Toward a Stable System of Exchange Rates:
Implications of the Choice of Exchange Rate Regime

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Abstract

This paper conducts a comprehensive empirical analysis to examine the stability of the overall system of exchange rates along two dimensions: does the choice of exchange rate regime help individual countries achieve their domestic macroeconomic goals? And does this choice of regime facilitate the country's interaction with the rest of the system? The empirical findings suggest that there is no universally "right" regime—pegged and intermediate regimes are associated with low nominal volatility and higher economic growth, especially for emerging market economies, and with deeper trade integration, which is growth enhancing. However, floating regimes imply a smoother external adjustment and lower susceptibility to financial crises. Individual countries should therefore tailor the choice of exchange rate regime according to their particular economic challenges, with the proviso that those opting for less flexible regimes should ensure strong macroeconomic fundamentals to minimize the risk of (potentially contagious) crises.

JEL Classification Numbers: F31, F40

Keywords: exchange rate regimes, systemic stability, inflation, growth, crisis

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I. INTRODUCTION

1.   The principal objective of the international monetary system is to facilitate the exchange of goods, services and capital among countries, and to sustain sound economic growth thus fostering economic and financial stability. To this end, individual member countries of the International Monetary Fund (IMF) undertake to collaborate with the Fund and other members to "assure orderly exchange arrangements and promote a stable system of exchange rates."[1]

2.   This paper reviews the stability of the overall system of exchange rates by focusing on two key elements that might contribute to a stable system. First, does the choice of exchange rate regime of individual countries' help them to achieve their domestic macroeconomic goals such as price stability and sustained output growth. Second, does exchange rate policy facilitate the country's interaction with the rest of the system, allowing smooth adjustment to external imbalances and facilitating cross border flows of goods and capital.

3.   Previous reviews on the issue, conducted by the IMF in 1999 and 2003, adopted a somewhat narrow approach and examined one or another of these aspects—but not both of them together.[2] Thus, the 1999 study argued that advanced economies had either hard pegs (for example, the euro zone) or pure floats hence emerging market (and eventually, developing) countries should also go to either end of the bipolar spectrum, mainly to avoid crises. The 2003 study focused only on growth and inflation performance—replacing the de jure classification of regimes with the IMF's de facto measure. It found some benefits of pegging for developing countries, but argued that the costs of pegged regimes for emerging market economies (EMEs) outweighed the benefits; and therefore advised EMEs to move toward greater exchange rate flexibility.

4.   In recent years, important developments have occurred on the international monetary landscape, including the collapse of Argentina's currency board in 2002, which may have reduced the attractiveness of the hard end of the bipolar spectrum; the large buildup in precautionary reserves in many EMEs and the potential for further build up as a reaction to the global financial crisis; and the older problem of global imbalances, which call for a fresh assessment of the systemic stability issue. The paper addresses this need by assessing the stability of the overall system of exchange rates through a comprehensive empirical analysis using data of 150 countries over the period 1980-2007.

5.   The key findings of the paper lead to a more nuanced message on the choice of exchange rate regimes than in earlier studies, particularly with respect to the recommendation that EMEs should move to one of the two extremes of the regime choice spectrum. Specifically, the results indicate that:

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[1] Article IV, Section 1 of the "Articles of Agreement of the International Monetary Fund" available at http://www.imf.org/external/pubs/ft/aa/aa04.htm.

[2] See IMF (1999, 2003).

- Pegged exchange rate regimes provide a useful nominal anchor for both developing and emerging market countries, delivering lower inflation compared to other regimes (including those with explicit inflation targeting frameworks), without compromising growth performance. The main exception to this inflation dividend is the case where the country has a large current account surplus and is unable to permanently sterilize the resulting reserve inflows.

- Intermediate exchange rate regimes, by combining the benefits of still relatively low exchange rate volatility with a competitive level of the real exchange rate—reflecting the "management" of exchange rates to avoid overvaluation—are associated with the fastest output growth, particularly in the EMEs. Pegged and intermediate regimes are associated with deeper trade integration, which is also growth-enhancing.

- Floating exchange rate regimes, however, are associated with lower susceptibility to financial crises, and faster and smoother external adjustment than pegged or intermediate regimes. Less flexible regimes are associated with larger external imbalances (surplus or deficit) and, in the case of deficits, more abrupt adjustment (while surpluses tend to be highly persistent under these regimes).

These findings underscore that the key tradeoff is not between inflation and growth as non-floating regimes are generally associated with lower inflation *and* higher growth, but rather between the performance along these dimensions on the one hand, and the greater risk of crisis and delayed external adjustment, on the other. Against that background, a country should choose the regime best suited to address its particular economic challenges, factoring into its decision in systemic cases the implications of that choice for overall systemic stability.

II.   COUNTRIES' CHOICE OF EXCHANGE RATE REGIME

6.   Exchange rate policy is just one facet of the country's overall set of macroeconomic policies, but an appropriate choice of exchange rate regime can help the country meet particular macroeconomic goals. This section first describes broad trends in exchange rate regimes based on a three-way, de jure and de facto categorization into *pegged*, *intermediate*, and *floating* regimes.[3] It then summarizes the findings of a comprehensive empirical analysis of how the exchange rate regime affects macroeconomic performance. The section concludes by drawing some implications for countries' choice of exchange rate regime.

[3] See Appendix 1 for a discussion on the issue of regime classification.

A. Trends in Regimes

7.   The past decade has seen important developments in the choice of exchange rate regime across the membership.[4] In ***advanced economies****,* the most significant development was the adoption of irrevocably fixed exchange rates and a common currency by euro area countries in 1999 (Figure 1, panel [a]). Since, under ERMII, these countries' currencies were allowed to fluctuate within wide bands, they were previously classified as having an intermediate exchange rate regime. Although the euro floats against other currencies, countries adopting the euro are classified as having a (hard) peg, both because the empirical analysis uses country-level (rather than euro area) statistics, and because it would be strange to treat the adoption of a common currency as a move toward greater flexibility. Beyond the introduction of the euro, there has been some further "hollowing out" of the intermediate regime category with more countries adopting the euro, while at the other end, some countries shifting from intermediate to floating exchange rate regimes.

8.   Among ***emerging market economies*** (Figure 1[b]), three trends are discernible:

- First, consistent with the 1999 review and the bipolar prescription, there is significant hollowing out of the intermediate regime category.[5]

- Second, since the 1999 review, the proportion of both de jure and de facto floating exchange rate regimes has roughly doubled. However, contrary to the prescription in the 2003 review, the proportion of de facto floating regimes has fallen somewhat since 2003.

- Third, there is significant divergence between the de jure and de facto classifications. In a number of cases, the central bank intervenes in the foreign exchange market without taking on the formal commitment to the peg. This is reflected in a larger number of de facto pegs than de jure pegs, and a larger number of de jure

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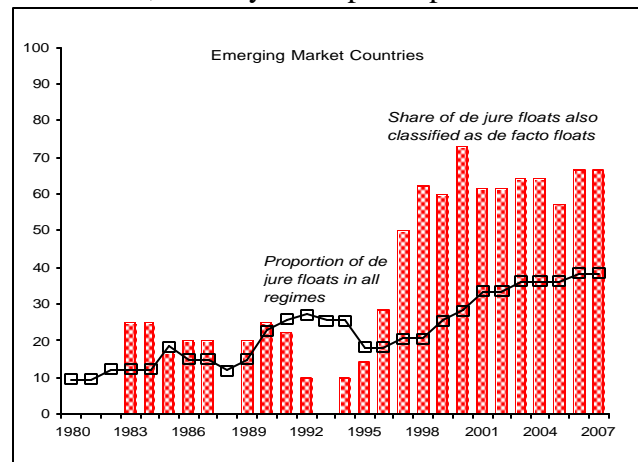
[4] Underlying these trends are changes in the choice of regime. Over the sample period (28 years), on average de jure pegs lasted 12 years, intermediate regimes lasted 13 years, and floating regimes lasted 10 years; corresponding statistics using the de facto classification are: 10 years, 10 years, and 7 years, respectively.

