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Michael Bleaney and Mo Tian

Produced By:

Centre for Finance, Credit and Macroeconomics
School of Economics
Sir Clive Granger Building
University of Nottingham
University Park
Nottingham
NG7 2RD

hilary.hughes@nottingham.ac.uk

Exchange Rate Flexibility:
How Should We Measure It?

Michael Bleaney[1] and Mo Tian[2]

[1]School of Economics, University of Nottingham

[2]Business School, University of Nottingham

Abstract

This paper examines the extent of agreement between some recent exchange rate classification schemes, and also assesses the merits of some continuous measures of exchange rate flexibility. There is a probability of between 18 and 28 percent that a peg in one classification scheme is coded as a float in a different scheme, or vice versa. This probability is much smaller for the tightest forms of peg and the most volatile floats. An appropriately selected numerical index of exchange rate flexibility is potentially very useful.

Keywords: exchange rates regimes, inflation

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[1]Corresponding author: Professor M F Bleaney, School of Economics, University of Nottingham, Nottingham NG7 2RD. e-mail: michael.bleaney@nottingham.ac.uk. Tel. +44 115 951 5464. Fax +44 116 951 4159.

1 Introduction

Since the 1990s, when it was recognised that central banks had sometimes been misreporting their exchange rate regimes, there has been intensive work on finding new methods of classification (e.g. Ghosh et al., 2002; Klein and Shambaugh, 2010; Levy-Yeyati and Sturzenegger, 2005; Reinhart and Rogoff (2004); Shambaugh, 2004). This research has almost entirely followed the path of defining a number of "fine" (disaggregated) or "coarse" (aggregated) categories to which to allocate each observation, rather than develop a numerical measure of exchange rate flexibility. Although Ghosh et al. (2002, pp. 49-51) suggest a simple numerical flexibility index, they make no use of it except to define three categories of regime (pegged, intermediate and floating). Reviews of this research effort have generally concluded that it has been unsatisfactory, at least in so far as that is measured by the degree of agreement between alternative schemes (Bleaney et al., 2017; Eichengreen and Razo-Garcia, 2013; Tavlas et al., 2008). The purpose of the present paper is twofold: to investigate whether this remains true of the more recent classification efforts, and to assess the value of numerical alternatives.

The recent exchange rate regime classifications that we consider are those of Ilzetzki et al. (2017), Obstfeld et al. (2010) and Bleaney and Tian (2017), together with numerical measures of exchange rate flexibility associated with the last two. Ilzetzki et al. (2017) have updated the Reinhart-Rogoff classification up to 2016 without changing the classification algorithm in any way. Obstfeld et al. (2010) have relaxed the rather stringent definitions of a peg used by Shambaugh (2004) and Klein and Shambaugh (2010) to be more in line with other classifications, and the data have been updated to 2014. Bleaney and Tian (2017) have suggested a method of measuring exchange rate flexibility and identifying exchange rate regimes by a regression similar to that previously used by Frankel and Wei (1995) and Slavov (2013) to identify the basket of anchor currencies for a pegged regime.

All of these classification schemes are designed to capture how much variation is permitted about a defined central rate, if one exists, but they have different ways of answering that question. In an ideal world, the different approaches would make little difference in practice, and the outcomes would be similar. Unfortunately, as we show, that remains far from true.

Section Two discusses the classification schemes, and Section Three compares the outcomes on a country-year basis back to 1980. In Section Four, biases caused by regime changes are discussed. Section Five investigates continuous measures of exchange rate flexibility. Further issues are discussed in Section Six, and Section Seven concludes.

2 The Classifications

We shall be concerned here with classification systems designed to cover a large number of countries over a considerable period, whose output is then available for addressing a variety of research questions about the impact of the choice of exchange rate regime. Any system for classifying exchange rate regimes needs to address a number of issues, such as the following: (a) is it to be based on purely statistical analysis, or should it take account of other information such as stated government policy or the assessment of informed observers, which would involve a considerably more intensive research effort? (b) How disaggregated should the classification aim to be? (c) How many months' data should be used to define the regime (there is obviously a trade-off here between accuracy and the possibility of regime change during the period)? (d) What are the critical issues: is it whether the nominal exchange rate is strictly constant or not, and should it be an exchange rate against a single currency or possibly a currency basket? How should the occasional parity change be dealt with?

If these questions are answered differently in the construction of different classification systems, clearly the outcomes will differ. How important those differences turn out to be cannot be answered in the abstract, but only in practice. In the next section we compare in some detail the outcomes for different classification schemes.

The schemes that we compare are the updated Reinhart-Rogoff scheme of Ilzetzki et al. (2017) [hereafter IRR], the updated Shambaugh classification and a modified version of the Bleaney-Tian (2017) method. We compare these schemes with each other and with the IMF de facto classification.

The Reinhart-Rogoff method uses a combination of detailed chronologies and statistical methods. If the authorities announce some form of peg, statistical analysis is used to confirm that over the relevant period. If no peg is announced, rolling five-year periods are used to define the regime, based on whether 80 percent of the monthly absolute percentage changes in the exchange rate again the identified anchor currency fall within a limited range (one percent for a peg). If no peg or band as wide as ±5 percent is identified, the regime is defined as either a managed or an independent float, depending on the degree of exchange rate volatility. Because the statistical analysis is based on five years rather than one, regime switches are much rarer in IRR than in the other classifications.[1]

The updated Shambaugh classification (hereafter referred to as OST) uses the definition of a peg introduced by Obstfeld et al. (2010). Shambaugh (2004) used a strict definition of a peg, according to which a currency either moved by less than two percent in any month relative to an identified anchor currency, or (to allow for parity changes) was absolutely fixed for eleven months out of twelve, but could have any size of movement in the remaining month. The OST classification also allows for soft pegs that do not meet either of these criteria for a strict peg, but stay within a band of up to ±5 percent. In addition the OST classification has a category labelled "Single-Year Pegs", that meet the criteria for a peg in year *T*, but not in year *T-1* or

[1] See Reinhart and Rogoff (2004, Appendix) for details. If the rolling five-year data yield a different result for years *T* to *T+4* to that for years *T+1* to *T+5*, presumably it is the result for the later period that is used for the overlapping years *T+1* to *T+4*, although this is not explicitly stated.

year *T+1*. These "Single-Year Pegs" are coded as floats in the OST system, on the grounds that such episodes are more likely to be floats that are undergoing a period of temporary stability than genuine pegs.

