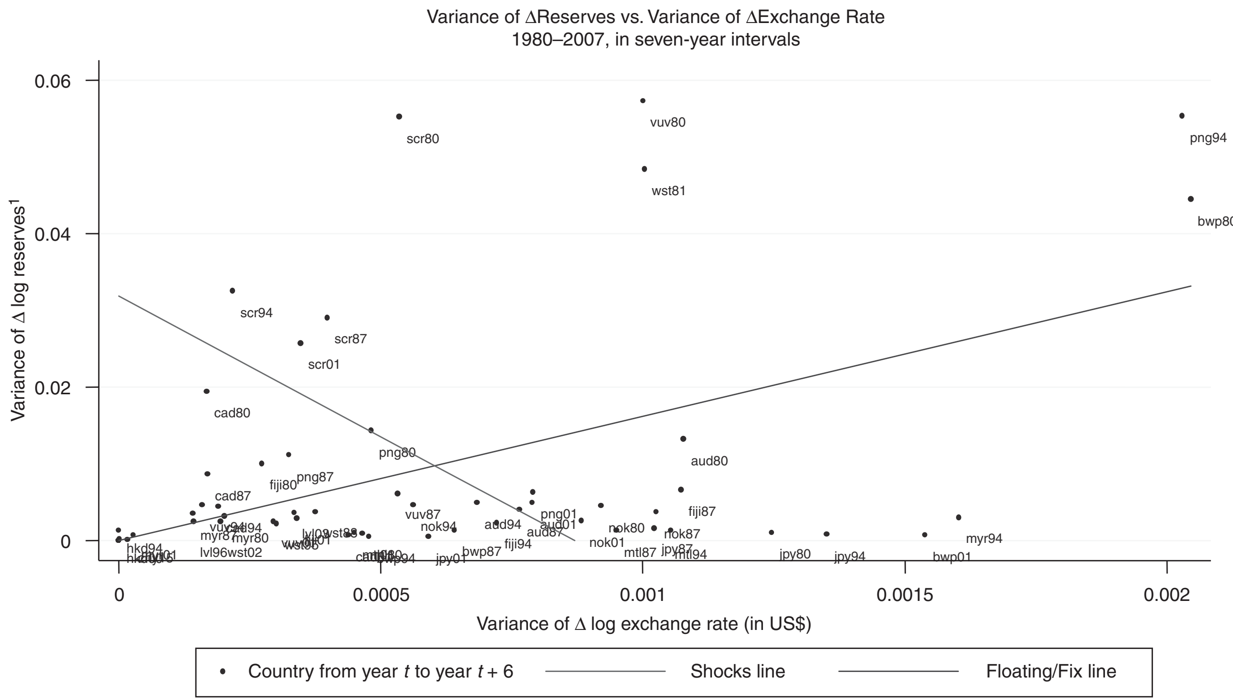
It is important when inferring the de facto flexibility of an exchange rate regime to look beyond the variability of the exchange rate in itself. The korona could show a higher degree of variability than the thollar, and yet this might be because the korona has been subject to larger shocks than the thollar, rather than because the authorities intervene less and allow a given shock to show up more in the form of price movement. Thus we want to look at the variability of the exchange rate *relative to* the variability of foreign exchange reserves, or the monetary base, or some other monetary aggregate.

Figure 1 is a preliminary look at the data on exchange rate variability and reserve variability for 15 countries. We selected our sample to emphasize countries that claim to follow a basket peg, but added in a few that are known to be firm peggers and others that are known to be floaters, to be able to calibrate the results along the fixed-versus-floating dimension. We chose nine (small) countries that have been officially identified by the IMF as following basket pegs: Latvia, Papua New Guinea, Botswana, Vanuatu, Fiji, Western Samoa, Malta, and the Seychelles. We also added several known floaters: Australia, Canada, and Japan, and three peggers of special interest: Hong Kong, China, and Malaysia. The paper emphasizes commodity-exporting countries, such as Norway, in our list of currencies examined, for reasons that will be obvious later.[4] Variances are computed for seven-year intervals, within the period 1980–2007. The aim in choosing this length of the interval is that it be long enough to generate reliable estimates of the parameters, and yet not so long as inevitably to include important changes in each country's exchange rate regime. Here, as throughout this paper, we work with logarithmic changes in the exchange rate.

An upward-sloping line runs from the origin. It runs through the point that represents the combination of average variance of (logarithmic change in) reserves and the average variance of (logarithmic change in) reserves. The points that lie well above this upward-sloping line represent countries that intervened actively in the foreign exchange market to stabilize their

[4]Before any readers hear faint alarm bells about the absence of a complete or random sample, we will note that we have no need of a random or complete sample. We have no need of a random sample because, although we are testing hypotheses about individual currencies, we are not testing any general hypotheses (such as "countries are at the corners"). We have no need of a complete sample, because we are not attempting to offer a complete classification of IMF members as many of the other papers in the literature have done. Rather we are proposing a new technique. We have chosen to try it out on countries that we think are of interest for one reason or another.

Figure 1. Comparison of Reserve Variability vs. Exchange Rate Variability



[1]Intervention is computed by subtracting imputed interest earnings from reported change in reserves.

Note: Currencies: Canadian dollar (cad), Hong Kong dollar (hkd), Malaysian ringgit (myr), Chinese yuan (cny), Japanese yen (jpy), Latvian lat (lvl), Papua New Guinea kina (png), Botswana pula (bwp), Vanuatu (vuv), Fiji dollar, Western Samoa tala (wst), Maltese lira (mtl), Seychelles rupee (scr), Norwegian kroner (nok), and Australian dollar (aud). Each data point represents a seven-year period, denoted in the suffix by the starting year of each period. Periods of countries with yearly inflation rate higher than 40 percent have been eliminated.

currencies during the period in question, for example, the Seychelles. The points that lie well below this upward-sloping line represent flexible-rate countries, where the authorities allow fluctuations in the demand for their currencies to show up primarily as movements in the exchange rate, for example, Japan. The downward-sloping line runs through the point representing the medians of reserve variability and exchange rate variability, and is also drawn so that half the points are above and to the right of the line, and the other half are below and to the left. The points in the first category represent countries where shocks tend to be large; this tends particularly to be the case with commodity producers, such as Botswana and Papua New Guinea. The points below and to the left of the downward-sloping lines represent countries where shocks tend to be small, for example, Hong Kong.

Several interesting lessons emerge from the graph, even without further analysis. The first is the folly of judging a country's exchange rate regime—specifically, the extent to which it seeks to stabilize the value of its currency—by looking simply at variation in the exchange rate. The 1980–86 Australian dollar shows a higher exchange rate variance than the 2001–07 Japanese yen. But this is not because the Australian dollar followed a more flexible exchange rate policy at that time. It is rather because Australia was hit by much larger shocks. One must focus on exchange rate variability *relative to* reserve variability to gauge where the country sits on the spectrum from fixed to floating. Perhaps this is obvious, but some have focused exclusively on exchange rate variability.

The second interesting lesson to be drawn from the graph—though a less original observation than the first—is that countries that specialize in mineral products tend to have larger shocks, which presumably take the form primarily of volatility in their terms of trade. The third lesson, which was quite surprising when it was first noticed but should be familiar by now, is that even countries that float hold and use foreign exchange reserves in substantial magnitudes, sometimes more actively than countries that peg.[5] An example in the figure is Canada in the 1980s. The fourth lesson is a counterpart to the third: a currency with a firm peg like the Hong Kong dollar can experience very low variability of reserves, because it has very low variability of shocks. It may in part be the absence of commodities in Hong Kong's production portfolio that makes possible the low level of shocks. But the low variability in international demand for the Hong Kong dollar must also result in part from the stability and credibility that the currency board has itself achieved. After all, Hong Kong did experience large shocks in the late 1990s—the reversion of the territory from Britain to China and the East Asia crisis—and yet the shocks do

[5]In the early 1970s, when the international monetary system moved from fixed exchange rates to floating, the demand for international reserves did not fall as would have been predicted. Early references include Frenkel (1978) and Bilson and Frenkel (1979). Similarly, when many emerging market countries switched to more flexible exchange rate exchange rate regimes, or even to outright floating, in the currency crises of 1994–2002, the demand for reserves subsequently did not fall, but rather rose sharply (Rodrik, 2006).

not show up in either the exchange rate *or reserves*. Reassuring nervous investors presumably was the goal in the first place, when the Crown Colony of Hong Kong adopted the currency board in 1983.

It is for just such reasons that the classification schemes of Calvo and Reinhart (2002) and Levy-Yeyati and Sturzenegger (2003, 2005) do not look at exchange rate variability alone (prices), but rather compare it to variability in reserves or money supplies (quantities). The question is: when there is a shock that increases international demand for korona, to what extent do the authorities allow it to show up as an appreciation, and to what extent as an increase in reserves. In this paper, we frame the issue in terms of the exchange market pressure (EMP) variable, which is defined as the percentage increase in the value of the currency plus the percentage increase in reserves (or the monetary base, or M1).[6] When this variable appears on the right-hand side of an equation and the percentage increase in the value of the currency appears on the left, a coefficient of 0 signifies a completely fixed exchange rate (no changes in the value of the currency), a coefficient of 1 signifies a freely floating rate (no changes in reserves), and a coefficient somewhere in between indicates a correspondingly flexible/stable intermediate regime.