[5] More formal statistical tests, however, reject the strict bipolarity hypothesis as a positive prediction. These tests are based on the notion that, if the bipolar hypothesis is correct, then countries should never switch from either pole towards more intermediate exchange rate regimes; specifically, using a Markov transition matrix, neither hard pegs (monetary union/currency board), nor free floats are an absorbing state (i.e., once adopted, never abandoned) and the union of the set of hard pegs and free floats does not constitute a closed set (i.e., some countries transition from these regimes to intermediate exchange rate regimes).

Figure 1. Frequency Distribution of Exchange Rate Regimes (in percent)

[a] Advanced Economies

[b] Emerging Markets

[c] Developing Economies
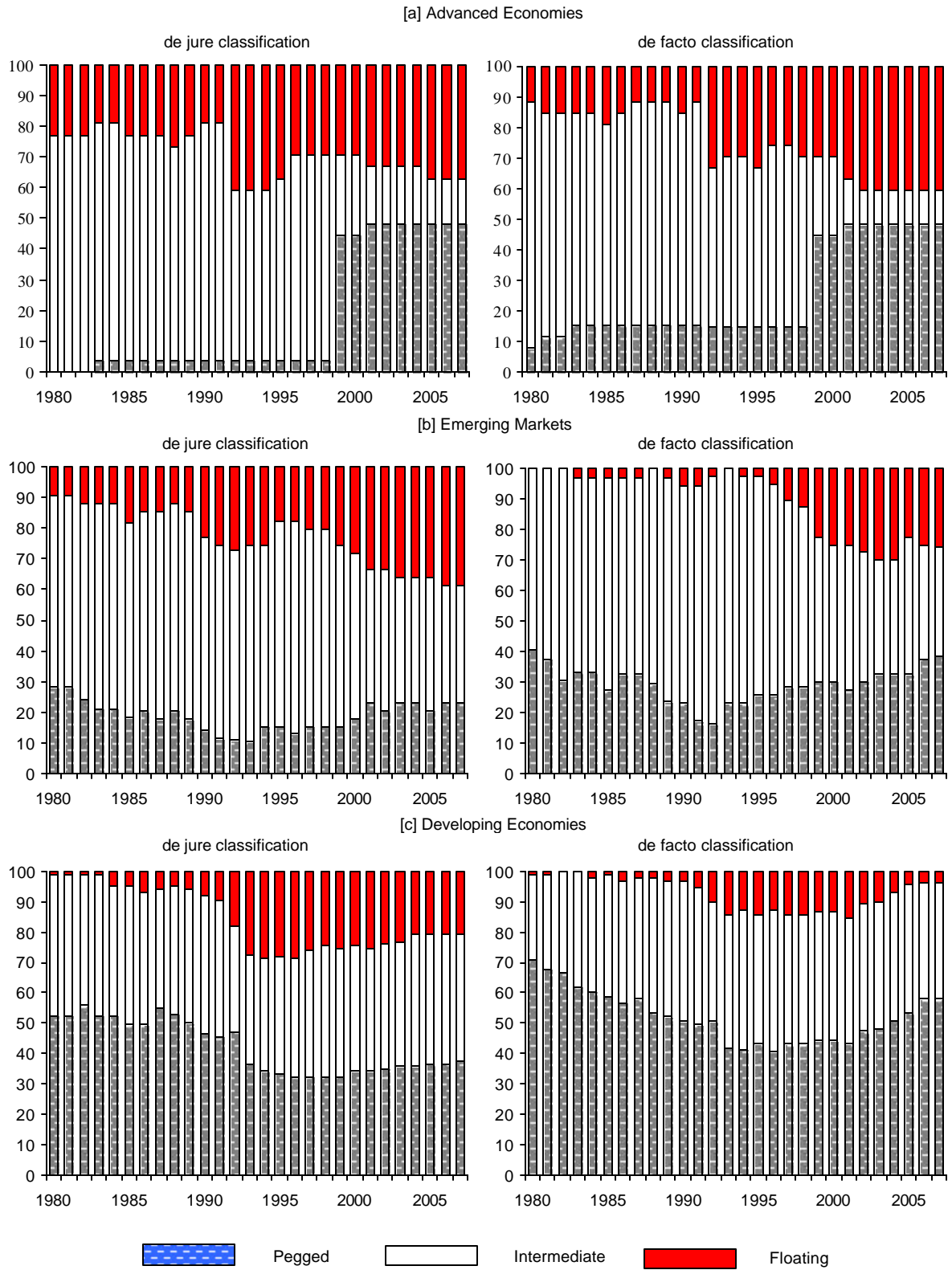
floats than de facto floats.[6] Though the latter phenomenon has decreased since 1998, in some 40 percent of de jure floats, the country does not have a de facto floating exchange rate regime.

9.   In *developing countries*, there has been no hollowing out of the (de jure or de facto) intermediate regime category (Figure 1[c]). The proportion of de jure pegs and de jure floats has also remained roughly constant over the past decade (with a slight increase in pegs and decrease in floats). And, as with emerging market economies, there is significant divergence between de jure and de facto regimes.

10.   The divergence between de jure commitments and de facto behavior, evident in both emerging market and developing countries, nearly always reflects cases where the central bank intervenes but does not commit to the parity. The opposite case—taking on a de jure commitment but de facto not defending the parity—is much rarer. Indeed, across the full sample, in more than 90 percent of cases where the exchange rate is de jure pegged it is also de facto pegged, but only in 50 percent of cases where the exchange rate de jure floats does it also de facto float.

	De Jure Classification		
De Facto Classification	Peg	Int	Flt
Pegged	1588	477	81
Intermediate	92	1677	392
Floating	19	53	476
Total	1,699	2,207	949
Percentage consensus	**93.5**	**76.0**	**50.2**

11.   Together, these trends suggest that developing and emerging market countries have only partially followed the advice of previous studies. Thus, consistent with the 1999 review, there has been some hollowing out of the middle; and, following the 2003 study, more emerging market countries are de jure floating their exchange rates. Contrary to the prescriptions of these two reviews, however, a large proportion of developing and emerging market countries de facto peg their exchange rates—intervening in the foreign exchange markets without taking on the formal commitment to the peg. But, as elaborated upon below, this may be the worst of both worlds: providing neither the policy discipline and credibility of a formal peg nor the benefits of flexibility that a floating exchange rate affords. While the inflation benefits of pegging accrue mainly to de jure pegs (particularly in emerging market countries), the costs in terms of susceptibility to crisis and more abrupt external adjustment apply equally to de facto and de jure pegs.

B. Macroeconomic Performance under Alternative Exchange Rate Regimes

12.   Although the theoretical literature on the choice of exchange rate regime is vast, at some risk of oversimplification it can be categorized into three main strands.[7] The first examines the adjustment, policy effectiveness, and insulating properties of the regime—whether the exchange rate regime facilitates adjustment to trade imbalances, against what types of shocks (domestic or foreign,

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[6] These groups overlap but are not identical because some de facto pegs are de jure intermediate regimes, and some de jure floats are de facto intermediate regimes.

[7] See Ghosh, Gulde, and Wolf (2003), Chapter 3 for a survey of the literature.

nominal or real) the regime best insulates output, and whether the regime constrains other macroeconomic stabilization policies. Some papers took the analysis a step further to ask whether the lower volatility of output translates into higher average growth. The second, originating in post-war Europe, weighs the benefits of adopting pegged exchange rates (or a common currency) to foster deeper goods and capital market integration against the cost of giving up the exchange rate as an adjustment tool. The third, rooted in the high-inflation experiences of the 1970s and 1980s, considers how an exchange rate peg can provide a precommitment device to a central bank battling entrenched inflationary expectations, helping it to disinflate by disciplining credit expansion and by engendering confidence in the currency. Although such exchange-rate based stabilizations (ERBS) enjoyed several successes, their overall record was more mixed (with initial disinflation often followed by a consumption boom, overvaluation, and a fresh BOP crisis), while the capital account crises of the 1990s seemed to further underscore the fragility of fixed exchange rate regimes and their susceptibility to crisis.