The Bleaney-Tian (2017) method [hereafter referred to as BT] requires the identification of a numeraire currency. Previous research has often used the Swiss franc as the numeraire currency, but in the last few years the Swiss franc has not always been floating freely, so here we modify the method by using the Japanese yen as a numeraire instead. The potential anchor currencies that we consider are the US dollar and the euro, but with others added in particular cases as listed in Bleaney and Tian (2017, p. 304). Up to 1998, when the euro had not yet been created, we use the German mark and the French franc instead. The regression relates exchange rate movements of currency *i* against the chosen numeraire currency *N* (in this case the Japanese yen) to movements of potential anchor currencies against *N*:

$$\Delta \ln E(i,N)_t = a + b\Delta \ln E(USD,N)_t + c\Delta lnE(EUR,N)_t + u_t \qquad (1)$$

where *USD* is the US dollar, *EUR* is the euro, *E*(*i*, *N*) is the number of units of currency *i* per yen, and Δ is the first-difference operator. In a single-currency peg to the euro, the euro-yen exchange rate should have a coefficient equal to one, and any other exchange rate should have a coefficient of zero. In a basket peg, the coefficients of the currencies making up the basket should sum to one. If the government operates a crawling peg, with a steady devaluation rate of *x*% per month, the value of *x* can be estimated from the intercept term in the regression.

The classification is based on the root mean square error (RMSE) of this regression, which we shall call Regression A. To allow for the possibility of one parity change per year, Bleaney and Tian (2017) estimate 12 extra regressions, each with a dummy variable equal to one in one month only added to Regression A. Call these regressions B(1) to B(12). If none of the dummy variables is statistically significant enough, Regressions B(1) to B(12) are ignored, and that country-year is coded a Fix if RMSE < 0.01, and a Float otherwise. If any of the dummy variables is significant enough, the B regression with the most significant dummy variable becomes the focus of attention.[2] If the RMSE < 0.01 in the chosen B regression, that country-year is coded as a Peg with a Parity Change, and otherwise a Float. We impose two exceptions to this rule, however. (1) If the estimated parity change is very small (< ±0.02), we treat it as a movement within an unchanged band rather than a shift in the central rate, and the observation is coded a Fix. (2) Since revaluations are in practice rare, except where one is known to have occurred, if the estimated parity change is a revaluation of > 0.02, this is assumed to be spurious, and the B regressions are ignored, the coding instead being based on Regression A.[3] This classification is available up to 2017.

Finally, the IMF de facto classification is based on IMF country desks' perception of the regime in force at the time, according to defined criteria. It identifies a number of different types of peg or band, a managed float and an independent float. Since 2012, the IMF has changed its approach, so this classification is available only up to 2011.

It is reasonable to hypothesise that the primary reason for managing a floating exchange rate is to reduce its volatility (see Frankel, 2019, for some evidence). In order to create some symmetry between the classifications that distinguish between managed and independent floats and those that do not, we make use of a continuous measure of exchange rate flexibility to distinguish high-volatility from low-volatility floats in the latter. In the BT system, the RMSE from the regression on which the classification is decided is that measure. Floats are deemed to be high-volatility if RMSE > 0.02, and low-volatility otherwise. For the OST system, the

[2] Bleaney and Tian (2017) suggest an F-statistic > 30 for the addition of the dummy variable as the critical value.
[3] We treat Germany 1983 and China 2005 as genuine parity changes.

dataset provides a slightly different flexibility measure, named EVOL, which is the standard deviation of monthly proportional changes in the exchange rate against the identified anchor currency. A similar criterion is applied: if EVOL > 0.02, it is a high-volatility float; otherwise it is a low-volatility float. One of the main differences between RMSE and EVOL is that the size of any parity change in the year will tend to affect EVOL but not RMSE, since in the latter case it will have been captured by the dummy variable in the regression.

Table 1 summarises the categories used for each classification scheme in the subsequent analysis.[4]

[1] The sources of regime classification data are https://www2.gwu.edu/~iiep/about/faculty/jshambaugh/data.cfm; http://www.carmenreinhart.com/data/browse-by-topic/topics/11/; and https://nottingham.ac.uk/economics/people/michael.bleaney.

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Table 1. Summary of categories used in each classification

Classification	Peg/Band	Float
BT	Fix Peg with parity change	Low-volatility float High-volatility float
IMF	Hard peg Conventional peg Basket peg Band Crawl	Managed float Independent float
IRR	Peg (1-4) Crawl (5-8)	Wide moving band/managed float (9-12) Free float (13)
OST	Strict peg Other peg	Single-year peg Low-volatility float High-volatility float

Notes. In the BT system, a high-volatility float is defined as RMSE>0.02. In the IRR system, the numbers refer to the disaggregated classification (Ilzetzki et al., 2017, Table 2); categories 1-4 are a de jure or de facto horizontal peg; categories 5-8 are a crawling band up to ±2%; categories 9 to 12 are a moving band wider than ±2% or a managed float. In the OST system, a strict peg conforms to the Shambaugh (2004) definition, and “other peg” is one that meets the definition of a soft peg in Obstfeld et al. (2010); a single-year peg is an observation that satisfies the criteria for a peg but one that lasts for a single year only, and is therefore reclassified as a float; a high-volatility float is defined as EVOL>0.02.