One possible limitation of these and other papers that estimate flexibility vs. stability of exchange rate regimes is that they sometimes have to make arbitrary judgments regarding what is the major currency in terms of which flexibility and stability are to be defined. The dollar is the most common choice. This may be fine for most Western hemisphere countries (though in fact not for Chile, and perhaps not Argentina and Brazil either). But for European countries, the euro is obviously more relevant. And for many others, particularly in Asia and the Pacific, and probably also the Middle East and parts of Africa, the relevant foreign currency is neither the dollar nor the euro, but some (possibly trade-weighted) basket. It would be better to let the data tell us what is the relevant anchor for a given country, especially for those that are not clearly in either the dollar or euro camp, rather than making the judgment subjectively or a priori.[7]

III. Inferring De Facto Weights

So, on the one hand, the main branch of the regime classification literature has the drawback that—in its zeal to uncover the true degree of flexibility—it is unable to infer the relevant anchor. But, on the other hand, the smaller branch of the literature, which specializes in inferring the relevant anchor currency or basket under the null hypothesis of a perfect fit, equally omits to include anything to help make sense out of the error term under the alternative hypothesis that the country is not perfectly pegged to a major currency or to a basket. The equation is correctly specified to infer the

[6]The progenitor of the EMP variable, in a rather different context, was Girton and Roper (1977).

[7]Clearly, many of the authors of these papers are fully aware of the issue.

weights in the case of a perfect basket peg, with an R^2 of 1, but is on less firm ground if the authorities allow even a relatively small band of flexibility around the central parity. Thus the contribution of this paper is to bring these two branches of the literature together to produce a complete equation suitable for use in inferring de facto regimes across the spectrum of flexibility *and* across the array of possible anchors.

Assume that the value of the home currency is indeed determined by a currency basket. How does one then uncover the currency composition and weights in the basket? This is a problem to which ordinary least squares regression is unusually well suited. If we know the list of currencies in the basket, or a list that includes as a subset those that are used in the basket, then we regress changes in the log of H, the value of the home currency, against changes in the log values of the candidate currencies, X. This technique from Frankel and Wei (1994, 1995) has recently been applied to the current Chinese exchange rate regime.[8]

The reason to work in terms of changes rather than levels is the likelihood of nonstationarity. Concern for nonstationarity goes beyond the common refrain of modern time series econometrics, the inability to reject statistically a unit root. Working in changes, we can also include a constant term to allow for the likelihood of a trend appreciation (a key question of interest in the new renminbi regime) or trend depreciation (as in the crawling pegs popular in Latin American and elsewhere in the 1980s), whether against the dollar alone or a broader basket. Algebraically, if the value of the home currency H is pegged to the values of currencies $X1, X2, \ldots$ and Xn, with weights equal to $w1, w2, \ldots$ and wn, then

$$\Delta \log H_t = c + \sum w(j)[\Delta \log X(j)_t]. \qquad (1)$$

If the exchange rate is truly governed by a strict basket peg, then we should be able to recover the true weights, $w(j)$, precisely, so long as we have more observations than candidate currencies, and the equation should have a perfect fit.

[8]Shah, Zeileis, and Patnaik (2005) adopted the implicit-weight methodology to study the Chinese currency basket after July 21, 2005 and found that the renminbi is still tightly pegged to the dollar and nothing else. However, they only consider four candidate currencies in the renminbi basket (the dollar, the yen, the euro, and the pound), probably unaware of the 11-currency disclosure made by the Chinese central bank. In addition, their sample was only the initial few months after July 21, 2005. Eichengreen (2006, pp. 22–25) had daily observations of data that ran from July 22, 2005, to March 21, 2006, and found a dollar weight around 0.9, but with no evidence of a downward trend in the weight, and no significance on nondollar currencies. Each of these three papers was too early to catch the evolution in 2006. Yamazaki (2006, p. 8) updated the estimation, and found some weight had shifted to the euro, yen, and won; but he estimated the equation in terms of levels rather than changes (risking nonstationarity), did not allow for a trend, did not allow for the other currencies on the list, and had a relatively small number of (bimonthly) observations. Frankel and Wei (2007) updated the estimation, ran the equation in monthly changes, included the full list of 11 candidate currencies, and allowed for gradual evolution during the sample period in both the basket weights and the trend term.

One methodological question, before we turn to the new synthesis estimation specification. How do we define the "value" of each of the currencies? This is the question of the numeraire.[9]

If the exchange rate is truly a basket peg, the choice of numeraire currency is immaterial; we estimate the weights accurately regardless. If the linear equation holds precisely in terms of any one "correct" numeraire, then add the log exchange rate between that numeraire and any arbitrary unit to see that the equation also holds precisely in terms of the arbitrary numeraire. This assumes the weights add to 1, and there is no error term, constant term, or other noncurrency variable.

In practice, few countries take their basket pegs literally enough to produce such a tight fit. One must then start to think about the nature of the error term and nonbasket factors in the regression (such as the trend term), and about whether they are better measured in terms of one numeraire or another. The introduction of reserves or the EMP variable as explanatory variables should soak up some of the error term and give better estimates: by including on the right-hand side of the equation percentage changes in total EMP (defined as percentage changes in the value of the currency plus percentage change in reserves), the test can allow for the fluctuations in demand for the currency that can push the exchange rate away from the central basket parity. The hope is that this approach may do a better job of answering the question to what extent the authorities intervene to stabilize the currency, not just the question what is the basket in terms of which the authorities define stability.

If the true regime is more variable than a rigid basket peg, then the choice of numeraire does make some difference to the estimation. Some authors in the past have used a remote currency, such as the Swiss franc (for example, Frankel and Wei, 1994). But a weighted index such as the special drawing right (SDR) or a trade-weighted measure is probably more appropriate. Here is why. If the true regime is a target zone or a managed float centered around a reference basket, where the authorities intervene to an extent that depends on the magnitude of the deviation—and this seems the logical alternative hypothesis in which a strict basket peg is nested—then the error term in the equation represents shocks in demand for the currency that the authorities allow to be partially reflected in the exchange rate (but only partially, because they intervene if the shocks are large). Then one should use a numeraire that is similar to that used by the authorities in measuring what constitutes a large deviation. The authorities are unlikely to use the Swiss franc or Canadian dollar in thinking about the size of deviations from their reference point. They are more likely to use a weighted average of major currencies. If we use

[9]Frankel (1993) used purchasing power over a consumer basket of domestic goods as numeraire; Frankel and Wei (1995) used the SDR; Frankel and Wei (1994), Ohno (1999), and Eichengreen (2006) used the Swiss franc; Bénassy-Quéré (1999) used the dollar; Frankel, Schmukler, and Servén (2000) used a GDP-weighted basket of five major currencies; and Yamazaki (2006) used the Canadian dollar.

a similar measure in the equation, it should help minimize the possibility of correlation between the error term and the numeraire. Similarly, if there is a trend in the exchange rate equation (a constant term in the changes equation) representing deliberate gradual appreciation of the currency, then H should be defined in terms of whatever weighted exchange rate index the authorities are likely to use in thinking about the trend. These considerations suggest a numeraire that is itself composed of a basket of currencies. We choose here the SDR.

IV. Results of the Synthesis of Flexibility-Inference and Weight-Inference Techniques

Our equation is

$$\Delta \log H_t = c + \sum w(j) \Delta \log X(j)_t + \beta\{\Delta emp_t\} + u_t. \qquad (2)$$

One way to define the percentage change in total EMP[10] is by

$$\Delta emp_t = \Delta \log EMP_t = \Delta \log H_t + \Delta \log Res_t.$$

The $w(j)$ coefficients capture the de facto weights on the constituent currencies. The coefficient β captures the de facto degree of exchange rate flexibility: $\beta = 1$ means the currency floats purely, because there is no foreign exchange market intervention (no changes in reserves); $\beta = 0$ means the exchange rate is purely fixed, because it never changes in value; and most currencies probably lie somewhere in between. Endogeneity is a possible problem, and is addressed below.

We have tried estimating the equation without imposing a constraint on the sum of the weights in the basket. But there is a good argument for constraining the weights on the currencies to add up to unity: $\sum w(j) = 1$. However weak one thinks the link to the reference basket might be and however large or small the weight on the dollar, the authorities must view movements in the home currency through the metric of distance from some reference rate or effective exchange rate. There is no point throwing away the information represented by the summing-up constraint; we only have 48 observations per regression, and we need every degree of freedom we can get. The easiest way to implement the adding up constraint is to run the regressions with the changes in the log value of the home currency on the left-hand side of the equation transformed by subtracting off the changes in the log value of one of the currencies, say the British pound, and the changes in the values of the nonpound currencies on the right-hand side transformed in the same way.

[10]As noted, another way to define exchange market pressure is by expressing the change in reserves as fraction of the level of the monetary base rather than as a fraction of the level of reserves. Such regression results are reported subsequently.