13.   The theoretical literature thus gives rise to a number of empirical questions: does the regime constrain monetary and fiscal policies? Are pegged exchange rates associated with lower inflation? Are there systematic differences in growth performance across regimes? Are floating exchange rates less susceptible to crisis? Do floating exchange rate facilitate external adjustment? Do pegged exchange rates promote cross border goods and capital market integration? To help answer these questions, this section reports the key findings of a comprehensive empirical analysis based on some 150 advanced, emerging market, and developing countries over the period 1980-2007, and using the three-way (pegged, intermediate, floating) de jure and de facto regime classifications.[8]

Macroeconomic polices

14.   Since exchange arrangements are just part of the overall macroeconomic policy package, a first question is how the choice of regime affects the scope for monetary and fiscal policies. Regarding *monetary policy*, the "impossible trinity" implies that a country cannot have a pegged exchange rate, open capital account, and an independent monetary policy. But how important is this constraint in practice?

15.   Empirically, pegged exchange rate regimes seem to constrain the ability of monetary policy to react to domestic macroeconomic conditions considerably more than do either intermediate or floating regimes:

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[8] To prevent "contamination" across regimes (e.g., inflationary pressures that build up under a pegged exchange rate regime being attributed to the subsequent float after the peg collapses), the empirical analysis excludes the year of, and the year following, a change in exchange rate regime. The main findings are generally robust to longer exclusion windows.

- Estimated interest rate reaction functions ("Taylor rules") show that monetary policy reacts to inflation and the output gap under floating and intermediate regimes, but not under pegged exchange rate regimes (Table 1, panel [1]).[9]

- Similar results are obtained across country income groups (Table 1 [2]-[4]), though the loss of autonomy under pegged exchange rate regimes is more pronounced for emerging market and developing countries than for advanced economies.[10]

- Robustness tests (not reported here) suggest that the lower responsiveness of monetary policy under pegged exchange rates also holds for countries with low capital mobility; distinguishing pegged exchange rate regimes according to the degree of sterilization (since heavy sterilizers may have greater autonomy); and adding the exchange rate to the interest rate reaction function (on grounds that, even under a flexible exchange rate regime, the central bank may react to the exchange rate).

16.   Turning to *fiscal policy*, the unsustainability of a peg when the government is money-financing the fiscal deficit is well-known; more generally, the fiscal theory of the price level stresses that a pegged exchange rate will not be sustainable unless fiscal policy—including money and bond financing—is sufficiently flexible to respect the government's present value budget constraint at a price level consistent with the peg.[11]

- In terms of simple averages, overall general government deficits are smaller under pegged and intermediate regimes compared to floating regimes, especially in developing countries.

Overall Government Balance, 1990-2007 (in percent of GDP)					
	De Jure			De Facto	
	Peg	Int	Flt	Peg	Int	Flt
Full Sample	-1.9	-1.9	-3.4	-2.1	-2.6	-2.2
Advanced	-0.8	-1.4	-1.5	-1.1	-2.1	-0.6
Emerging	-3.2	-3.0	-4.0	-3.5	-3.1	-3.8
Developing	-2.2	-1.6	-5.7	-2.4	-2.9	-4.6

- Fiscal policy is also much less counter-cyclical under pegged exchange rate regimes (and, to a lesser extent, under intermediate exchange rate regimes) compared to floating regimes (Table 2 [1]).

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[9] Regressions are estimated by OLS, include annual fixed effects, with t-statistics based on robust, country-clustered standard errors; this section was prepared, in part, by Jay Shambaugh. Similar findings are obtained using explicit policy interest rates (available for a smaller sample of countries) and forward-looking measures of inflation and the output gap. See also Borenzstein and others (2001), Shambaugh (2004), and Di Giovanni and Shambaugh (2009).

[10] While emerging market and developing countries tend to be less financially open than advanced economies, they are also "smaller" in the world capital markets, and thus have less policy autonomy.

[11] See Krugman (1979); Diba, Canzoneri, and Cumby (1998) and Wolf, Ghosh, Berger, and Gulde (2008) on the fiscal theory of the price level as applied to exchange rate regimes.

Table 1. Monetary Policy Under Alternative Exchange Rate Regimes 1/

Dep. variable: interest rate	De Jure Classification		De Facto Classification	
	coef.	t-stat.	coef.	t-stat.
[1] All Countries				
Inflation	0.24	1.71 *	0.14	1.00
Pegged regimes*inflation	-0.21 a	-1.50	-0.19 a	-1.19
Intermediate regimes*inflation	-0.17	-1.13	0.03	0.21
Output gap	0.14	2.33 **	0.40	2.67 ***
Pegged regimes*output gap	-0.13 a	-2.17 **	-0.41 a	-2.73 ***
Intermediate regimes*output gap	0.04	0.57	-0.24	-1.50
Anchor interest rate	0.38	0.97	0.45	1.55
Anchor interest rate*Pegged regimes	0.12	0.32	0.12	0.44
Anchor interest rate*Intermediate regimes	-0.31 a	-0.69	-0.42 a	-1.27
Number of observations, R^2	1,902	0.12	1,842	0.15
[2] Advanced economies 2/				
Inflation	0.05	1.67 *	0.06	1.50
Inflation*Pegged regimes	-0.09	-2.25 **	-0.09 a	-1.80 *
Output gap	0.03	1.50	0.03	1.00
Output gap*Pegged regimes	0.01	0.33	-0.02 a	-0.67
Anchor interest rate	0.40	2.50 **	0.38	2.53 **
Anchor interest rate*Pegged regimes	0.36	1.29	0.42	3.00 ***
Number of observations, R^2	542	0.24	539	0.25
[3] Emerging market countries 2/				
Inflation	0.25	2.50 **	0.32	2.91 ***
Inflation*Pegged regimes	-0.41 a	-2.16 **	-0.68	-5.67 ***
Output gap	0.29	2.90 ***	0.30	3.00 ***
Output gap*Pegged regimes	-0.33 a	-2.36 **	-0.19 a	-1.19
Anchor interest rate	0.19	0.21	0.02	0.02
Anchor interest rate*Pegged regimes	0.10 a	0.15	0.98 a	1.24
Number of observations, R^2	501	0.19	476	0.24
[4] Developing countries 2/				
Inflation	0.09	3.00 ***	0.09	2.25 **
Inflation*Pegged regimes	-0.02	-0.50	-0.02	-0.40
Output gap	0.13	3.25 ***	0.17	4.25 ***
Output gap*Pegged regimes	-0.13 a	-3.25 ***	-0.17 a	-4.25 ***
Anchor interest rate	0.07	0.30	-0.07	-0.28
Anchor interest rate*Pegged regimes	0.45	1.96 *	0.64	2.46 **
Number of observations, R^2	946	0.11	924	0.12

Source: IMF; staff estimates
Regression shows the response of the domestic interest rate (proxy for monetary policy) to
inflation, the output gap (+: indicates output above potential), and the identified anchor country's
interest rate. The omitted category is floating exchange rate regimes (in the three-way classification)
and floating and intermediate exchange rate regimes (in the two-way classification).
 Significant regime interactive coefficients indicate that the policy response under that regime
differs from the response under the omitted category.
Insignificant sum of interacted and non-interacted variable indicates that policy does not react to that
variable under that exchange rate regime.
Asterisks indicate statistical significance at the 10(*), 5(**), and 1(***) percent levels.
a indicates that the combination of the coefficient on the interacted variable
(inflation, output gap, anchor interest rate) with the coefficient on the non-interacted
variable is not statistically significantly different from zero.
Example: Combined coefficient of 0.03 (=0.24-0.21) under pegged regimes implies that interest rates
are 0.03 percentage points higher for each percentage point of inflation. Insignificant sum of coefficients
implies that 0.03 is not statistically significantly different from zero.
1/ Regression of change in interest rate on inflation, output gap, and anchor country interest rate with
    dummies and interactive dummies for pegged and intermediate exchange rate regimes.
2/ Two-way classification of regimes: pegged regimes compared to intermediate and floating regimes.