3 Comparisons between classifications

Tables 2 to 7 show the pairwise comparisons between our four schemes, using the regime categories shown in Table 1. For example, Table 2 compares the BT and IMF classifications for the period 1980-2011. The first row shows that, of the 1064 IMF Hard Peg episodes, 1053 are classified as a Fix in the BT system, one as a Peg with a Parity Change, and five each as Low-Volatility or High-Volatility Floats. In general, a greater concentration of the numbers along the north-west/south-east axis implies greater agreement.

Table 2. Comparison between BT and IMF classifications 1980-2011

	BT classification				
	Fix	Peg with parity change	Low-Vol. Float	High-Vol. Float	Total
IMF classification:					
Hard peg	1053	1	5	5	1064
Conventional peg	1024	89	38	69	1220
Basket peg	376	55	64	31	526
Band	225	15	46	16	302
Crawl	365	29	111	85	590
Managed Float	386	39	252	342	1019
Independent Float	86	9	173	306	574
Total	3515	237	689	854	5295

Table 3. Comparison between BT and IRR classifications 1980-2016

	BT classification				
	Fix	Peg with parity change	Low-Vol. Float	High-Vol. Float	Total
IRR classification:					
Peg (1-4)	2683	40	47	37	2807
Crawl (5-8)	1112	114	330	176	1732
Wide moving band/ managed float (9-12)	523	57	345	358	1283
Free float	21	4	28	119	172
Total	4339	215	750	690	5994

Notes. IRR freely falling and missing parallel market data omitted.

Table 4. Comparison between BT and OST classifications 1980-2014

	BT classification				
	Fix	Peg with parity change	Low-Vol. Float#	High-Vol. Float#	Total
OST classification:					
JS Peg	2715	53	21	14	2803
Other Peg	694	51	339	63	1147
Single-Year Peg	175	13	16	2	206
Low-Vol. Float#	239	19	206	29	493
High-Vol. Float#	92	114	177	793	1176
Total	3915	250	759	901	5825

Note. #Other than single-year pegs.

Table 5. Comparison between OST and IRR classifications 1980-2014

	OST classification					
	JS Peg	Other Peg	Single-Year Peg	Low-Vol. Float#	High-Vol. Float#	Total
IRR classification:						
Peg (1-4)	2141	95	24	24	49	2333
Crawl (5-8)	364	682	119	187	260	1612
Wide moving band/ managed float (9-12)	190	330	44	192	414	1170
Free float	3	10	3	24	124	164
Total	2698	1117	190	427	847	5279

Notes. See notes to Tables 3 and 4.

Table 6. OST/IMF comparison 1980-2011

	OST classification					
	JS Peg	Other Peg	Single-Year Peg	Low-Vol. Float#	High-Vol. Float#	Total
IMF classification:						
Hard peg	1009	2	0	4	13	1028
Conventional peg	982	57	37	10	81	1167
Basket peg	66	218	36	75	128	523
Band	110	93	19	33	43	298
Crawl	53	189	32	144	160	578
Managed Float	116	305	59	132	376	988
Independent Float	33	152	17	63	304	569
Total	2369	1016	200	461	1105	5151

Notes. #Excluding Single-Year Pegs

Table 7. IMF/IRR comparison 1980-2011

	IRR classification				
	Peg (1-4)	Crawl (5-8)	Wide moving band/ managed float (9-12)	Free float	Total
IMF classification:					
Hard peg	1023	1	32	0	1056
Conventional peg	745	192	159	8	1104
Basket peg	51	240	189	10	490
Band	97	137	37	19	290
Crawl	43	292	140	0	475
Managed Float	66	508	278	16	868
Independent Float	12	116	262	99	489
Total	2037	1486	1097	152	4772

Notes. IRR freely falling and missing parallel market data omitted.

To clarify the interpretation of these tables, Table 8 summarises them in terms of the percentage of each row category that appear in the relevant column. For example the top row of Table 8 shows that, of the 3515 BT Fixes in the first column of Table 2, 14.4 per cent were classified by the IMF as a managed float (386 cases) or an independent float (86 cases). The other two figures in the first row of Table 8 show that a similar proportion of BT fixes (12.5 percent and 12.9 percent) were classified as floats in the other two classifications.

The second row of Table 8 shows the proportion of floats identified by the other classifications when BT identifies a peg with a parity change. For IMF and IRR, this proportion is still quite low, at 20.3 percent and 28.4 percent respectively, but for OST it is much higher, at 58.4 per cent. The third row shows the figures for BT Low-Volatility Floats, which in other classifications are fairly evenly split between pegs and floats (the proportion of floats is 61.7 percent, 49.7 percent and 52.5 percent for IMF, IRR and OST respectively). Finally, in the fourth row of Table 8, we see that there is a heavy majority of floats in other classifications when the BT classification is a High-Volatility Float (75.8 per cent for IMF, 69.1 percent for IRR and 91.5 percent for OST).

Thus the clear pattern in the top panel of Table 8, which compares each other classification in turn with the BT classification, is that there is much more likely to be agreement in the case of the more extreme regimes; for intermediate regimes, the disagreements are quite numerous.