To see this, we repeat Equation (2), with some of the major currencies made explicit:

$$\begin{aligned}\Delta\log H_t &= c + \sum w(j)[\Delta\log X_t] + \beta\{\Delta emp_t\} + u_t \\ &= c + w(1)\Delta\log\$_t + w(2)\Delta\log €_t \\ &\quad + w(3)\Delta\log¥_t + w(4)\Delta\log£_t + \ldots \\ &\quad + \beta\{\Delta\log EMP_t\} + u_t. \qquad (2')\end{aligned}$$

We want to impose the adding up constraint $w(4) = 1 - w(1) - w(2) - w(3) - \ldots$

We implement it by running the regression Equation (3):

$$\begin{aligned}[\Delta\log H_t - \Delta\log£_t] = c &+ w(1)[\Delta\log\$_t - \Delta\log£_t] \\ &+ w(2)[\Delta\log€_t - \Delta\log£_t] \\ &+ w(3)[\Delta\log¥_t - \Delta\log£_t] + \ldots \\ &+ \beta\{\Delta\log EMP_t\} + u_t. \qquad (3)\end{aligned}$$

The results reported in the Appendix come from the estimation of this equation. One can recover the implicit weight on the pound by adding the estimated weights on the nonpound currencies, and subtracting the sum from 1. This coefficient estimate is reported in the last row of the table. Imposing the constraint sharpens the estimates a bit.

Again the currencies are those that are hypothesized to have followed a basket peg, to try out the ability of the technique to infer the weights or reject the null hypothesis, plus some clear floaters and clear peggers thrown in to calibrate the inference of flexibility. Tables A1 through A9, respectively, present the individual results for nine currencies. In the longer working paper version (Frankel and Wei, 2008) we report results for several others as well: the Malaysian ringgit, Botswana pula, Fiji dollar, Papua New Guinea kina, Vanuatu vatu, West Samoan tala, and Indonesian rupiah.[11]

Endogeneity of the EMP variable is a possible concern. One would prefer to observe changes in the international demand for the home currency that are known to originate in exogenous shocks. In the case of countries that specialize in the production of mineral or agricultural products, there is a ready-made instrumental variable: changes in the terms of trade reflecting the price of the mineral or agricultural product on world markets. (This assumes

[11]We omit the yen and other very major currencies from the list of home countries. Such a currency is sufficiently large in world monetary markets that one cannot take the value of the other major currencies as exogenous as is necessary to estimate the weights on the right-hand side of our equation. For other smaller currencies, the assumption that the value of the dollar, euro, and other major currencies can be taken as exogenous seems reasonable.

that the home country is too small to affect the world price, which is a reasonable assumption in all but a few cases, such as Saudi Arabia and oil.) Accordingly, Tables 3.1–3.21 in the working paper repeat the synthesis estimation technique, but for the commodity producers it uses changes in the world price of the commodity or commodities in question as an instrumental variable for changes in EMP.

There is a good argument, when defining EMP, for computing the changes in reserves as percentages of the monetary base, rather than as percentages of the level of reserves itself. The problem with the latter approach is that for a country that holds relatively small levels of reserves, such as Canada and Australia, a change in reserves that is very small in absolute terms can look like a moderately large intervention in percentage terms, as we see in Figure 1. Accordingly, on the vertical axis of Figure 2 we express reserve changes as a percentage of the monetary base, rather than as a percentage of reserves themselves. Now Australia and Canada appear close to the bottom of the range of reserve variability where they belong, well below the upward-sloping line that demarcates the fixers from the floaters. Correspondingly, Tables 4 and 5 in the working paper version of this paper re-run the regressions with reserve changes defined as percentages of the monetary base.

We begin with the estimated equations for two known peggers.

Table A1 reports the results for the Chinese yuan or renminbi. It confirms earlier findings of a perfect peg to the dollar during 2001–04 (dollar coefficient = 0.99, a flexibility coefficient insignificantly different from zero, and an R^2 of 0.99). In 2005–07, the EMP coefficient suggests that only 90 percent of increased demand for the currency shows up in reserves rather than 100 percent; but the dollar weight and R^2 are as high as ever.

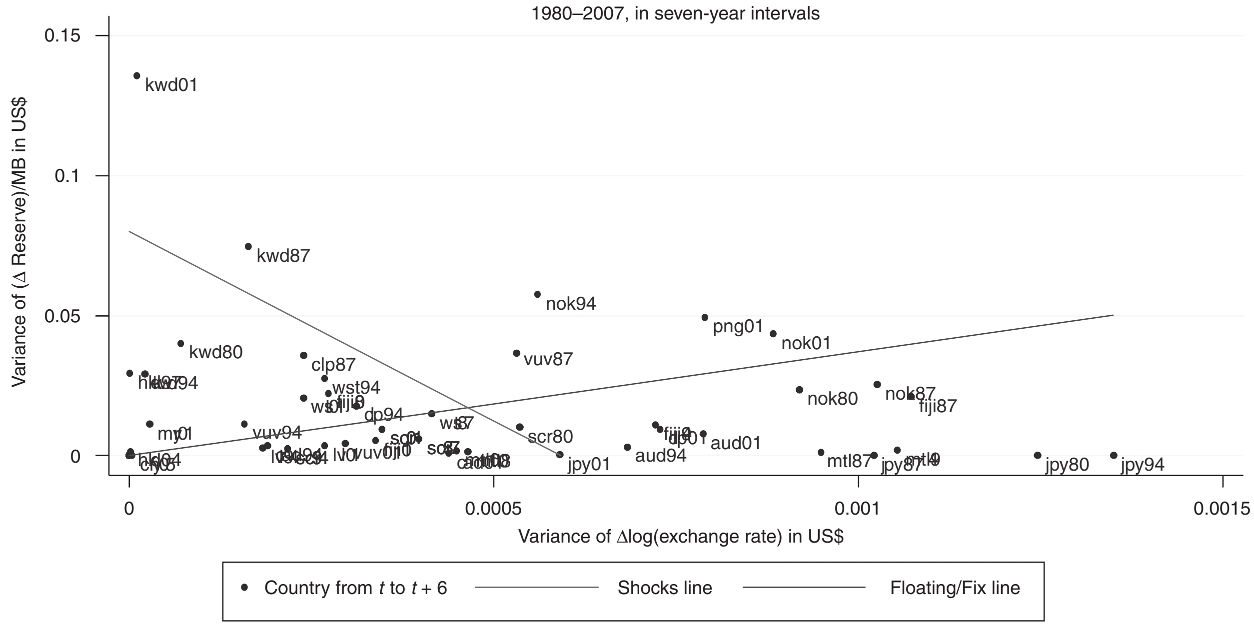
The Hong Kong dollar is covered in Table A2. As one would expect given the currency board arrangement, it is a simple tight peg to the US dollar: close to complete weight on the dollar, zero flexibility, and perfect fit.[12]

We now turn to some countries that are considered to have pegged or anchored to a basket for at least part of the sample period.

Table A3 applies the synthesis estimation technique to the Chilean peso. The EMP coefficient shows an intermediate degree of flexibility, consistent with the proclaimed band of the 1980s and 1990s. The combination of a basket, band, and crawl seems able to explain most of the variation in the value of the peso in the 1990s ($R^2 > 0.9$). The weight on the dollar is always high, but the yen also gets some weight in some years, until after 1999 when only the euro complements the dollar. There is a significant downward trend from 1980 to 1999. Of those countries to follow a band-basket-crawl regime in the 1980s and 1990s, Chile is one of the few that announced explicitly what

[12]Estimates in the middle column show the ill effects of near-perfect multilcollinearity between the US dollar and the Malaysian ringgit during this interval. We should adopt a rule that whenever the exchange rate between two potential regressors is virtually fixed, the smaller of the two currencies (in this case the ringgit) should be dropped from the regression equation.

Figure 2. Comparison of Reserve Variability vs. Exchange Rate Variability
(Changes in reserves are expressed as a percent of the monetary base)



Source: IMF, International Financial Statistics.
Note: Reserve data: after subtracting off the imputed interest.

were the parameters: basket weights, bandwidth, and rate of crawl.[13] Our findings correspond to the official regime, but only rather roughly. The band was officially centered on the dollar alone in the 1980s, and was broadened to a basket starting in 1992. Our estimates qualitatively capture the shift in emphasis away from the dollar; but they find an apparently spurious weight on the yen in the mid-1980s and they miss entirely the 30 percent weight officially placed on the mark in the mid-1990s. Likewise, Chile officially moved to full floating in 1999. Our estimates qualitatively show the increase in the flexibility coefficient in 2000–03, but the estimates do not show the (loose) basket peg disappearing completely as the Chileans claim is the reality.

Possible explanations for the lack of a close match between the official regime and the estimates include: (1) the common disjuncture between de facto and de jure (though it is much less likely to apply to Chile than for other countries), (2) endogeneity of the EMP variable, (3) some other shortcoming of the estimation technique, and (4) changes in the parameters that occur more frequently than the four-year subperiods examined here. For the years since the September 1999 move to floating, (5) the failure of the flexibility coefficient to approach 1.0 might possibly be explained by copper export earnings that add to reserves and yet are not considered by the authorities to constitute active foreign exchange intervention.