Table 2. Fiscal Policy Under Alternative Exchange Rate Regimes 1/

Dep. variable: fiscal stance	De Jure Classification		De Facto Classification	
	coef.	t-stat.	coef.	t-stat.
[1] All countries				
Output gap	-8.35	-3.39 ***	-9.37	-3.54 ***
Pegged regimes*output gap	9.73	2.36 **	10.55	2.38 **
Intermediate regimes*output gap	1.7	0.48	0.22	0.06
Number of observations, R^2	740	0.45	740	0.45
[2] Advanced economies				
Output gap	-18.92	-2.86 ***	-23.42	-3.43 ***
Pegged regimes*output gap	30.69	2.63 ***	32.33	3.02 ***
Intermediate regimes*output gap	-10.21	-1.38	-3.34	-0.44
Number of observations, R^2	300	0.63	300	0.62
[3] Emerging market countries				
Output gap	-7.86	-1.10	2.1	0.43
Pegged regimes*output gap	30.89 a	2.76 ***	10.94 a	1.40
Intermediate regimes*output gap	11.62	1.35	-3.27	-0.57
Number of observations, R^2	174	0.50	174	0.52
[4] Developing countries				
Output gap	-7.52	-2.27 **	-11.66	-2.67 ***
Pegged regimes*output gap	11.01	2.16 **	16.56	2.44 **
Intermediate regimes*output gap	6.03	1.18	6.74	1.05
Number of observations, R^2	266	0.43	266	0.44

Source: IMF; staff estimates
Regression shows response of fiscal policy to output gap under alternative exchange rate
regimes. Negative coefficient on output gap indicates countercyclical fiscal policy under
floating exchange rate regimes (the omitted regime category); positive interactive regime
dummy of equal or greater magnitude implies procyclical fiscal policy under that regime.
Asterisks indicate statistical significance at the 10(*), 5(**), and 1(***) percent levels.
a indicates that the combined coefficient on the output gap and the regime interaction is
positive and significant at the 10 percent level, implying procyclical fiscal policy.
Example: combined coefficient of 23.0 (=-7.86+30.80) under pegged regimes implies that
the fiscal stance is tightened by 0.23 percent of GDP for each percentage point of the output gap.

1/ Regression of fiscal stance (cyclically-neutral general government balance-actual balance;
   increase represents a fiscal expansion) on output gap (+: indicates output above potential)
   with regime dummies and regime interaction terms and other control variables
   (coefficients not reported): inflation, domestic interest rate, public debt and government
   expenditure (both in percent of GDP).

- This pattern generally holds across country income groups (Table 2 [2]-[4])—except that, in EMEs, fiscal policy is not significantly countercyclical under any exchange rate regime (and is strongly pro-cyclical under pegged regimes), and in developing countries it is much less countercyclical than in advanced economies.

One possibility is that the cycle in emerging market countries is driven by capital flows; when there are capital outflows, an expansionary fiscal policy would widen the risk premium and prompt further capital outflows, threatening the peg. Therefore, fiscal policy is constrained to be countercyclical. This is only a partial explanation, however, since it does not account for procyclicality during the boom period of capital inflows.

17.   Pegged exchange rate regimes thus impose significant constraints on the conduct of other macroeconomic policies. Under a peg, monetary policy largely follows the anchor currency's interest rate and, while the fiscal deficit is smaller, so is the use of countercyclical fiscal policy. Pegging the exchange rate may therefore be a double-edged sword: potentially useful for countries lacking credible institutions and macroeconomic discipline—but, by the same token, constraining the use of macroeconomic policies to offset shocks in countries that do have sufficient policy discipline.

Inflation

18.   The strongest implications in the theoretical literature on the effects of the nominal exchange rate regime concern the behavior of nominal variables such as price inflation. Policy credibility models suggest that pegged exchange rates should be associated with lower inflation both because they instill policy discipline (limit the rate of central bank credit expansion) and engender confidence in the currency (increase the private sector's willingness to hold the currency, leading to lower inflation for a given rate of monetary expansion).[12] For countries trying to disinflate against a history of high inflation, pegging the exchange rate to a strong anchor currency may therefore be a way of "importing" credibility and low inflation. But it is also possible that, if the exchange rate is undervalued and there are limits to sterilization, maintaining the parity in the face of balance of payments surpluses would lead to faster money growth, and higher inflation; particularly if the anchor currency is itself subject to depreciation and inflation, the country could end up importing

Inflation 1980-2007 (in percent per year)						
	De jure			De Facto		
	Peg	Int	Flt	Peg	Int	Flt
All countries	8.0	10.8	13.6	11.0	15.5	9.5
Advanced	2.7	6.7	3.6	2.7	7.5	2.8
Emerging market	11.6	12.9	17.1	11.0	15.5	10.4
Developing	8.1	11.1	17.4	8.2	13.2	15.9

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[12] These models are often based on a Barro-Gordon setup in which the central bank has an incentive to create surprise inflation (either to boost employment or to reduce the real value of public debt) that imparts an inflationary bias to the economy. Pegging the exchange rate provides a pre-commitment device, allowing the central bank to import the credibility of the anchor currency (see Cukierman, 1992). The empirical work follows Ghosh, Gulde, Ostry and Wolf (1997a,b), Ghosh, Gulde and Wolf (2003), Wolf, Ghosh, Berger and Gulde (2008). The discussion here is in terms of the consumer price index; asset price inflation (specifically, credit booms) under alternative regimes is discussed below.

higher inflation. In terms of simple averages, however, the former effect dominates: across the full sample of countries, inflation is lowest under de jure pegs.

19.   The finding of lower inflation under pegged exchange rates generally holds controlling for other likely determinants of inflation (Table 3):

- For the full sample, de jure pegs are associated with about 5 percent lower inflation than intermediate or floating regimes (Table 3[1]). This reflects both a direct association between inflation and the exchange rate regime (i.e., controlling for all of these determinants; the residual "confidence" effect in the policy credibility models) and an indirect association through the behavior of money growth under the regime (the "discipline" effect).

- Pegged exchange rates are not associated with lower inflation in advanced economies (Table 3[2])—these countries generally have strong institutions that provide policy credibility regardless of the exchange rate regime, and their inflation performance is similar to that of potential anchor currencies, so there would be little benefit to "importing" the credibility of an anchor currency.[13]

- For developing and emerging market countries, the association between low inflation and the regime is stronger for de jure pegs than for de facto pegs (Table 3[3]-[4]). This may reflect the formal *commitment* by the central bank to maintain the parity under a de jure peg which, in policy credibility models, is costly to break and leads to the better inflation performance. Dropping those de facto pegged exchange rate observations that are not also classified as pegs under de jure classification yields statistically significant effects of the regime (Table 3, "consensus sample"). Therefore, de facto pegs in which the central bank is also making a formal commitment are indeed associated with lower inflation than floating regimes.[14]

- Across the full sample (i.e., including advanced economies), countries with floating regimes and explicit inflation-targeting frameworks have lower inflation than countries with pegged regimes (Table 3[6]). But for EMEs, pegged exchange rates

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[13] For instance, inflation averaged 2-2.5 percent per year for Germany/euro area and 4 percent for the United States over the period 1980-2006—not much below the average inflation rate for the whole advanced economy sample (around 5 percent per year).

[14] This explains why the 2003 review, which used a de facto classification, but did not distinguish between de facto pegs and cases where the central bank both de facto pegs the exchange rate and makes a de jure commitment to the parity, concluded that pegging the exchange rate brings no inflation advantage to emerging market countries. Likewise, restricting the sample of de facto *intermediate* regimes to those where the central bank is also making a de jure commitment to a pegged or intermediate exchange rate regime yields a significant negative coefficient for the effect of intermediate regimes on inflation in the EME sample.