The other panels of Table 8 repeat the exercise for the other three classifications. The general pattern is the same. There is a high degree of agreement (greater than 90 per cent) in the case of the tightest form of peg, and a reasonably high one (always greater than 60 per cent) for the more extreme form of floating, but much less so for intermediate regimes. Managed or low-volatility floats are coded as pegs in another classification in a relatively high number of cases (the highest proportion of floats is 61.7 percent for BT Low-Volatility Floats in the IMF classification, and in five out of the twelve pairwise comparisons the number is below 50 percent). For pegs other than the tightest form, there is generally a solid majority of pegs in the comparison classification; for IRR Crawls the proportion of floats is 29.2 percent (BT), 42.0 per cent (IMF) and 35.1 percent (OST); for OST Other Pegs the proportion of floats is 35.0 percent (BT), 45.0 percent (IMF) and 30.4 percent (IRR); finally, summing the figures for IMF Conventional Pegs, Basket Pegs, Bands and Crawls gives a somewhat lower proportion of floats in the comparison classification: 17.7 percent for BT, 23.8 percent for IRR and 26.3 percent for OST.

In the OST classification, Single-Year Pegs are coded as floats. It can be seen from Table 8 that they tend not to be coded as floats in the other classifications. In the BT classification only 8.7 percent of these observations are floats; the figure for the IMF classification is 38.0 percent, and for the IRR classification it is 24.7 percent. The low figure for IRR is particularly striking, because one would expect that temporarily rather stable floats would still come out as floats in the IRR classification, because of its reliance on five-year rolling windows rather than twelve-month windows.

Table 9 shows the aggregate disagreement rate between each pair of schemes, based on the figures in Tables 2 to 7. A disagreement is registered when one of the pairs codes a form of peg or band and the other codes a form of float. The BT classification has a disagreement rate of slightly below 20 percent with each of the other three schemes, whereas the disagreement rate between the other three is always somewhat higher (27.2 percent for IMF/IRR, 27.6 percent for IMF/OST and 22.7 percent for IRR/OST). Whether one should conclude from these figures that the BT classification is in some sense better than the others is not entirely clear.

Table 8. Percentages of floats in each pairwise comparison

	IMF	IRR	OST
BT Fix	14.4	12.5	12.9
BT Parity Change	20.3	28.4	58.4
BT LV Float	61.7	49.7	52.6
BT HV Float	75.8	69.1	91.5
	BT	IMF	OST
IRR Peg	3.0	3.8	4.2
IRR Crawl	29.2	42.0	35.1
IRR Man. Float	59.8	49.2	55.6
IRR Free Float	85.5	75.7	92.1
	BT	IMF	IRR
OST Strict Peg	1.2	6.3	7.2
OST Other Peg	35.0	45.0	30.4
OST Single-Yr Peg	8.7	38.0	24.7
OST LV Float	46.9	42.3	50.6
OST HV Float	82.4	61.5	68.5
	BT	IRR	OST
IMF Hard Peg	0.9	3.0	1.7
IMF Conv. Peg	8.8	15.1	11.4
IMF Basket Peg	18.1	40.6	45.7
IMF Band	20.5	19.3	31.9
IMF Crawl	33.2	29.5	58.1
IMF Man. Float	58.3	33.9	57.4
IMF Indep. Float	83.1	73.8	67.5

Notes. The table shows the percentage of the row classification that is coded as some type of float in the column classification, based on the figures in Tables 2 to 7.

Table 9. Aggregate percentage disagreement rate (Float/non-float)

	BT	IMF	IRR	OST
BT	x			
IMF	18.7	x		
IRR	19.8	27.2	x	
OST	18.7	27.6	22.7	x
Average	*19.1*	*24.5*	*23.2*	*23.0*

Note. Statistics derived from Tables 2 to 7. A disagreement is registered if a country-year is coded as a type of peg or band by one classification and a type of float by the other. Single-year pegs in the OST system are counted as floats.

4 Regime changes

Regime changes during the period are obviously going to distort the results of any classification based on purely statistical data. In any regression analysis, any structural change tends to worsen the fit. Deciding whether an exchange rate regime is a peg or a float is largely based on the idea that the exchange rate is more predictable under a peg; any regime switch will reduce that predictability, and one would therefore expect that regime switches would make a float classification more likely. In Tables 10 and 11 we separate the comparison between the BT classification and the IMF classification shown in Table 2 into cases where the IMF regime is the same in year *T* as in year *T-1* (Table 10) and cases where it is not (Table 11).[5]

In Table 10 (no regime change) there are a total of 786 cases out of 4567 (17.1 percent) where the BT classification is some type of float when the IMF classification is a peg or band, or vice versa. In Table 11 (regime change) the disagreements of this sort amount to 204 cases out of 728 (28.0 percent), substantially higher than in Table 10. We can further separate these disagreements into cases where an IMF float is a BT peg and vice versa. In Table 10, 430 out of 1307 IMF floats (32.5 percent) are BT pegs, whereas in Table 11 this proportion is actually lower (82 out of 287, or 28.6 percent). If we look at IMF pegs that are BT floats, however, we get very much the opposite picture: there are 346 out of 3260 such cases in Table 10 (10.6 percent), and 122 out of 553 such cases in Table 11 (27.7 per cent). So a switch of IMF regime makes a BT peg classification less likely but a BT float classification more likely. This confirms the conjecture that regime switches tend to bias statistical measures towards greater exchange rate flexibility.

[5] Since the IMF classification is essentially an observation at a point in time (at the end of the year), a change in the classification since the previous year tends to indicate a change of regime during the year.