Explanation (2) can be addressed by the instrumental variables technique, for which Chile is a natural candidate because copper is half its exports. Table 3.1 of the working paper uses the world copper price as the instrumental variable. At least the spurious significant coefficient on the yen in the mid-1980s disappears. But the German mark still does not make the dramatic appearance onstage in 1992–99 that one would expect from the official announcements.

Proposition (4) may be the real explanation, and it is harder to address. The Chilean authorities announced 18 changes in regime parameters (basket weights, width of band, and rate of crawl) during the 18-year period 1982–99. One could imagine estimating each year separately, or matching the subsamples to the official announcements, or using more sophisticated econometric techniques that allow endogenously estimated breakpoints. The obstacle in all cases is that we have only monthly data, so it is not possible to estimate meaningful parameter values if they change every 12 months on average. The original Frankel-Wei technique required only exchange rate data, which allowed estimation at a daily frequency (or even intra-day). But the synthesis technique requires data on foreign exchange reserves, which are only available monthly for most countries. Indeed, the attempt to estimate six or more parameters on each set of 48 observations may already produce too much "estimation error."

[13]Details reported in the Appendix of Frankel and others (2001).

The Latvian lat, shown in Table A4, is officially on a basket peg. Here the estimation technique appears to work well. The flexibility coefficient is low during the 1990s, and has disappeared altogether since 2000. The R^2 exceeds 0.9 during 1996–2003. The combination of low flexibility coefficient and a high R^2 during 2000–2003 suggests a particularly tight basket peg during these years. Initially, the estimated weights include 0.4 on the dollar and 0.3 on the yen, but both decline over time. There is a weight of 0.3 on the mark up until 1999, which is then transferred to the euro: 0.2 in 2000–03 and 0.5 in 2004–07. Latvia is preparing to enter the eurozone. Surprisingly, however, the estimation shows a coefficient of similar size on the Russian ruble popping up during 2004–07.

The Maltese lira (Table A5) shows a tight peg during 1984–91 and 2004–07 (low flexibility coefficient and high R^2). The share of the dollar varies between 0.2 and 0.4 during 1980–2003. The European currencies garner 0.3–0.4 during 1980–95, the pound perhaps 0.2–0.3 and the yen 0.1. At the end of the sample period, the weight on the euro rises almost to 0.9, with perhaps bit parts assigned to the dollar and pound. Malta is one of the 10 countries that joined the European Union in 2005 and one of two that joined the euro in 2008.

For the Danish krone the EMP coefficient suggests that a very high share of fluctuations in currency demand are accommodated from foreign exchange reserves (Table 2.6 of the working paper). The weight on European currencies begins above 0.8, and rises to 1.0 with the advent of the euro in 1999. The R^2 ranges from 0.85 to 0.99. In short the evidence is consistent with the known regime: Denmark remained behind in the 2¼ percent band, when its (non-Scandinavian) neighbors joined the euro.

The Kuwaiti dinar shows a firm peg throughout most of the period: a near-zero flexibility parameter and R^2 mostly above 0.9 (IV estimates in Table 3.5 of working paper). In the second half of the sample, the anchor was usually a simple dollar peg, although a small weight was assigned to other currencies in the 1980s basket. In a widely watched move, the Kuwaitis in 2007 abandoned the simple dollar peg that its partners in the Gulf Cooperation Council partners have been wedded to, and returned to a basket peg; but this shift is probably too recent to have had a substantial effect on any of these estimates.

The Norwegian krone (Table A6) is one of the few basket peggers in the developed world. The estimates show heavy intervention, although the R^2 never crosses 0.8. The weights are initially 0.3 on the dollar and 0.4 on European currencies (and perhaps a little weight on the yen and pound). But the weight on the European currencies rises at the expense of the dollar, until the latter part of the sample period shows full weight on the euro and none on the dollar. The results are similar to ordinary least squares when the world oil price is used as the instrumental variable for EMP (Table 3.8 of the working paper).

The Russian ruble shows high intervention from the beginning (Table 2.13 in the working paper). There is evidence of an attempt to stabilize around the dollar during 1996–2003, but the peg is loose; this no doubt reflects both the discrete devaluation of 1998 and the band that preceded it. More recently, the ruble has acted more like a basket peg, and has assigned somewhat less weight to the dollar. With use of the oil price as the instrumental variable, the flexibility parameter in the current decade drops more rapidly than under ordinary least squares (Table 5.10 in the working paper).

The Seychelles rupee in Table A7 confirms its official classification as a basket pegger, particularly in 1984–95: not only is the flexibility coefficient essentially zero, but the R^2 exceeds 0.97. The estimated weights are 0.4 on the dollar, 0.3 on the European currencies, 0.2 on the yen, and 0.1 on the pound. After 2004, however, the weight on the dollar suddenly shoots up to 0.9.

Estimation for Thailand shows that the authorities intervened heavily in the 1980s and 1990s (Table 2.14 of the working paper). During 1988–95 they indeed adhered to a very tight basket peg ($R^2 = 0.999$). The weight on the dollar reached 0.75–0.88, but there was still a significant weight of 0.1 on the yen. That the weight on the dollar falls short of 1.0 may come as a surprise to those who, in the wake of the Thai crisis of 1997, received the impression that the baht had been explicitly pegged to the dollar. But the official policy had been a basket peg, not a dollar peg. In the early 1990s, observers had been surprised that the estimated weight on the dollar was so *high*, because the earlier orthodoxy had been that Southeast Asia was rapidly becoming a yen bloc.[14] The flexibility parameter rises sharply in 2000–07, although there is still plenty of intervention.[15] When the price of rice is used as an instrumental variable, once again the point estimates of the flexibility parameter rise, but the significance levels fall (Table 3.11 of the working paper).

We now turn to a set of floaters. The estimated equation for the Australian dollar is reported in Table A8. The coefficient on EMP shows a lower degree of exchange rate flexibility than one would have expected, given that the currency is thought to have floated fairly freely throughout this period. The problem may be that reserves are measured as more variable than seems right. Or the problem may be endogeneity of the EMP variable. The Australian dollar is considered a commodity currency, so world commodity prices are a natural instrumental variable to correct for endogeneity. The IV estimation for Australia (Table 3.18 in the working paper) shows for each of the subperiods the estimated flexibility coefficient higher than it was under ordinary least squares; but they remain surprisingly low in magnitude and statistical significance.

As noted regarding the definition of EMP, there is a good argument for computing the changes in reserves as a percentage of the monetary base,

[14]Frankel (1993); Frankel and Wei (1994), and references cited therein.

[15]Very high multicollinearity between the dollar and the Malaysian ringgit impedes the estimation. The won, Australian dollar, and ringgit probably ought to be dropped on a priori grounds.

rather than as a percentage of the level of reserves itself. The lower half of Table A8, section b, uses the alternative definition of EMP, with changes in reserves expressed as percentages of the monetary base:

$$\Delta emp_t \equiv \Delta \log H_t + \Delta \log Res_t / MB_t.$$

As before, a coefficient of $\beta = 1$ would means that the currency floats purely, because there are no changes in reserves and $\beta = 0$ would mean the exchange rate is fixed. Now the estimated coefficient and significance level on the EMP variable are higher. This tends to confirm the value of this approach, as Australia is known to be a floater. Table 5.18 in the working paper applies instrumental variables to this same alternate definition of EMP, but it is little changed from IV with the first EMP definition.

The Canadian dollar in Table A9 shows up as mostly flexible, though experiencing some intervention (the EMP coefficient ranges from 0.1 to 0.4), with the U.S. dollar usually receiving the largest weight in the basket that the authorities are treated as implicitly using as a reference. Again, when we switch to the alternative definition of EMP in the second half of the table, with reserve changes expressed as a percentage of the monetary base, the coefficient estimates and significance levels of EMP are generally a bit higher, as is consistent with the floating nature of the Canadian dollar. As with Australia, the other rich commodity-exporting floater, the IV estimates show estimates of the flexibility parameter in each subperiod that are higher than they were under ordinary least squares, but that are surprisingly insignificant statistically (Table 3.19 in the working paper).

The Mexican peso shows a significant downward crawl throughout (until 2004), but it shows a peg to the dollar that is otherwise quite tight in 1988–91 (Table 2.20 in the working paper). Flexibility increases after the mid-point of the sample, which happens to be the peso crisis years of 1994–95. The flexibility parameter does not climb out of the range 0.3–0.4, indicating that reserve changes have remained substantial during the latter three subperiods, when the peso was supposedly floating. One likely explanation is that many monthly increases in reserves are associated with revenue earned by PEMEX oil exports, which the authorities leave in the form of dollar deposits, but which are not conventionally considered foreign exchange intervention. Using the oil price as an instrumental variable again produces flexibility parameters that are estimated higher in magnitude, but lower in significance (Table 3.20 in the working paper; 5.20 for the IV version where intervention is measured as a share of the monetary base).