Table 3. Inflation Under Alternative Exchange Rate Regimes 1/

Dep. variable: inflation	De Jure Classification		De Facto Classification		Peg Consensus 2/	
	coef.	t-stat.	coef.	t-stat.	coef.	t-stat.
	[1] All countries					
Constant	0.031	3.11 ***	0.015	1.86 *	0.003	0.01
Pegged regimes	-0.046	-9.57 ***	-0.002	-0.33	-0.012	2.62 ***
Intermediate regimes	0.003	0.71	0.055	12.47 ***	0.053	10.51 ***
Number of observations, R^2	2,174	0.47	2,065	0.48	1,716	0.43
	[2] Advanced economies					
Constant	-0.029	-3.21 ***	-0.015	-1.28	-0.02	-0.01 **
Pegged regimes	0.027	5.630 ***	-0.013	-2.47 ***	0.03	6.13 ***
Intermediate regimes	0.022	5.130 ***	0.025	5.48 ***	0.04	6.57 ***
Number of observations, R^2	442	0.71	437	0.74	373	0.73
	[3] Emerging market countries					
Constant	0.064	4.92 ***	0.044	2.91 ***	0.02	0.02
Pegged regimes	-0.106	-7.86 ***	0.012	0.75	-0.04	-2.93 ***
Intermediate regimes	-0.031	-3.19 ***	0.074	5.61 ***	0.05	3.57 ***
Number of observations, R^2	582	0.60	522	0.64	415	0.58
	[4] Developing countries					
Constant	0.056	3.71 ***	0.048	2.20 **	0.03	0.03
Pegged regimes	-0.059	-8.93 ***	-0.051	-5.81 ***	-0.07	-6.70 ***
Intermediate regimes	-0.002	-0.28	0.003	0.33	0.01	0.54
Number of observations, R^2	1,150	0.38	1,106	0.32	928	0.34

Source: IMF; staff estimates

Regression shows the association between inflation (as a decimal fraction, per year) and the exchange rate regime, taking account of both the direct channel (i.e., controlling for all other determinants) and the indirect channel through the behavior of broad money growth under the regime.
Negative coefficient on pegged or intermediate exchange rate regime dummies indicate lower inflation under that regime relative to inflation under floating exchange rate regimes (the omitted category).
Example: coefficient of -0.046 for pegged regimes implies 4.6 percent per year lower inflation under pegged exchange rate regimes compared to floating regimes, taking account of differential money growth and controlling for other variables.
Other control variables (coefficients not reported): annual dummies, broad money growth, real GDP growth, trade openness, central bank governor turnover rate (proxy for low central bank independence), terms of trade growth, and fiscal balance (in percent of GDP).

1/ Regression of inflation (decimal fraction, per year) on regime dummies and other control variables; instrumental variable estimation; t-statistics based on clustered, robust standard errors.
2/ Includes only de facto pegged exchange rate regime observations that are also classified as de jure pegs.

Table 3 (cont). Inflation Under Alternative Exchange Rate Regimes 1/

Dep. variable: inflation	De Jure Classification		De Facto Classification	
	coef.	t-stat.	coef.	t-stat.
[5] Observations with below 5 percent per year inflation				
All countries				
Constant	0.024	3.93 ***	0.021	3.45 ***
Pegged regimes	-0.011	-5.94 ***	-0.007	-4.16 ***
Intermediate regimes	0.000	-0.19	0.004	1.60
Number of observations, R^2	981	0.14	955	0.17
[6] Relative to inflation-targeting floating regimes				
All countries				
Constant	0.012	1.54	0.023	3.29 ***
Pegged regimes	0.022	5.06 ***	0.010	2.25 **
Intermediate regimes	0.070	14.58 ***	0.061	13.33 ***
Number of observations, R^2	1809	0.42	1760	0.43
Emerging market countries				
Constant	0.032	2.45 **	0.030	2.32 **
Pegged regimes	-0.047	-4.02 ***	-0.037	-4.01 ***
Intermediate regimes	0.033	3.61 ***	0.053	5.14 ***
Number of observations, R^2	478	0.61	443	0.62
[7] Current account balance above 2 percent of GDP 2/				
All countries				
Constant	0.021	1.50	-0.007	-0.62
Pegged regimes	0.029	2.72 ***	0.063	6.21 ***
Intermediate regimes	0.034	4.77 ***	0.089	10.03 ***
Number of observations, R^2	410	0.57	407	0.60
Emerging market countries				
Constant	0.051	1.65	-0.034	-0.88
Pegged regimes	-0.033	-0.80	0.040	1.08
Intermediate regimes	0.007	0.23	0.128	3.33 ***
Number of observations, R^2	105	0.70	104	0.80
[8] Capital inflows exceeding 2.5 percent of GDP 2/				
All countries				
Constant	0.001	0.14	0.024	2.96 ***
Pegged regimes	-0.042	-7.32 ***	-0.019	-2.72 ***
Intermediate regimes	0.027	4.77 ***	0.036	5.35 ***
Number of observations, R^2	1,040	0.49	988	0.49
Emerging market countries				
Constant	0.025	1.25	0.037	1.78 *
Pegged regimes	-0.092	-5.71 ***	-0.102	-7.11 ***
Intermediate regimes	-0.004	-0.36	0.019	1.33
Number of observations, R^2	269	0.57	241	0.60

Source: IMF; staff estimates

Regression shows the association between inflation (as a decimal fraction, per year) and the exchange rate
regime, taking account of both the direct channel (i.e., controlling for all other determinants) and the
indirect channel through the behavior of broad money growth under the regime.
Negative coefficient on pegged or intermediate exchange rate regime dummies indicate lower inflation under
that regime relative to inflation under floating exchange rate regimes (the omitted category).
Example: coefficient of -0.011 for pegged regimes implies 1.1 percent per year lower inflation under pegged
exchange rate regimes compared to floating regimes, taking account of differential money growth and
controlling for other variables.
Other control variables (coefficients not reported): annual dummies,
broad money growth, real GDP growth, trade openness, central bank governor turnover rate (proxy for
low central bank independence), terms of trade growth, and fiscal balance (in percent of GDP).

1/ Regression of inflation (decimal fraction, per year) on regime dummies and other control variables;
instrumental variable estimation; t-statistics based on clustered, robust standard errors.
2/ Sample's 30th percentile of positive current account balances and positive net capital flows, respectively.

outperform inflation targeting—a result that holds both for the full sample period (1980-2007) and for a more recent period (2000-07), when IT frameworks in emerging market countries have become more prevalent and better developed.

- The relative inflation performance of pegged exchange rate regimes when the country has a balance of payments surplus depends on the source—current account or capital account—of that surplus:

  - In the face of large *current account surpluses* (above 2 percent of GDP—the top 30th percentile of the sample), money growth under pegged exchange rates is higher because the accumulation of reserves cannot be sterilized. This faster money growth results in higher inflation under pegged regimes compared to floating exchange rates (Table 3[7]).

  - In the face of large *capital inflows* (above 2.5 percent of GDP—the top 30th percentile of the sample), money growth under pegged exchange rates is again higher (compared to when there are no such inflows). But money growth in the face of capital inflows is even greater under floating regimes—presumably reflecting looser credit policy in "good times" of capital inflows.[15] As a result, inflation is lower under pegged exchange rate regimes even in the face of capital inflows (Table 3[8]).

20.   Thus, except in the face of large current account surpluses, pegging the exchange rate is associated with significantly lower inflation—especially in cases where the central bank is willing to take on the formal commitment to the peg. Moreover, this association survives a battery of robustness tests, including the possibility of "regime endogeneity" (in which low- inflation countries are more likely to adopt or maintain a peg, rather than the other way around).[16]

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[15] This applies both to the de jure and the de facto classifications of floating regimes, and therefore does not reflect de jure floats acting as de facto pegged or intermediate regimes. Such higher credit growth would be an implication of "balance sheet models" in which domestic credit depends on the collateral that firms can post, and the value of that collateral increases with the appreciation of the exchange rate (see Aghion et al., 2000).

[16] These results are based on a "two-stage" model—a "first-stage" probit on the choice of regime (with the identifying restriction that geographic concentration of exports and country size help determine the choice of exchange rate regime but not inflation performance directly), and a "second-stage" regression in which the fitted regime choice is used in lieu of the regime dummy. Two further robustness test are: (i) to estimate the regression using five-year average panels to help control for country-specific effects (e.g., national aversion to inflation) and for non-contemporaneous effects of the regime on inflation; and (ii) include country fixed effects. Both yield the finding of lower inflation under pegged exchange rates. Finally, evidence from regime transitions suggests that adoption of pegged regimes is associated with lower inflation, and exchange-rate based disinflation programs are as, or more, likely to succeed than disinflation attempts undertaken under more flexible regimes.