Table 10. BT/IMF comparison 1980-2011 with no IMF regime change t-1 to t

	BT classification				
	Fix	Peg with parity change	Low-Vol. Float	High-Vol. Float	Total
IMF classification:					
Hard peg	1006	0	4	0	1010
Conventional peg	897	75	26	40	1038
Basket peg	339	46	60	25	470
Band	201	10	39	7	257
Crawl	319	19	91	56	485
Managed Float	331	29	218	242	820
Independent Float	74	4	160	249	487
Total	3167	183	598	619	4567

Table 11. BT/IMF comparison 1980-2011 with IMF regime change t-1 to t

	BT classification				
	Fix	Peg with parity change	Low-Vol. Float	High-Vol. Float	Total
IMF classification:					
Hard peg	47	1	1	5	54
Conventional peg	127	14	12	29	182
Basket peg	37	9	4	6	56
Band	24	5	7	9	45
Crawl	46	10	20	29	105
Managed Float	55	10	34	100	199
Independent Float	12	5	13	57	87
Total	348	54	91	235	728

5 Continuous measures of exchange rate flexibility

Two of the classification schemes that we have been considering offer continuous measures of exchange rate flexibility. In each case there tend to be some outliers at the upper end, so any statistics that we report refer to the median or percentiles rather than the mean of these measures, and in any regression, each measure is trimmed at the upper end by dropping the highest two percent of observations. In the BT classification, the RMSE itself is a natural measure of flexibility relative to the estimated central rate, which may be a constant, or undergo one step change (if the B regressions are being used) and/or be subject to a trend. In the OST dataset, data are given for the standard deviation of the proportional rate of change of the nominal exchange rate against the identified anchor currency (EVOL). This allows for a trend, which would emerge in the mean rather than the standard deviation, but unlike RMSE EVOL will be affected by a step change in the central rate.[6]

Table 12 shows the median value of these two statistics (each multiplied by 100) for each regime classification. In the first column RMSE has a steady gradation from zero or close to it for the tightest peg, up to the highest value for an independent or high-volatility float. In the second column EVOL shows a similar pattern but with two exceptions. For a BT Peg with Parity Change, its median is 3.205, which is considerably higher than for a Low-Volatility Float. This is because a parity change affects the value of EVOL. The other classification where EVOL seems out of line with RMSE is an IMF Basket Peg, where the EVOL median value of 1.556 is well above the value for a Band or a Crawl, and almost as large as for an IMF Managed Float. This presumably reflects the fact that the OST algorithm searches for single-currency pegs only, and not basket pegs.

[6] EVOL is quite similar to the *z*-statistic suggested by Ghosh et al. (2002), which is equal to the square root of the sum of the square of the mean rate of monthly depreciation against the anchor currency and its variance. The difference is that EVOL takes no account of the mean.

Table 12. Continuous measures of exchange rate flexibility

	100 times median value of	
	BT RMSE	OST EVOL
BT Fix	0.000	0.003
BT Parity Change	0.320	3.205
BT LV Float	1.500	1.745
BT HV Float	3.517	3.954
IRR Peg	0.000	0.000
IRR Crawl	0.632	1.096
IRR Man. Float	1.242	1.801
IRR Free Float	1.971	3.038
OST Strict Peg	0.000	0.000
OST Other Peg	0.768	1.294
OST Single-Yr Peg	0.519	0.758
OST LV Float	1.013	1.527
OST HV Float	2.717	3.902
IMF Hard Peg	0.000	0.000
IMF Conv. Peg	0.000	0.000
IMF Basket Peg	0.455	1.556
IMF Band	0.636	1.001
IMF Crawl	0.662	1.148
IMF Man. Float	1.294	1.740
IMF Indep. Float	2.063	2.414

More detailed information about the distribution of RMSE and EVOL, including the quintiles of the distribution, are given in the Appendix. To test the statistical significance of the differences in RMSE and EVOL across regime classifications, Tables 13 to 15 show some regression analysis of each numerical index (multiplied by 100) on the regime dummies for different classifications. The numerical indices are trimmed at the upper end (two percent), and the regressions include country and year dummies.

Table 13 shows the regressions on the IMF regime categories. The omitted category is a hard peg, so the coefficients show the difference in mean RMSE between the relevant category and a hard peg. In Column (1), the mean RMSE for conventional and basket pegs is about half the value for crawls and bands, which are in turn quite a bit smaller than managed floats, with independent floats having the highest value. At the foot of Table 13, two *p*-values are shown, one for the test that the coefficients of bands and managed floats are equal, and one for the test of equality between the coefficients of managed and independent floats. Both *p*-values in Column (1) are 0.000, indicating that independent floats have significantly higher RMSE on average than managed floats, which in turn have significantly higher RMSE than bands.

Column (2) shows a similar regression for EVOL. The pattern is similar, except for the rather high coefficient for basket pegs, and the *p*-values are both significant at the 0.05 level. Finally Column (3) shows that the coefficients for RMSE and EVOL are not significantly different from one another in most cases, with the exception of basket pegs.

Table 14 shows similar regressions for the IRR classification. In Column (1) crawls have a significantly higher coefficient in the RMSE regression than the omitted category of pegs, but a significantly lower one than managed floats, which in turn have one that is just significantly lower than free floats at the 0.05 level. For EVOL (Column (2)), the pattern is similar, but the difference between managed and independent floats is not significant. There is a significant difference between the RMSE and EVOL coefficients for managed floats (Column (3)).

Finally, Table 15 shows a regression of RMSE on the OST classification, and EVOL on the BT classification. The pattern is the same except that for EVOL, pegs with parity changes have a higher coefficient than low-volatility floats. This reflects the sensitivity of EVOL to devaluations.

Overall, these regression results suggest that BT RMSE in particular is a satisfactory index of exchange rate flexibility that captures what classification schemes are designed to achieve.