V. Extensions

In various extensions of the basic analysis, we have also

1. allowed coefficients to vary over time, even within the four-year sub-samples;
2. relaxed the constraint that $\log H_t$ and $\Delta \log Res_t$ enter with the same coefficient;

3. entered the change in the interest rate alongside the change in reserves and the change in the exchange rate;
4. checked for robustness with respect to the numeraire unit used to define currency values; and
5. tried Monte Carlo studies on fabricated currencies to see if the new synthesis technique is giving us the right answer.

The results in the extensions are generally in line with the results reported here. Using a different numeraire does not make too much difference, for example.

Tables 6.1–6.10 of the working paper report the extension that allows the coefficients to vary over time, even within the subperiods (extension 1, above). We expand the specification of (3) to allow for trends in level and in the currency weights:

$$\begin{aligned}[\Delta\log H_t - \Delta\log £_t] = {} & f(t) + w(1)[\Delta\log \$_t - \Delta\log £_t] \\ & + w(2)[\Delta\log €_t - \Delta\log £_t] \\ & + w(3)[\Delta\log ¥_t - \Delta\log £_t] + \ldots \\ & + \beta\{\Delta\log EMP(t)\} + u_t, \end{aligned} \tag{4}$$

where $f(t) = c0 + c1 \times t$. The time-dependent weight terms can be defined either using the exponential functional form for the weights $w(j)$ so that they are automatically bounded by 0 and 1 or, for simplicity, linearly: $w(j) = b0(j) + b1(j) \times t$.

The case of most interest is probably China (2005–07). There is no sign in this monthly data of a downward trend in the coefficient on the dollar: the estimated trend is 0.000. But there is a sign that the trend in the value of the yuan itself is rising over time: because the dependent variable is first differences, the statistically significant coefficient on "t" indicates an upward acceleration. The other results are as before: zero coefficients on nondollar currencies, zero coefficient on EMP, and an R^2 of 1.00, all of which indicate a simple dollar peg holding during most of this period.

Tables 7.1–7.8 of the working paper relax the constraint that $\Delta\log H(t)$ and $\Delta\log Res(t)$ enter EMP with the same coefficient (extension 2 above). The estimation takes into account that the variation of reserve changes is much larger than the variation of exchange rate changes (as can be seen in Figure 1), so that giving them equal weight means allowing the former to dominate in the estimates already reported. We define the new EMP variable as

$$\begin{aligned}\Delta[\log EMP] = {} & \{[var\Delta[\log Ex]/(var\Delta[\log Ex] + Var(\Delta[\log Res])\} \cdot \Delta[\log Res] \\ & + \{Var(\Delta[\log Res]/(var\Delta[\log Ex] + Var(\Delta[\log Res])\} \\ & \cdot \Delta[\log Ex]. \end{aligned} \tag{5}$$

Tables 8.1–8.5 of the working paper broaden the definition of EMP another step (extension 3 above). Here the change in the interest rate is entered alongside the change in reserves and the change in the exchange rate, as three alternative ways that the authorities can respond to a change in demand for their currency (Eichengreen, Rose, and Wyplosz, 1996). We define the new EMP variable as

$$\Delta[\log EMP] = \{var(\Delta[\log Ex])/Var(\Delta[\log Res])\} \cdot \Delta[\log Res] + \{var(\Delta[\log Ex])/Var(\Delta i)\} \cdot \Delta i + \Delta[\log Ex] \quad (6)$$

$$\lambda = var(\Delta[\log Ex])/Var(\Delta[\log Res])$$

$$\gamma = var(\Delta[\log Ex])/Var(\Delta[i]).$$

That is, $\Delta[\log EMP] = \lambda \cdot \Delta[\log Res] + \gamma \cdot \Delta i + \Delta[\log Ex]$.

Table 9 of the working paper checks whether the results are robust with respect to the choice of numeraire, by using the Swiss franc as the standard by which currencies are valued, in place of the SDR. The results are similar. The choice of numeraire does not appear to make much difference.

Last come the Monte Carlo exercises. We construct artificial exchange rate series under two regimes: managed float and band (Tables 10.1–10.4, and Tables 10.5–10.8, respectively, in the working paper). In the former case, we assume that a certain percentage of any change in EMP is absorbed in reserves and the rest in the exchange rate (“leaning against the wind”). In the latter case we restrict the width of the band or target zone to plus or minus 2 and ½ percent. Within the band we have tried a random walk subject to the restriction that the exchange rate cannot wander outside the band. One could consider other distributions. The Krugman theory of target zones provides a precise mathematical specification for the distribution within the band; but it assumes unrealistically that there is no intervention inside the band (only at the margins) and also that the band is 100 percent credible.

In each case we try one version where the central parity is a basket that puts one-third weight on the dollar, one-third on the euro, and one-third on the yen, and we try another version where the central parity is simply pegged to the dollar. In the estimation, we constrain the weights to add to 1. Although the disturbances are drawn from a random normal distribution, the magnitude (variance of the distribution) is taken from real-world cases. We try two such cases: we take the Canadian dollar’s parameters as representative of a floating currency (a low-variance reserve case), and we take Papua New Guinea’s parameters as representative of a high-variance (attributable to commodity exports) small country with an intermediate regime.

In most cases, the estimates correspond well with the parameters that were built in. For example, the difference between a band with sharp borders and a policy of consistently leaning against the wind turns out to be not all that important. In every case, the estimated weights are within one or two standard errors of 1/3-1/3-1/3 for the basket case, and 1 for the dollar peg case. The technique tends to pick out the correct weights even though it is not designed for the specific statistical distribution of a band. The results are especially insensitive to the choice of numeraire, as between SDR and Swiss Franc. This is reassuring, because previously we have had to rely on the a priori theorem that the choice of numeraire makes no difference in the special case of a perfect peg. The technique seems equally robust when estimating the parameter that represents the degree of exchange rate flexibility.

Typical R^2's tend to lie in the range 0.87–0.89. Our conclusion is that the technique works fairly well and robustly, when the true exchange rate regime is the one assumed (in this case leaning against the wind, around either a basket or the dollar). The technique may not always work as well in practice (of which one reflection may be lower R^2's in the tables reported in this paper), because in practice many countries do not in fact follow a regime such as a basket band for more than a few years in a row, without devaluing or otherwise changing the parameters. To allow for changes in parameters within the sample period one would have to take the technique to the next stage of econometric sophistication, and perhaps suffer nonetheless from data frequency insufficient to produce reliable estimates.

VI. Conclusion

Intermediate exchange rate regimes remain alive and well. Some countries have announced basket regimes, often with an intermediate degree of flexibility that can be captured by some combination of a crawl, a band, or leaning-against-the-wind intervention. Most basket peggers keep the weights in the basket secret, which usually means they want to preserve a degree of freedom from prying eyes (whether to pursue a lower degree of de facto exchange rate flexibility, as with China, or a higher degree, as with others).

The necessary task of distinguishing de facto from de jure exchange rate regimes has produced an active recent subliterature. But inferring de facto weights and inferring de facto flexibility are equally important, whereas most authors have hitherto done only one or the other. This paper's main contribution is to propose a synthesis specification that allows estimation of true weights at the same time as estimation of the true tendency of monetary authorities to allow EMP to show up in the price, vs. the quantity, of foreign exchange.

We have tried out the technique on some 20 currencies. The majority are countries reported by the IMF to have declared the use of baskets. But we have also included some floaters and some simple peggers. For the most part the synthesis technique seems to work as it should. Known floaters tend to score much higher flexibility parameters than known peggers, with the BBC countries in between. In some cases, the inferred behavior differs in some way from the de jure regime. For example China's "basket" puts more weight on the dollar than the impression given by the government, but other declared basket peggers are not as firmly tied to the basket as they claim. Meanwhile, declared floaters often intervene heavily to dampen exchange rate fluctuations (fear of floating), but sometimes with reference to an anchor that is not a simple dollar parity as other authors may have assumed.

APPENDIX

Estimating De Facto Exchange Rate Regimes

This appendix estimates de facto exchange rate regimes for nine countries grouped as either known peggers (Tables A1 and A2), known basket peggers (Tables A3–A7), and known floaters (Tables A8 and A9). The dependent variable for the tables is changes in the value of local currency from January 1980 to June 2007. Values of all currencies are measured in terms of numeraire currency = special drawings rights. Parameters are estimated by ordinary least squares: implicit weights in basket and degree of flexibility. For all of the tables, $*$ denotes statistically significant at the 0.10 level; $**$ statistically significant at the 0.05 level, and $***$ statistically significant at the 0.01 level.