Output growth and volatility

21.   A key purpose of the international monetary system, as stressed in the Articles, is to provide a framework that sustains sound economic growth. In terms of unconditional averages, output growth (per capita, constant prices in national currency) in advanced economies is higher under pegged and intermediate exchange rate regimes compared to floating exchange rate regimes. In emerging market and developing countries, growth rates do not differ markedly between pegged

Output Growth 1980-2007 (per capita, in percent per year)						
	De jure			De Facto		
	Peg	Int	Flt	Peg	Int	Flt
All countries	1.4	1.9	1.4	1.6	1.7	1.5
Advanced	2.5	2.3	1.9	2.5	2.2	1.9
Emerging market	1.2	2.4	1.5	1.7	2.2	1.6
Developing	1.3	1.5	1.1	1.4	1.4	1.1

and floating exchange rate regimes, while intermediate regimes exhibit the highest output growth rates.

22.   Although the theoretical literature linking the nominal exchange rate regime to real variables is less developed, there are several channels through which the regime might matter for output growth. For instance, the regime may affect trade and inflation, with most empirical studies finding that greater trade openness and lower inflation are associated with faster output growth. Another is volatility: if nominal or real exchange rate volatility is detrimental to growth, then floating regimes may be associated with lower growth. Some studies also stress the importance of a competitive level of the real exchange rate; inasmuch as pegged exchange rates are more susceptible to overvaluation because of higher inflation than the anchor currency (or, conversely, to undervaluation if the central bank is able to resist real appreciation pressures through intervention), this might affect growth performance.[17]

23.   For the exchange rate regime to be linked to growth performance through the channels mentioned above, these variables must differ systematically across regimes—which they do. Pegged exchange rate regimes are associated with (statistically significantly) greater overvaluation—but lower volatility—of the real exchange rate, lower inflation, and greater trade openness relative to floating regimes. The overvaluation of the real exchange rate is particularly pronounced for de jure pegs, where there may be residual inflation dynamics (or Balassa-Samuelson effects) such that inflation continues at a higher rate than in the anchor country.

Channels of Indirect Association between Regime and Output Growth 1/				
	De jure		De Facto	
	Peg	Int	Peg	Int
Comp. real exch.	-0.16 ***	0.03	-0.04	0.13 ***
Real exch. vol.	-0.85 ***	0.30	-1.30 ***	-0.12
Price vol.	0.03	-0.46 ***	0.22	-0.31 **
Inflation	-0.04 ***	-0.01	0.00	0.05 ***
Trade openness	0.36 ***	0.13 ***	0.37 ***	0.12 ***
1/ Relative to floating regimes; includes other controls from growth regression				
2/ Higher value indicates more competitive (less overvalued) real exchange rate				
3/ Volatility measured as standard deviation of monthly growth rates				

At least in some de facto pegs, the central bank may be intervening to limit the appreciation of the

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[17] See Johnson, Ostry, and Subramanian (2007); Berg, Ostry, and Zettelmeyer (2008).

nominal (and real) exchange rate in the face of BOP surpluses; nevertheless, although the difference is not statistically significant, de facto pegs are more prone to overvaluation than de facto floats. Intermediate regimes are associated with (statistically significantly) lower real exchange rate overvaluation, lower price volatility, and higher trade, but also higher inflation (again compared to floating exchange rate regimes).

24.   Taking account of these various indirect channels, and controlling for other growth determinants (Table 4):

- Across the full sample of countries, intermediate exchange rate regimes are associated with about 0.5 percentage points per year higher growth than pegged or floating exchange rate regimes (Table 4[1]).

- The faster growth performance under intermediate regimes stems mainly from the emerging market country sample—and is stronger for the de jure classification than for the de facto classification (Table 4[3]). The statistical decomposition into the various indirect channels suggests that intermediate regimes are associated with faster growth because they combine more competitive real exchange rates than pegged exchange rate regimes, with lower real exchange rate volatility, greater trade openness, and—to some degree—lower inflation than floating exchange rate regimes.[18] The main systematic difference between pegged and intermediate exchange rate regimes is that the former are more susceptible to overvaluation of the exchange rate, suggesting that growth performance under pegged exchange rates can be improved if overvaluation can be avoided.

- The finding of higher growth in EMEs under intermediate regimes is robust to alternative econometric specifications, including the possibility that the choice of regime is endogenous to the country's growth performance. Moreover, similar results are obtained using five-year average, rather than annual, real GDP growth rates (the differential in favor of intermediate regimes rising to 1.0 percentage point)—the main difference being that pegged exchange rate regimes also perform well in the five-year growth regressions, with about 1 percentage point higher growth per year than floating exchange rate regimes (though the difference is not statistically significant; Table 4, "five-year average growth" columns).

- For developing countries, no very clear results are obtained—growth seems to be determined by factors other than the exchange rate regime. There is some evidence of

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[18] This would also explain why the results are somewhat stronger for the de jure than the de facto classification of intermediate regimes. Recall from above that de facto intermediate regimes exhibit higher money growth and inflation than de jure intermediate regimes (because the central bank is not making a formal commitment); this has real consequences here as the higher inflation feeds through to lower growth.

slower growth under de jure pegs—which are more likely to be subject to overvaluation of the exchange rate (Table 4[4]). But annual output growth rates in developing countries are likely to be very noisy. Regressions using five-year growth rates suggest somewhat higher growth under pegged and especially intermediate exchange rate regimes compared to floating regimes, though the differences are not statistically significant.

Table 4. Output Growth Under Alternative Exchange Rate Regimes 1/

Dep. Var.: real GDP growth	Annual Growth Rates				5-year Average Growth Rates			
	De Jure Classification		De Facto Classification		De Jure Classification		De Facto Classification	
	coef.	t-stat.	coef.	t-stat.	coef.	t-stat.	coef.	t-stat.
[1] All countries								
Constant	-0.005	-0.29	-0.007	-0.40	-0.026	-0.86	-0.032	-1.06
Pegged regimes	-0.004	-1.90 *	-0.001	-0.22	0.007	1.60	0.008	1.31
Intermediate regimes	0.006	2.91 ***	0.005	2.05 **	0.010	2.62 ***	0.009	1.67 *
Number of observations, R^2	1,742	0.18	1,667	0.18	398	0.20	398	0.2
[2] Advanced economies								
Constant	0.172	3.44 ***	0.171	3.29 ***	0.135	1.93 *	0.143	2.04 **
Pegged regimes	-0.002	-0.62	-0.002	-0.70	0.001	0.27	0.002	0.59
Intermediate regimes	-0.003	-1.26	-0.003	-1.30	-0.002	-0.74	0.000	0.00
Number of observations, R^2	473	0.27	470	0.26	100	0.44	100	0.42
[3] Emerging market countries								
Constant	0.031	0.61	0.106	2.04 **	0.109	1.55	0.092	1.14
Pegged regimes	0.003	0.52	-0.004	-0.74	0.012	1.26	0.000	0.00
Intermediate regimes	0.011	3.28 ***	0.000	0.00	0.014	2.44 **	-0.002	-0.30
Number of observations, R^2	502	0.38	453	0.37	110	0.3	110	0.29
[4] Developing countries								
Constant	-0.017	-0.67	0.000	-0.01	-0.015	-0.29	-0.023	-0.44
Pegged regimes	-0.007	-1.68 *	-0.008	-1.21	0.006	0.77	0.002	0.11
Intermediate regimes	-0.001	-0.24	-0.002	-0.28	0.009	1.17	0.005	0.35
Number of observations, R^2	767	0.19	913	0.18	188	0.23	188	0.23

Source: IMF; staff estimates

Regression shows association between output growth (as a decimal fraction, per year) and the exchange rate regime, taking account of both the direct (i.e., controlling for all other determinants) and indirect channels through the behavior of competitiveness (relative price of traded/non-traded goods, controlling for per capita income), real exchange rate volatility, inflation, price volatility, and trade openness.
Positive coefficients on pegged or intermediate exchange rate regime dummies indicate higher per capita output growth under that regime relative to growth under floating regimes (the omitted category).
Other control variables (coefficients not reported): annual dummies, initial per capita income, population growth, average years of schooling, terms of trade growth, and investment, fiscal balance and government spending (all in percent of GDP).
Example: Coefficient of 0.006 implies per capita output growth is 0.6 percentage points higher under intermediate regimes compared to floating regimes.