Table 13. Comparing Flexibility Measures by IMF Regimes (Fixed Effects Regressions)

Dependent variable:	(1) BT RMSE	(2) OST EVOL	(3) RMSE-EVOL
IMF Conv. Peg	0.334**	0.408	-0.077
	(2.45)	(1.05)	(-0.29)
IMF Basket Peg	0.377**	1.078***	-0.782**
	(2.23)	(2.60)	(-2.52)
IMF Band	0.762***	1.040***	-0.270
	(5.45)	(2.74)	(-1.02)
IMF Crawl	0.606***	0.826*	-0.274
	(3.54)	(1.91)	(-0.82)
IMF Managed Float	1.449***	1.821***	-0.080
	(9.31)	(4.45)	(-0.29)
IMF Independent Float	2.040***	2.549***	-0.182
	(11.19)	(5.32)	(-0.63)
Currency Dummies	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
No. Currencies	179	173	171
No. Observations	5097	5034	4895
R2	0.32	0.14	0.04
p-Val. Band = Mng. Float	0.000	0.023	0.405
p-Val. Mng. Float = Ind. Float	0.000	0.013	0.533
RMSE	1.037	2.681	1.957

Note. RMSE and EVOL are trimmed at the top 2% and multiplied by 100. Heteroscedasticity-robust *t*-statistics in parentheses. ***, **, * significant at the 1, 5 and 10% levels respectively.

Table 14. Comparing Flexibility Measures by IRR Regimes (Fixed Effects Regressions)

	(1)	(2)	(3)
Dependent variable:	BT RMSE	OST EVOL	RMSE-EVOL
IRR Crawl	0.526***	0.637***	-0.149
	(8.14)	(4.83)	(-1.43)
IRR Man. Float	0.960***	1.327***	-0.257**
	(10.49)	(8.03)	(-2.30)
IRR Free Float	1.409***	1.973***	-0.321
	(5.90)	(4.03)	(-1.03)
Currency Dummies	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
No. Currencies	186	175	173
No. Observations	5801	5174	5037
R2	0.36	0.36	0.09
p-Val. Crawl=Mng. Float	0.000	0.000	0.196
p-Val. Mng. Float = Ind. Float	0.049	0.158	0.829
RMSE	0.615	0.983	0.697

Note. RMSE and EVOL are trimmed at the top 2% and multiplied by 100. IRR Free Falling and Dual Market Rate Missing categories are excluded. Heteroscedasticity-robust *t*-statistics in parentheses. ***, **, * significant at the 1, 5 and 10% levels respectively.

Table 15. Comparing Flexibility Measures between BT and OST (Fixed Effects Regressions)

	(1)		(2)
Dependent variable:	BT RMSE		OST EVOL
OST Other Peg	0.632***		
	(12.39)	BT Parity Change	3.956***
OST Single-Yr Peg	0.237***		(7.07)
	(4.51)		
OST LV Float	0.770***	BT LV Float	1.703***
	(11.82)		(13.11)
OST HV Float	2.448***	BT HV Float	5.063***
	(21.79)		(20.00)
Currency Dummies	Yes		Yes
Year Dummies	Yes		Yes
No. Currencies	175		177
No. Observations	5627		5708
R2	0.54		0.42
RMSE	0.836		2.189

Note. RMSE and EVOL are trimmed at the top 2% and multiplied by 100. IRR Free Falling and Dual Market Rate Missing categories are excluded. Heteroscedasticity-robust *t*-statistics in parentheses. ***, **, * significant at the 1, 5 and 10% levels respectively.

We might also ask what would happen if we used a numerical index of flexibility instead of the standard classification dummy variables in empirical applications. Here we take a very simple example: whether the world has been moving towards greater exchange rate flexibility up to 2000, and since. We first do this for our flexibility indices, and then for a float dummy from each classification scheme, based on the categories in Table 1, that is equal to one for a float and zero for a peg or band. The results are shown in Table 16 for the flexibility indices and Table 17 for the float dummies.

In Table 16 results are presented both for pooled OLS and for currency fixed effects. The results are very similar. For BT RMSE, there is a positive trend up to the year 1999, and a negative trend since, suggesting that the late twentieth-century trend towards greater exchange rate flexibility has been reversed during the twenty-first century. Both trends are significant at the 0.01 level. For OST EVOL, the picture is rather different: a slightly negative but insignificant trend up to 1999, and a rather fast downward trend since.

In Table 17, the float dummies in the IMF and BT classifications show a pattern similar to that of BT RMSE, of increasing flexibility up to 1999 and decreasing flexibility thereafter. For IRR, the trend is slightly negative in both periods but not statistically significant, and for OST there is a strong negative trend from 2000 onwards and an insignificant one before that, which is similar to the results for OST EVOL.

Table 16. Time Trends of Exchange Rate Flexibilities

	(1)	(2)	(3)	(4)
	Pooled OLS		Currency Fixed Effects	
Dependent variable:	BT RMSE	OST EVOL	BT RMSE	OST EVOL
1 (Year<=1999) *	0.014***	-0.012	0.013***	-0.015*
(Year-2000)	(3.23)	(-1.34)	(2.73)	(-1.67)
1 (Year>1999)*	-0.013***	-0.054***	-0.014***	-0.055***
(Year-2000)	(-2.89)	(-5.16)	(-3.17)	(-5.11)
Constant	0.906***	1.701***	0.906***	1.689***
	(12.28)	(13.30)	(24.00)	(23.65)
No. Currencies			211	177
No. Observations	7124	5708	7124	5708
R2	0.00	0.01	0.00	0.01
RMSE	1.312	3.036	1.042	2.663

Notes. Standard errors are clustered at currency-level. **1**(.) represents an indicator function taking the value of one if the condition holds and zero otherwise.