Table A1. Known Peggers: Chinese Yuan (cny)

	(1)	(2)
(a)		
Δ log EMP defined as: $\Delta \log res_t + \Delta \log ExR_t$	2001–04	2005–08
USD	0.988***	1.054***
	(0.023)	(0.110)
JPY	−0.006	0.039
	(0.009)	(0.035)
Euro	0.054	0.080
	(0.052)	(0.081)
Δ log EMP	0.035	0.107*
	(0.038)	(0.051)
KRW		0.061
		(0.051)
SGD		−0.163
		(0.104)
MYR		0.025
		(0.042)
RUB		−0.130
		(0.146)
AUD		0.026
		(0.026)
THB		0.036
		(0.048)
CAD		−0.052
		(0.031)
Constant	−0.001	0.000
	(0.001)	(0.002)
Observations	48	23
R^2	0.986	0.995
GBP	−0.036	0.024

Table A1 *(concluded)*

	(1)	(2)
(b)		
Δ log EMP defined as: $\Delta res_t/MB_{t-1} + \Delta\log ExR_t$	cny 2001–04	2005–07
USD	0.916***	1.029***
	(0.079)	(0.106)
JPY	−0.010	0.040
	(0.017)	(0.031)
KRW	−0.000	0.058
	(0.010)	(0.048)
SGD	0.104	−0.150
	(0.091)	(0.096)
RUB	0.027	−0.100
	(0.034)	(0.136)
AUD	0.001	0.020
	(0.011)	(0.025)
THB	−0.054	0.036
	(0.050)	(0.044)
CAD	−0.017	−0.052*
	(0.021)	(0.028)
EUR	0.061	0.062
	(0.056)	(0.077)
Δemp	0.069	0.103**
	(0.063)	(0.039)
MYR		0.027
		(0.039)
Constant	−0.001	0.000
	(0.001)	(0.001)
Observations	48	23
R^2	0.989	0.996
GBP	−0.028	0.030

Table A2. Known Peggers: Hong Kong dollar (hkd)

	(1)	(2)	(3)
(a)			
Δ log EMP defined as: $\Delta\log res_t + \Delta\log ExR_t$	1997–2000	2001–04	2005–08
JPY	−0.000	−0.005	−0.007
	(0.003)	(0.011)	(0.021)
USD	0.987***	−326.676	1.009***
	(0.016)	(334.281)	(0.039)
KRW	0.003	0.001	0.007
	(0.003)	(0.014)	(0.029)
SGD	0.003	−0.021	0.020
	(0.009)	(0.022)	(0.049)

Table A2 *(concluded)*

	(1)	(2)	(3)
AUD	0.004	−0.003	0.023
	(0.008)	(0.006)	(0.020)
MYR	−0.005	327.678	−0.009
	(0.005)	(334.278)	(0.034)
THB	−0.002	0.018	−0.024
	(0.005)	(0.018)	(0.031)
German mark	−0.003		
	(0.008)		
Δemp	0.001	−0.027*	−0.018
	(0.005)	(0.014)	(0.032)
Euro		−0.004	−0.003
		(0.010)	(0.033)
Constant	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)
Observations	23	48	30
R^2	0.998	0.998	0.997
GBP	0.012	0.011	−0.017

(b)

Δ log EMP defined as: $\Delta res_t / MB_{t-1} + \Delta \log ExR_t$	hkd 1997–2000	2001–04	2005–07
JPY	0.000	−0.001	−0.009
	(0.003)	(0.012)	(0.019)
USD	0.987***	0.990***	1.016***
	(0.013)	(0.013)	(0.032)
KRW	0.003	0.001	0.012
	(0.003)	(0.014)	(0.029)
SGD	0.002	−0.022	0.023
	(0.009)	(0.023)	(0.047)
AUD	0.004	−0.001	0.023
	(0.009)	(0.006)	(0.019)
MYR	−0.005		−0.017
	(0.005)		(0.036)
THB	−0.001	0.017	−0.017
	(0.004)	(0.018)	(0.030)
German mark	−0.002		
	(0.007)		
Δemp	0.000	−0.006*	−0.013
	(0.001)	(0.003)	(0.010)
Euro		0.004	−0.007
		(0.008)	(0.030)
Constant	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)
Observations	23	48	30
R^2	0.998	0.997	0.997
GBP	0.012	0.012	−0.024

Table A3. Known Basket Peggers: Chile (clp)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(a)							
Δ log EMP defined as: $\Delta \log res_t + \Delta \log ExR_t$	1980–83	1984–87	1988–91	1992–95	1996–99	2000–03	2004–07
JPY	−0.077	0.638**	0.046	0.201***	0.108***	0.172	−0.031
	(0.084)	(0.255)	(0.134)	(0.057)	(0.035)	(0.108)	(0.143)
USD	0.642***	0.609**	0.957***	0.644***	0.884***	0.376**	0.755***
	(0.232)	(0.269)	(0.112)	(0.072)	(0.079)	(0.181)	(0.152)
French franc	0.421	−0.101	−0.233**				
	(0.282)	(0.442)	(0.112)				
Δ log EMP	0.192**	0.513**	0.036	0.390***	0.228***	0.675***	0.217***
	(0.081)	(0.222)	(0.052)	(0.062)	(0.037)	(0.100)	(0.050)
German mark				0.029	0.109*		
				(0.091)	(0.062)		
Euro						0.238**	0.584**
						(0.100)	(0.259)
Constant	−0.006*	−0.015**	−0.010***	−0.006***	−0.004***	−0.001	0.002
	(0.003)	(0.007)	(0.002)	(0.002)	(0.001)	(0.003)	(0.003)
Observations	46	48	48	48	36	48	41
R^2	0.681	0.768	0.886	0.907	0.911	0.769	0.692
GBP	0.014	−0.146	0.230	0.127	−0.101	0.214	−0.307
(b)							
Δemp defined as: $\Delta res_t/MB_{t-1} + \Delta \log ExR_t$	1980–83	1984–87	1988–91	1992–95	1996–99	2000–03	2004–07
JPY	0.013	0.600	−0.005	0.225**	0.089**	0.103	−0.068
	(0.102)	(0.466)	(0.103)	(0.092)	(0.041)	(0.159)	(0.159)
USD	0.672**	1.245***	1.040***	0.870***	0.998***	0.617**	0.804***
	(0.250)	(0.330)	(0.075)	(0.101)	(0.090)	(0.261)	(0.172)
German mark	0.278	−0.317	−0.276**	−0.150	0.065		
	(0.208)	(0.475)	(0.125)	(0.141)	(0.078)		
Δemp	0.148*	0.101	−0.014	0.053*	0.048***	0.107*	0.090***
	(0.073)	(0.100)	(0.012)	(0.026)	(0.011)	(0.060)	(0.028)
Euro						0.024	0.613**
						(0.132)	(0.295)
Constant	−0.010***	−0.023***	−0.008***	−0.006**	−0.005***	−0.002	0.002
	(0.003)	(0.008)	(0.002)	(0.003)	(0.002)	(0.004)	(0.003)
Observations	46	48	48	48	36	48	41
R^2	0.614	0.525	0.890	0.834	0.864	0.360	0.622
GBP	0.037	−0.528	0.241	0.055	−0.152	0.256	−0.349

Table A4. Known Basket Peggers: Latvian Lat (lvl)

	(1)	(2)	(3)	(4)
(a)				
Δemp defined as: $\Delta\log res_t + \Delta\log ExR_t$	1992–95	1996–99	2000–03	2004–07
JPY	0.319***	0.168***	0.110***	−0.008
	(0.079)	(0.012)	(0.026)	(0.055)
USD	0.427**	0.434***	0.338***	−0.096
	(0.169)	(0.025)	(0.088)	(0.124)
RUB	0.014	−0.006	0.118	0.455***
	(0.039)	(0.006)	(0.085)	(0.154)
German mark	0.260	0.270***		
	(0.148)	(0.032)		
Δemp	0.109**	0.024**	0.009	0.027
	(0.045)	(0.010)	(0.013)	(0.021)
Euro			0.197***	0.496***
			(0.024)	(0.092)
Constant	0.004	−0.001	0.000	−0.003
	(0.002)	(0.001)	(0.001)	(0.002)
Observations	16	36	48	42
R^2	0.824	0.958	0.925	0.617
GBP	−0.019	0.133	0.237	0.154
(b)				

Δemp defined as: $\Delta res_t/MB_{t-1} + \Delta\log ExR_t$	1993–96	1997–00	2001–04	2005–07
JPY	0.234***	0.152***	0.056	−0.003
	(0.046)	(0.019)	(0.034)	(0.144)
USD	0.439***	0.429***	0.048	−0.005
	(0.069)	(0.067)	(0.124)	(0.278)
RUB	−0.012	−0.005	0.391***	0.256
	(0.024)	(0.007)	(0.118)	(0.490)
DEM	0.268***	0.315***		
	(0.036)	(0.057)		
Δemp	0.081**	0.025	0.009	0.002
	(0.032)	(0.015)	(0.014)	(0.048)
EUR			0.332***	0.550
			(0.055)	(0.345)
Constant	0.000	−0.001	−0.002	−0.000
	(0.001)	(0.001)	(0.001)	(0.003)
Observations	34	18	48	24
R^2	0.894	0.948	0.799	0.517
GBP	0.072	0.110	0.173	0.202