1/ Regression of per capita output growth in constant local currency prices (decimal fraction, per year) on regime dummies and other control variables; instrumental variable estimation; t-statistics based on clustered, robust standard errors.

25.   Beyond average growth performance, the volatility of output growth may also be of interest. Theory suggests that more flexible exchange rate regimes should reduce, albeit not eliminate, the impact of aggregate supply shocks as they allow real wages to adjust in the face of nominal rigidities, while the impact of aggregate demand shocks depends on their source, and the economy's financial openness. Empirically, there is some evidence of greater output volatility under pegged exchange rates compared to either intermediate or floating exchange rate regimes. This result (not reported) stems from the advanced economies (where shocks are mainly to the fiscal balance) and from developing countries (where the main shocks are to the terms of trade, money velocity, and the fiscal balance). Controlling for the magnitude of these shocks, the standard deviation of output growth remains about 1 percentage per year higher under pegged exchange rate regimes—perhaps reflecting the lower scope for countercyclical macroeconomic policies under pegs. For emerging market countries, by contrast, pegged and intermediate regimes are associated with lower volatility than floating exchange rates (regardless of whether crisis episodes are included in the sample).

Crisis susceptibility

26.   Financial crises are a more extreme form of volatility, and avoiding them is a key goal of the international monetary system—important to the individual country because of the economic and social costs of the crisis, and important to the rest of the system because of the risk of contagion. How does the choice of exchange rate regime affect the risk of a crisis? The string of capital account crises at the turn of the century—starting with the European ERM crises of 1992/93 and culminating with the collapse of Argentina's currency board in early 2002—seemed to underscore the fragility of fixed exchange rate regimes. Likewise, the foreign currency denominated "debt overhangs" in a number of European emerging market countries with pegged exchange rates in the current global crisis suggests that such regimes may be more susceptible to unsustainable asset booms. But is this a misperception based on a handful of spectacular but ultimately unrepresentative cases? Or does it hold systematically in the data?

27.   Empirical analysis of the frequency of crises by regime suggests:

*   Across the full sample of countries, and consistent with the reasoning behind the bipolar prescription, currency crises are somewhat more common under intermediate regimes compared to pegged or floating exchange rate regimes (Table 5[1]).[19]

*   In financially open developing or emerging market countries, there is significantly higher likelihood of a financial (debt, sudden stop, banking) crisis under a pegged or an

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[19] In developing countries, however, currency crises are actually more likely under floating exchange rate regimes (Table 5[1]), likely reflecting instances of economic collapse in which the currency also collapses ("freely falling" currencies in Reinhart and Rogoff's terminology).

intermediate regime than under a floating exchange rate regime (Table 5[2]).[20] This greater susceptibility holds both for the de jure and the de facto classifications, suggesting that the additional "wiggle" room afforded by a de facto practice rather than a de jure commitment does not reduce the vulnerability to crisis (but also that the greater credibility for a de jure commitment does not reduce the likelihood of crisis). Among financially closed economies, there are no significant differences in crisis probabilities across regimes.

- Despite casual empiricism about credit booms and pegged exchange rate regimes, such booms (including those that end in crisis) are not, on average, more likely under pegged exchange rate regimes than under other regimes (not reported).

- Finally, more general "growth crises" (i.e., sharp declines in GDP growth regardless of the shock) are no more likely under pegged or intermediate exchange rate regimes than under floating exchange rate regimes (not reported).

28.   These results are generally in line with the findings of earlier studies that emerging market countries with more open capital accounts may be more vulnerable to currency and financial crises under less flexible exchange rate regimes, though the regime does not appear to particularly influence the risk of other crises (including credit busts and growth crises). Since crisis probabilities depend on other factors as well as the regime, the results suggest that emerging market countries opting for less flexible exchange rate regimes should ensure other strong fundamentals to help offset the greater likelihood of crisis.[21]

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[20] However, the output costs of crises—measured as the change in the real GDP growth rate over the three years following the crisis to the three years prior to the crisis —does not seem to depend on the exchange rate regime prevailing at the time of the crisis.

[21] While countries with less flexible exchange rate regimes are more susceptible to crisis, they could try to compensate for the higher crisis risk by improving their fundamentals (e.g., exchange rate overvaluation, debt, foreign reserves, fiscal balance). For example, the analysis in Postelnyak (2008) suggests that for countries with pegged regimes to achieve a comparable (though still somewhat higher) probability of crisis as countries with floating regimes, they would need to have 18 percent of GDP lower external debt or 5 percent of GDP higher foreign exchange reserves, or a stronger fiscal balance of 1¼ percent of GDP, or some combination of these.

Table 5. Likelihood of Currency or Financial Crisis by Exchange Rate Regime 1/
(In percent of regime observations)

Dep. Variable: Occurrence of currency or financial crisis	De Jure Classification			De Facto Classification		
	Pegged	Intermediate	Floating	Pegged	Intermediate	Floating
[1] Currency Crises 2/						
All countries	4.2	4.9 [c]	4.6	3.9	5.6 [b,c]	3.4
Advanced economies	0.0	1.5	0.5	0.0	1.8	0.0
Emerging market countries	5.5	6.5 [c]	4.9	4.5	7.6 [b,d]	0.9
Developing countries	4.4	5.3 [c]	6.4	4.2	5.8 [a]	7.5 [a]
[2] Financial Crisis (Open KA) 3/ 4/						
All countries	19.7 [a,c]	19.2 [c]	14.9	19.4 [a,d]	18.4	14.4
Advanced economies	8.3	16.0	18.4 [c]	5.4	19.4 [a,c]	16.1 [a,c]
Emerging market countries	29.6 [b]	20.1	15.8	30.8 [b,c]	16.6	15.0
Developing countries	18.5 [a,c]	22.5 [c]	11.1	18.4	18.9 [a]	12.1

Source: IMF; staff estimates

Logistic regression showing likelihood of currency crisis, financial (sudden stop, debt, or banking) crises,
 in percent of regime observations, controlling for other crisis determinants.

Statistical significance at the 10 percent of higher level indicated by:
 a: probability of crisis under the regime differs from one of the other regimes, not controlling for other crisis determinants
 b: probability of crisis under the regime differs from both of the other regimes, not controlling for other crisis determinants
 c: probability of crisis under the regime differs from one of the other regimes, controlling for other crisis determinants
 d: probability of crisis under the regime differs from both of the other regimes, controlling for other crisis determinants
 Example: Coefficient of 4.2 under pegged regimes implies that in 4.2 percent of pegged regime observations
there is a currency crisis.

1/ Logistic regression of crisis probability on regime dummies and other crisis determinants (lagged values of
exchange rate overvaluation, and external debt, foreign reserves and general government balance (all in percent of GDP)).
2/ Currency crisis is defined as a devaluation or depreciation of at least 25 percent over a 12 month period,
provided the devaluation/depreciation is at least 10 percentage points greater than in the preceding
12 months (Frankel and Rose, 1996).
3/ Financial crisis is a union of banking crisis, debt crisis, and sudden stops.
4/ Open capital account refer to above-sample median of the IMF AREAR-based Ito Chinn index of capital controls.

5/ Credit boom and bad credit boom are defined as in Dell'Ariccia and others (2008).
6/ GDP growth more than two country-specific standard deviations below country-specific average growth rate.