Table 17. OLS: Time Trends of Floats

	(1)	(2)	(3)	(4)
Dependent variable:	IRR	IMF	BT	OST
1 (Year<=1999) *	-0.002	0.020***	0.006***	-0.002
(Year-2000)	(-1.05)	(9.14)	(3.94)	(-1.16)
1 (Year>1999)*	-0.002	-0.006**	-0.003**	-0.008***
(Year-2000)	(-0.90)	(-2.06)	(-2.15)	(-4.14)
Constant	0.226***	0.435***	0.305***	0.301***
	(7.95)	(12.27)	(12.02)	(11.41)
No. Observations	6357	5349	7345	5829
R2	0.00	0.07	0.00	0.01
RMSE	0.420	0.442	0.439	0.450

Notes. Standard errors are clustered at currency-level. The dependent variables are equal to one where the classification identifies a float (see Table 1) and zero where it does not.
IRR Floats = Mng.+ Free Floats
IMF Floats = Mng.+ Indp. Floats
BT Floats = BT L-&H-Vol Floats
OST Floats = OST L-&H-Vol Floats

Bleaney et al. (2016) have pointed out that, since macroeconomic conditions can affect the choice of regime, time trends in regime choice should be estimated after controlling for such conditions. They find, in particular, that inflation rates up to a level of 25 percent p.a. are highly significant, with higher inflation being associated with a greater likelihood of floating. Accordingly in Tables 18 and 19 we repeat the regressions show in Tables 16 and 17 with the addition of the lagged inflation rate (winsorised at 25 percent p.a.). The inflation variable is always highly significant in the pooled OLS regressions. The pre-2000 positive trend in regime flexibility shown by BT RMSE, IMF and BT is slightly stronger than in Tables 16 and 17, whilst OST EVOL, IRR and OST show no significant pre-2000 positive trend. After 2000, OST EVOL shows a significant negative trend in Table 18, although it is a weaker one than in Table 16, but that is the exception. All the other measures in Tables 18 and 19 show no significant trend in regime choice since 2000. This is rather different from Tables 16 and 17, where the post-2000 time trend had a significantly negative coefficient for every measure except IRR. In other words, although there has been some tendency towards reduced exchange rate flexibility since 2000, that is largely an effect of global disinflation, and it does not represent a shift in preferences for given macroeconomic conditions.

Table18. Time Trends of Exchange Rate Flexibilities Controlling for Inflation Effects

	(1)	(2)	(3)	(4)
	Pooled OLS		Currency Fixed Effects	
	RMSE	EVOL	RMSE	EVOL
1 (Year<=1999) *	0.026***	0.003	0.016***	-0.016
(Year-2000)	(5.01)	(0.25)	(2.81)	(-1.34)
1 (Year>1999)*	-0.003	-0.027***	-0.008*	-0.035***
(Year-2000)	(-0.66)	(-2.63)	(-1.97)	(-3.18)
Inflation t-1	4.469***	9.984***	1.236**	3.651*
(winsorised at 0.25)	(7.51)	(5.71)	(2.31)	(1.95)
Constant	0.641***	0.904***	0.870***	1.353***
	(8.69)	(5.80)	(17.77)	(8.80)
No. Currencies			184	173
No. Observations	5720	5010	5720	5010
R2	0.07	0.09	0.06	0.07
RMSE	1.268	2.792	1.026	2.525

Notes. Standard errors are clustered at currency-level.

Table 19: Time Trends of Floats Controlling for Inflation Effects

	(1)	(2)	(3)	(4)
	IRR	IMF	BT	OST
1 (Year<=1999) *	-0.004*	0.024***	0.009***	0.000
(Year-2000)	(-1.74)	(9.53)	(5.19)	(0.06)
1 (Year>1999)*	-0.001	-0.004	-0.000	-0.004**
(Year-2000)	(-0.58)	(-1.14)	(-0.08)	(-2.16)
Inflation t-1	0.756***	0.759***	1.243***	1.635***
(winsorised at 0.25)	(3.58)	(3.84)	(6.49)	(7.39)
Constant	0.197***	0.383***	0.234***	0.175***
	(5.56)	(9.36)	(7.76)	(6.10)
No. Observations	5211	4632	5899	5095
R2	0.03	0.09	0.05	0.10
RMSE	0.433	0.445	0.442	0.432

Notes. Standard errors are clustered at currency-level. See notes to Table 17.

6. Other information in the classifications

In the BT classification, there are other statistics that one might consider. The intercept of the regression provides an estimate of the trend in the central rate. In the B regressions, the coefficient of the dummy variable provides an estimate of the size of the parity change. Here, however, we focus on another statistic: the coefficients of the exchange rates themselves. What do they reveal about the choice of exchange rate anchors?

In Table 20 we tabulate, for observations coded in the BT system as some form of peg, the number of cases in which an exchange rate coefficient is greater than 0.9 (suggesting a single-currency peg), and the number of cases where there is no exchange rate coefficient greater than 0.9, by IMF regime, because that is the most disaggregated classification. It is clear that most pegs or bands are single-currency pegs to the US dollar or to the euro, except in the case of those classified by the IMF as Basket Pegs, for which 379 out of 432 cases have no exchange rate coefficient greater than 0.9, as one would expect for a basket peg. About two-thirds (288 out of 432) of IMF Managed Floats show strong attachment to a single currency, which in 90 percent of cases is the US dollar.