Table A5. Known Basket Peggers: Maltese Lira (mtl)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(a)							
Δemp defined as: $\Delta\log res_t + \Delta\log ExR_t$	1980–83	1984–87	1988–91	1992–95	1996–99	2000–03	2004–07
JPY	0.054*	0.163***	0.011	0.085	0.178	0.041**	−0.002
	(0.030)	(0.049)	(0.033)	(0.086)	(0.143)	(0.020)	(0.032)
USD	0.405***	0.258***	0.288***	0.242***	0.400**	0.212***	0.055*
	(0.053)	(0.036)	(0.027)	(0.077)	(0.187)	(0.034)	(0.031)
French franc	0.280***	0.407***	0.381***				
	(0.053)	(0.064)	(0.041)				
Δemp	0.061**	0.083	0.034	0.212	0.540***	0.073***	0.029
	(0.028)	(0.089)	(0.039)	(0.162)	(0.126)	(0.026)	(0.021)
German mark				0.419***	0.168		
				(0.088)	(0.230)		
Euro						0.502***	0.859***
						(0.024)	(0.054)
Constant	0.001	0.001	0.000	−0.003	−0.002	0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.002)	(0.004)	(0.001)	(0.001)
Observations	46	48	48	48	36	45	41
R^2	0.875	0.918	0.933	0.592	0.724	0.934	0.894
GBP	0.261	0.171	0.321	0.253	0.253	0.245	0.089
(b)							
Δemp defined as: $\Delta res_t/MB_{t-1} + \Delta\log ExR_t$	1980–83	1984–87	1988–91	1992–95	1996–99	2000–03	2004–07
JPY	0.054***	0.090***	0.003	0.071	0.165	0.039*	−0.005
	(0.020)	(0.033)	(0.029)	(0.079)	(0.157)	(0.020)	(0.032)
USD	0.352***	0.297***	0.303***	0.227***	0.400**	0.207***	0.049
	(0.044)	(0.024)	(0.024)	(0.079)	(0.191)	(0.034)	(0.031)
German mark	0.326***	0.466***	0.349***	0.435***	0.154		
	(0.034)	(0.049)	(0.034)	(0.076)	(0.257)		
Δemp	0.023	0.004	0.051	0.175	0.480***	0.057**	0.017
	(0.014)	(0.056)	(0.034)	(0.144)	(0.129)	(0.021)	(0.015)
Euro						0.505***	0.867***
						(0.024)	(0.053)
Constant	−0.000	0.000	0.000	−0.003	−0.003	0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.002)	(0.004)	(0.001)	(0.001)
Observations	46	48	48	48	36	45	41
R^2	0.919	0.957	0.934	0.571	0.675	0.933	0.892
GBP	0.267	0.147	0.344	0.268	0.281	0.248	0.089

Table A6. Known Basket Peggers: Norwegian Kroner (nok)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(a)							
Δemp defined as: $\Delta \log res_t + \Delta \log ExR_t$	1980–83	1984–87	1988–91	1992–95	1996–99	2000–03	2004–07
JPY	0.117	0.119*	0.016	−0.037	−0.074	0.081	0.123
	(0.073)	(0.068)	(0.058)	(0.048)	(0.051)	(0.079)	(0.168)
USD	0.332***	0.067	0.177***	0.089**	0.260**	0.017	−0.089
	(0.089)	(0.067)	(0.033)	(0.044)	(0.114)	(0.110)	(0.144)
French franc	0.391***	0.699***	0.578***				
	(0.092)	(0.116)	(0.066)				
Δemp	0.017	0.106*	0.069**	0.050	0.076**	0.029	0.093**
	(0.026)	(0.054)	(0.029)	(0.031)	(0.035)	(0.057)	(0.044)
German mark				0.776***	0.873***		
				(0.066)	(0.100)		
Euro						0.803***	1.135***
						(0.113)	(0.220)
Constant	−0.003	−0.005**	0.001	−0.002	−0.001	−0.000	0.001
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)
Observations	46	48	48	48	36	48	42
R^2	0.728	0.768	0.781	0.798	0.793	0.624	0.546
GBP	0.160	0.115	0.229	0.171	−0.060	0.100	−0.169
(b)							
Δemp defined as: $\Delta res_t/MB_{t-1} + \Delta \log ExR_t$	1980–83	1984–87	1988–91	1992–95	1996–99	2000–03	2004–07
JPY	0.124*	0.055	−0.007	−0.049	−0.099*	0.056	0.005
	(0.063)	(0.077)	(0.054)	(0.047)	(0.051)	(0.075)	(0.304)
USD	0.276***	0.122*	0.185***	0.076*	0.264*	0.008	0.048
	(0.073)	(0.069)	(0.034)	(0.039)	(0.146)	(0.108)	(0.273)
German mark	0.451***	0.689***	0.543***	0.795***	0.910***		
	(0.056)	(0.133)	(0.061)	(0.073)	(0.109)		
Δemp	0.010	0.027	0.017*	0.012	0.015	−0.009	−0.010
	(0.014)	(0.018)	(0.009)	(0.011)	(0.009)	(0.012)	(0.028)
Euro						0.855***	1.469**
						(0.114)	(0.542)
Constant	−0.005**	−0.006*	0.000	−0.002	−0.001	−0.000	0.005
	(0.002)	(0.003)	(0.001)	(0.002)	(0.002)	(0.003)	(0.008)
Observations	46	48	48	48	36	48	11
R^2	0.785	0.724	0.758	0.782	0.765	0.625	0.658
GBP	0.149	0.134	0.279	0.178	−0.075	0.082	−0.523

Table A7. Known Basket Peggers: Seychelles Rupee (scr)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(a)							
Δemp defined as: $\Delta \log res_t + \Delta \log ExR_t$	1980–83	1984–87	1988–91	1992–95	1996–99	2000–03	2004-07
JPY	−0.068	0.230***	0.178***	0.201***	0.030	0.321***	0.073
	(0.154)	(0.033)	(0.020)	(0.016)	(0.049)	(0.115)	(0.086)
USD	0.391***	0.417***	0.370***	0.396***	0.586***	0.367***	0.934***
	(0.099)	(0.024)	(0.021)	(0.016)	(0.113)	(0.125)	(0.080)
French franc	0.430***	0.250***	0.312***				
	(0.135)	(0.038)	(0.028)				
Δemp	0.015	−0.002	0.002	−0.004	0.013	0.011	0.007
	(0.018)	(0.003)	(0.002)	(0.002)	(0.015)	(0.017)	(0.009)
German mark				0.277***	0.085		
				(0.018)	(0.140)		
Euro						−0.030	0.149
						(0.126)	(0.096)
Constant	0.007	0.000	−0.000	0.000	−0.003	−0.001	−0.003**
	(0.006)	(0.001)	(0.000)	(0.000)	(0.002)	(0.003)	(0.001)
Observations	46	48	48	48	36	48	42
R^2	0.530	0.972	0.982	0.992	0.565	0.391	0.833
GBP	0.246	0.103	0.140	0.125	0.299	0.343	−0.156
(b)							
Δemp defined as: $\Delta res_t / MB_{t-1} + \Delta \log ExR_t$	scr 1980–83	1984–87	1988–91	1992–95	1996–99	2000–03	2004–07
JPY	−0.062	0.188***	0.170***	0.203***	0.047	0.319***	0.077
	(0.154)	(0.029)	(0.016)	(0.016)	(0.048)	(0.115)	(0.087)
USD	0.359***	0.442***	0.378***	0.394***	0.538***	0.354***	0.926***
	(0.097)	(0.018)	(0.019)	(0.017)	(0.099)	(0.127)	(0.081)
German mark	0.460***	0.288***	0.299***	0.278***	0.130		
	(0.131)	(0.027)	(0.028)	(0.018)	(0.106)		
Δemp	0.044	−0.004	0.006	−0.006	0.144	0.053	0.016
	(0.044)	(0.005)	(0.007)	(0.005)	(0.103)	(0.041)	(0.015)
Euro						−0.006	0.160
						(0.120)	(0.102)
Constant	0.005	0.000	−0.000	0.000	−0.003	−0.001	−0.003**
	(0.005)	(0.000)	(0.000)	(0.000)	(0.002)	(0.003)	(0.001)
Observations	46	48	48	48	36	48	42
R^2	0.553	0.985	0.985	0.992	0.621	0.413	0.836
GBP	0.244	0.081	0.154	0.125	0.284	0.333	−0.163

Table A8. Known Floaters: Australian Dollar (aud)

	(1)	(2)	(3)	(4)
(a)				
Δ log EMP defined as: $\Delta \log res_t + \Delta \log ExR_t$	1992–95	1996–99	2000–03	2004–07
JPY	−0.008	0.210	0.250**	0.160
	(0.102)	(0.135)	(0.104)	(0.150)
USD	1.036***	0.676***	0.294	0.181
	(0.070)	(0.236)	(0.201)	(0.142)
German mark	−0.171	−0.140		
	(0.141)	(0.180)		
Δ log EMP	0.242***	0.062	0.175***	0.047
	(0.043)	(0.070)	(0.043)	(0.040)
Euro			0.554***	0.107
			(0.123)	(0.247)
Constant	0.002	−0.006	−0.001	0.001
	(0.002)	(0.005)	(0.003)	(0.003)
Observations	48	36	48	42
R^2	0.833	0.327	0.538	0.171
GBP	0.143	0.254	−0.098	0.552
(b)				
Δemp defined as: $\Delta res_t / MB_{t-1} + \Delta \log ExR_t$	1992–95	1996–99	2000–03	2004–07
	0.017	0.208	0.251**	0.165
	(0.095)	(0.123)	(0.103)	(0.151)
USD	0.996***	0.647***	0.269	0.177
	(0.066)	(0.227)	(0.202)	(0.144)
German mark	−0.148	−0.111		
	(0.133)	(0.200)		
Δ emp	0.300***	0.175	0.178***	0.032
	(0.050)	(0.128)	(0.044)	(0.028)
Euro			0.542***	0.099
			(0.124)	(0.243)
Constant	0.003	−0.006	−0.001	0.001
	(0.002)	(0.004)	(0.003)	(0.003)
Observations	48	36	48	42
R^2	0.853	0.385	0.541	0.164
GBP	0.134	0.256	−0.062	0.559

Table A9. Known Floaters: Canadian Dollar (cad)

	(1)	(2)	(3)	(4)	(5)
(a)					
Δ log EMP defined as: $\Delta\log res_t + \Delta\log ExR_t$	cad 1990–93	1994–97	1998–01	2002–05	2006–09
JPY	0.046	0.018	0.035	0.324***	−0.162
	(0.058)	(0.080)	(0.076)	(0.092)	(0.283)
USD	0.902***	0.966***	0.321	0.449***	0.543*
	(0.049)	(0.095)	(0.322)	(0.112)	(0.282)
German mark	0.007	0.018	0.101		
	(0.066)	(0.075)	(0.313)		
Δ log EMP	0.106***	0.067***	0.124**	0.366***	0.401**
	(0.014)	(0.024)	(0.034)	(0.112)	(0.129)
Euro				0.337*	0.189
				(0.179)	(0.522)
Constant	−0.002*	−0.002	−0.008	0.004	−0.005
	(0.001)	(0.002)	(0.006)	(0.002)	(0.005)
Observations	48	48	8	48	14
R^2	0.958	0.790	0.776	0.708	0.684
GBP	0.046	−0.002	0.543	−0.110	0.430
(b)					
Δemp defined as: $\Delta res_t / MB_{t-1} + \Delta\log ExR_t$	cad 1990–93	1994–97	1998–01	2002–05	2006–07
JPY	0.061	0.018	0.036	0.321***	−0.152
	(0.060)	(0.079)	(0.078)	(0.094)	(0.273)
USD	0.870***	0.953***	0.302	0.468***	0.540*
	(0.058)	(0.091)	(0.321)	(0.116)	(0.270)
German mark	0.017	0.026	0.118		
	(0.067)	(0.076)	(0.309)		
Δemp	0.150***	0.084***	0.126**	0.355***	0.433**
	(0.024)	(0.028)	(0.035)	(0.099)	(0.141)
EUR				0.349*	0.182
				(0.179)	(0.483)
Constant	−0.002*	−0.002	−0.009	0.004*	−0.005
	(0.001)	(0.002)	(0.006)	(0.002)	(0.005)
Observations	48	48	8	48	14
R^2	0.957	0.796	0.777	0.713	0.709
GBP	0.052	0.003	0.544	−0.138	0.430

REFERENCES

Bénassy-Quéré, Agnès, 1999, "Exchange Rate Regimes and Policies: An Empirical Analysis," in *Exchange Rate Policies in Emerging Asian Countries*, ed. by Stefan Collignon, Jean Pisani-Ferry, and Yung Chul Park (London, Routledge).

———, Benoît Coeuré, and Valérie Mignon, 2006, "On the Identification of De Facto Currency Pegs," *Journal of the Japanese and International Economies*, Vol. 20 (March), pp. 112–27.

Bilson, John, and Jacob Frenkel, 1979, "Dynamic Adjustment and the Demand for International Reserves," NBER Working Paper 407 (Cambridge, Massachusetts, National Bureau of Economic Research).

Burbula, Andrea, and Inci Ötker-Robe, 2002, "The Evolution of Exchange Rate Regimes Since 1990: Evidence from De Facto Policies," IMF Working Paper 02/155, September (Washington, IMF).

———, 2003, "Exchange Arrangements and Foreign Exchange Markets: Development and Issues," Monetary and Exchange Affairs Department, International Monetary Fund.

Calvo, Guillermo, and Carmen Reinhart, 2002, "Fear of Floating," *Quarterly Journal of Economics*, Vol. 117, No. 2 (May), pp. 379–408.

Eichengreen, Barry, 2006, "China's Exchange Rate Regime: The Long and Short of It," revision of paper presented at a conference on Chinese money and finance, Columbia University, New York, February 2–3.

———, Andy Rose, and Charles Wyplosz, 1996, "Contagious Currency Crises," NBER Working Paper 5681 (Cambridge, Massachusetts, National Bureau of Economic Research).

Frankel, Jeffrey, 1993, "Is Japan Creating a Yen Bloc in East Asia and the Pacific?" in *Regionalism and Rivalry: Japan and the U.S. in Pacific Asia*, ed. by Jeffrey Frankel and Miles Kahler (Chicago, University of Chicago Press).

———, and Shang-Jin Wei, 1994, "Yen Bloc or Dollar Bloc? Exchange Rate Policies of the East Asian Economies," in *Macroeconomic Linkages: Savings, Exchange Rates and Capital Flows*, ed. by Takatoshi Ito and Anne O. Krueger (Chicago, University of Chicago Press).

———, 1995, "Emerging Currency Blocs," in *The International Monetary System: Its Institutions and its Future*, ed. by Hans Genberg (Berlin, Springer).

———, 2007, "Assessing China's Exchange Rate Regime," *Economic Policy*, No. 51 (July), pp. 575–14.

———, 2008, "Estimation of De Facto Exchange Rate Regimes: Synthesis of the Techniques for Inferring Flexibility and Basket Weights," NBER Working Paper No. 14016 (May) (Cambridge, Massachusetts, National Bureau of Economic Research).

———, Sergio Schmukler, and Luis Servén, 2000, "Verifiability and the Vanishing Intermediate Exchange Rate Regime," in *Brookings Trade Forum 2000*, ed. by Susan Collins and Dani Rodrik (Washington, Brookings Institution).

———, Eduardo Fajnzylber, Sergio Schmukler, and Luis Servén, 2001, "Verifying Exchange Rate Regimes," *Journal of Development Economics*, Vol. 66, No. 2 (December), pp. 351–86.

Frenkel, Jacob, 1978, "International Reserves Under Alternative Exchange Rate Regimes and Aspects of the Economics of Managed Float," NBER Working Paper No. 287 (Cambridge, Massachusetts, National Bureau of Economic Research).

Ghosh, Atish, Anne-Marie Gulde, and Holger Wolf, 2002, "Currency Boards: More than a Quick Fix?" *Economic Policy*, Vol. 31 (October), pp. 270–335.

Girton, Lance, and Don Roper, 1977, "A Monetary Model of Exchange Market Pressure Applied to the Postwar Canadian Experience on Growth," *American Economic Review*, Vol. 67, No. 4 (September), pp. 537–48.

Levy-Yeyati, Eduardo, and Federico Sturzenegger, 2003, "To Float or to Trail: Evidence on the Impact of Exchange Rate Regimes on Growth," *American Economic Review*, Vol. 93, No. 4 (September), pp. 1173–1193.

———, 2005, "Classifying Exchange Rate Regimes: Deeds vs. Words," *European Economic Review*, Vol. 49, No. 6 (August), pp. 1603–35.

Masson, Paul R, 2001, "Exchange Rate Regime Transitions," *Journal of Development Economics*, Vol. 64, No. 2 (April), pp. 571–86.

Ohno, Kenichi, 1999, "Exchange Rate Management in Developing Asia," Working Paper No. 1 (January), Asian Development Bank Institute.

Reinhart, Carmen, and Kenneth Rogoff, 2004, "The Modern History of Exchange Rate Arrangements: A Reinterpretation," *Quarterly Journal of Economics*, Vol. 119, No. 1, pp. 1–48.

Rodrik, Dani, 2006, "The Social Cost of Foreign Exchange Reserves," NBER Working Paper No. W11952 (Cambridge, Massachusetts: National Bureau of Economic Research).

Shah, Ajay, Achim Zeileis, and Ila Patnaik, 2005, "What is the New Chinese Currency Regime?" Research Report Series, Department of Statistics and Mathematics, (Vienna, Austria, Wirtschaftsuniversität Wien), No. 3, November.

Shambaugh, Jay, 2004, "The Effects of Fixed Exchange Rates on Monetary Policy," *Quarterly Journal of Economics*, Vol. 119, No. 1 (February), pp. 301–52.

Tavlas, G., H. Dellas, and A. Stockman, 2006, "The Classification and Performance of Alternate Exchange-Rate Systems," Bank of Greece, March.

Williamson, John, 2001, "The Case for a Basket, Band and Crawl (BBC) Regime for East Asia," in *Future Directions for Monetary Policies in East Asia*, ed. by David Gruen and John Simon (Sydney, Reserve Bank of Australia).

Yamazaki, Kazuo, 2006, "Inside the Currency Basket," Columbia University and Mitsubishi UFJ Trust and Banking Corp., December.