Table 21 provides a similar tabulation for BT pegs by IRR regime. If the IRR classification is a peg, then the overwhelming likelihood is that the BT regression results suggest that it is a single-currency peg. If the IRR classification is a Crawl or a Wide Moving Band/Managed Float, then the chance of a BT exchange rate coefficient being greater than 0.9 is not that much above 50 percent (690/1233 = 56.0 percent for crawls, and 302/590 = 52.1 percent for Managed Floats). This figure is lower for Managed Floats than in the IMF classification, possibly because it includes some IMF Basket Pegs.

Table 20. Distribution of exchange rate coefficients for BT pegs by IMF regime 1980-2011

	Count of exchange rate coefficient > 0.9			
	US$	Euro	Other	None
IMF classification:				
Hard peg	334	654	61	5
Conventional peg	795	128	137	53
Basket peg	18	31	4	379
Band	15	102	1	122
Crawl	230	23	1	141
Managed float	261	27	0	144
Independent float	54	21	0	20
Total	1707	986	204	864

Table 21. Distribution of exchange rate coefficients for BT pegs by IRR regime 1980-2016

	Count of exchange rate coefficient > 0.9			
	US$	Euro	Other	None
IRR classification:				
Peg (1-5)	1269	1070	198	187
Crawl (6-9)	579	95	16	543
Wide moving band/ managed float (10-12)	224	40	38	278
Free float (13)	5	17	0	3
Freely falling	101	3	0	26
Parallel market data missing	59	7	4	11
Total	2237	1232	256	1048

7 Conclusion

What have we learned about classifying exchange rate regimes?

1) There is no hard and fast statistical boundary between a peg or band and a float; the behaviour of the exchange rate over a defined period can be similar for a wide band or a managed float. Consequently the boundaries between regimes in a categorical classification are inevitably somewhat arbitrary.
2) Twelve months is probably shorter than the ideal span of time over which to classify an exchange rate regime using statistical methods, but it is convenient since so many other macroeconomic data are annual. In detailed studies of particular countries, the logical time span for statistical analysis is whatever period is perceived by the observer to be subject to the same exchange rate regime.
3) Regime switches during the period tend to bias the results towards greater flexibility.
4) Classification systems designed to capture single-currency pegs only are not good at capturing basket pegs.
5) Disagreements between classifications centre on the less extreme regimes, as one might expect. Even so, a disagreement rate of between 18 and 28 percent as to whether a particular country-year is a peg or a float seems unsatisfactorily high.
6) Numerical measures of exchange rate flexibility capture most of what categorical classifications aim to represent, without the unnecessary loss of information or the arbitrary choice of regime boundaries involved in any categorical classification. They are likely to be at least as useful in empirical applications as categorical regime indicators, although attention needs to be paid to outliers at the upper end.

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Table A1. Quintiles of the distribution of flexibility indices by exchange rate regime

	20th cent.	40th cent.	x 100 Median	60th cent.	80th cent.
			RMSE		
BT Fix	0.000	0.000	0.000	0.054	0.467
BT Parity Change	0.000	0.227	0.320	0.410	0.680
BT LV Float	1.226	1.404	1.500	1.609	1.840
BT HV Float	2.483	3.041	3.517	4.098	7.144
IRR Peg	0.000	0.000	0.000	0.000	0.060
IRR Crawl	0.242	0.489	0.632	0.795	1.404
IRR Man. Float	0.295	0.919	1.242	1.593	2.568
IRR Free Float	0.757	1.731	1.971	2.372	3.625
OST Strict Peg	0.000	0.000	0.000	0.000	0.155
OST Other Peg	0.324	0.595	0.768	0.980	1.414
OST Single-Yr Peg	0.187	0.415	0.519	0.625	0.840
OST LV Float	0.533	0.810	1.013	1.225	1.627
OST HV Float	1.186	2.298	2.717	3.203	5.447
IMF Hard Peg	0.000	0.000	0.000	0.000	0.000
IMF Conv. Peg	0.000	0.000	0.000	0.000	0.319
IMF Basket Peg	0.229	0.362	0.455	0.577	1.004
IMF Band	0.324	0.527	0.636	0.752	1.116
IMF Crawl	0.227	0.499	0.662	0.871	1.654
IMF Man. Float	0.521	1.015	1.294	1.765	2.956
IMF Indep. Float	1.119	1.783	2.063	2.483	4.059
			EVOL		
BT Fix	0.000	0.000	0.003	0.266	0.896
BT Parity Change	1.623	2.547	3.205	4.271	12.747
BT LV Float	1.364	1.626	1.745	1.883	2.347
BT HV Float	2.645	3.409	3.954	4.757	9.552
IRR Peg	0.000	0.000	0.000	0.000	0.171
IRR Crawl	0.437	0.871	1.096	1.353	2.089
IRR Man. Float	0.818	1.524	1.801	2.118	3.232
IRR Free Float	2.014	2.785	3.038	3.430	4.246
OST Strict Peg	0.000	0.000	0.000	0.000	0.248
OST Other Peg	0.775	1.126	1.294	1.463	1.837
OST Single-Yr Peg	0.420	0.654	0.758	0.853	1.124
OST LV Float	1.047	1.415	1.527	1.618	1.857
OST HV Float	2.657	3.379	3.902	4.705	8.744
IMF Hard Peg	0.000	0.000	0.000	0.000	0.000
IMF Conv. Peg	0.000	0.000	0.000	0.003	0.725
IMF Basket Peg	0.877	1.334	1.556	1.763	2.639
IMF Band	0.421	0.831	1.001	1.317	1.927

IMF Crawl	0.319	0.838	1.148	1.517	2.876
IMF Man. Float	0.771	1.362	1.740	2.179	3.942
IMF Indep. Float	1.342	2.014	2.414	2.826	4.371