External adjustment

29.   An important characteristic of floating exchange rates, emphasized in the early literature (Friedman 1953), is that they should facilitate external adjustment. Some more recent studies, however, conclude that adjustment to current account imbalances is no slower under pegged (or intermediate) exchange rate regimes than under floating regimes.[22] Although there is little pattern to *average* current account balances across regimes, the magnitude of current account surpluses and deficits tends to be larger under less flexible exchange rate regimes.[23]

Current Account Balances (in percent of GDP)						
	De Jure			De Facto		
	Peg	Int	Flt	Peg	Int	Flt
Advanced						
Surpluses	5.4	5.0	4.2	5.3	4.5	5.0
Deficits	-4.4	-3.3	-3.8	-3.7	-3.4	-3.9
Emerging market						
Surpluses	7.9	4.1	2.6	5.9	4.2	2.4
Deficits	-5.7	-4.5	-3.4	-5.5	-4.4	-2.7
Developing						
Surpluses	6.2	8.4	6.1	7.0	7.7	4.6
Deficits	-10.7	-8.3	-8.4	-10.2	-8.6	-7.1

30.   Larger deficits and surpluses are not necessarily a problem: there is no theory that optimal current account balances should be zero or even close to zero. Nonetheless, large imbalances, especially deficits, may portend an abrupt—and disruptive—adjustment. One simple, albeit crude, way to identify potentially problematic imbalances, therefore, is according to whether they ended in an "abrupt reversal"—as that term is commonly used in the current account reversals literature (see Freund, 2005). Are such abrupt reversals, and hence the buildup of "unsustainable" imbalances, more prevalent under certain regimes? The empirical analysis suggests two results (Table 6). First, the magnitude of surpluses or deficits prior to an abrupt reversal are generally smaller under floating regimes than under pegged or intermediate regimes. Second, the likelihood of a deficit that ends abruptly tends to be highest under less flexible regimes—intermediate regimes in emerging market countries, and pegged regimes in the case of developing countries. Moreover, reversals of deficits that developed under pegged (or, to a lesser extent, intermediate) exchange rate regimes are more costly than those that developed under floating exchange rate regimes (both because the imbalances tend to be larger and because the real exchange rate absorbs less of the current account adjustment). For example, the reversal of a deficit that developed under a pegged or an intermediate exchange rate regime is associated with a decline in output growth of about 1.0 to 1.5 percentage points per year compared to almost no decline for those that developed under floating regimes.[24]

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[22] Chinn and Wei (2008) claim that mean reversion of the current account balance does not depend on the exchange rate regime; for contrary evidence, see Ghosh, Terrones and Zettelmeyer (2008).

[23] Moreover, imbalances measured as deviations of actual current accounts from CGER norms (Lee et al., 2008) are larger and more likely (statistically significantly so) under pegged or intermediate regimes (about 2.0-2.5 percent of GDP) than under floating regimes (1.5 percent of GDP) .

[24] The comparison is between average growth in the three years following the reversal to growth in the year of the reversal. An alternative metric tries to capture the cost of the entire episode—taking account of growth performance during the buildup of the imbalance and the costs associated with the subsequent reversal—

31.   Further evidence of slower external adjustment under less flexible exchange rate regimes comes from an analysis of the persistence of the current account dynamics. Table 7 reports the persistence of the current account balance allowing for threshold effects for "large" current account surpluses (top 75th percentile of the distribution of current account balances) and large deficits (bottom 25th percentile).[25]

- Under floating regimes, there are no threshold effects: regardless of whether the current account is in surplus or deficit, and regardless of the magnitude of the imbalance, the autoregressive coefficient is around 0.5 (i.e., a half-life of one year).

- Under pegged and intermediate exchange rate regimes, threshold effects are significant and go in opposite directions according to whether the country has a surplus or deficit (Table 7[2]-[3]). When the current account is in *deficit*, the threshold effect is negative—implying that large deficits *unwind more abruptly* under intermediate and pegged exchange rate regimes.[26] When the current account is in *surplus*, the threshold effect is positive—implying that once surpluses become large, they also become *highly persistent* under these less flexible regimes.

32.   In sum, large imbalances (deficits or surpluses) are more likely under less flexible regimes. Conditional on a large deficit developing under a pegged or an intermediate exchange rate regime, it is more likely to reverse abruptly than under a floating regime. Conditional on a large surplus developing under a pegged or intermediate exchange rate regime, it is more likely to persist than under a flexible exchange rate regime. As such, the results confirm the intuition of the early literature on exchange rate regimes that less flexible exchange rate regimes tend to impede adjustment of external imbalances and that, in particular, surpluses are likely to be more persistent under less flexible regimes.

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relative to the long-run growth performance of the country. By this metric, reversals of deficits that developed under pegged exchange rate regimes are associated with a decline in growth of about 0.5 percentage points, compared to an increase in growth of about 0.5 percentage points for those that developed under floats.

[25] Chinn and Wei (2008) do not consider threshold effects, which is why they conclude that persistence of current account imbalances does not depend on the exchange rate regime.

[26] The lower persistence of large current account deficits holds especially for intermediate exchange rate regimes where, adding the coefficients on the autoregressive term and the threshold interaction terms, yields a persistence parameter of around 0.2 compared to about 0.5 under pegged or floating exchange rate regimes. Recall that intermediate exchange rate regimes are the most likely to experience large deficits (that reverse abruptly), and the most likely to experience currency crises.

Table 6. Current Account Reversals (in percent) 1/

	De Jure Classification		De Facto Classification	
	Prior balance 2/	Reversal probability 3/	Prior balance 2/	Reversal probability 3/
[1] Advanced Economies				
Surplus				
Pegged regimes	7.6	2.3	7.9	3.4
Intermediate regimes	5.5	2.6	4.4	1.9
Floating regimes	3.7	0.9	3.7	1.1
Deficit				
Pegged regimes	-6.3	0.8	-6.3	0.6
Intermediate regimes	-6.2	4.2 *	-6.0	5.4 **
Floating regimes	-5.3	2.3	-4.7	1.1
[2] Emerging market countries				
Surplus				
Pegged regimes	10.9	0.9	10.4	0.8
Intermediate regimes	9.1	0.9	8.8	1.0
Floating regimes	5.0	0.3	…	0.0
Deficit				
Pegged regimes	-10.6	0.7	-11.4	0.8
Intermediate regimes	-9.2	2.0 **	-8.6	1.9 **
Floating regimes	-10.3	0.7	…	0.0
[3] Developing countries				
Surplus				
Pegged regimes	12.3	1.4	11.5	0.9
Intermediate regimes	10.5	0.9	11.7	1.0
Floating regimes	6.6	0.5	6.6	1.1
Deficit				
Pegged regimes	-22.2	4.9	-20.6	4.6
Intermediate regimes	-19.7	2.8	-20.8	2.9 *
Floating regimes	-13.7	3.1 *	-10.4	2.9

Source: IMF; staff estimates
Table indicates the likelihood (in percent of regime observations) and magnitude of
 current account imbalances that are subject to sharp reversals, as defined in Freund (2005).

Asterisks denote differences from pegged regime proportions that are significant
 at the 10 (*), 5 (**), and 1 (***) percent levels.

1/ Reversals defined by (i) a current account deficit or surplus that exceeds 2 percent of GDP
(4 percent of GDP for developing and emerging market countries), (ii) the average deficit (surplus)
improves (deteriorates) by 2 percent of GDP (4 percent of GDP for EMEs and DCs),
(iii) the maximum (minimum) deficit (surplus) in the five years after the reversal is not larger
(smaller) than the minimum (maximum) in the years before the reversal; (iv) the deficit (surplus)
improves (deteriorates) by at least one-third.
2/ Maximum surplus or deficit prior to the reversal, in percent of GDP.
3/ Frequency of reversal as a proportion of exchange rate regime observations.

Table 7. Non-linear Current Account Persistence Regression by Regime 1/

Dep. variable: current account balance	De Jure Classification				De Facto Classification			
	Deficit		Surplus		Deficit		Surplus	
	coef.	t-stat.	coef.	t-stat.	coef.	t-stat.	coef.	t-stat.
[1] Floating Exchange Rate Regimes								
CA_{t-1} 1/	0.51	4.56 ***	0.48	7.45 ***	0.51	7.71 ***	0.40	3.21 ***
CA_{t-1} 1/ x $1(CA_{t-1} < q.25)$	-0.03	-0.29			-0.17	-1.24		
CA_{t-1} 1/ x $1(CA_{t-1} > q.75)$			0.02	0.09			0.04	0.27
Number of observations	717		717		373		373	
[2] Intermediate Exchange Rate Regimes								
CA_{t-1} 1/	0.66	17.78 ***	0.16	1.27	0.58	12.30 ***	0.14	1.12
CA_{t-1} 1/ x $1(CA_{t-1} < q.25)$	-0.44	-3.10 ***			-0.40	-2.88 ***		
CA_{t-1} 1/ x $1(CA_{t-1} > q.75)$			0.73	4.98 ***			0.67	4.16 ***
Number of observations	1728		1728		1683		1683	
[3] Pegged Exchange Rate Regimes								
CA_{t-1} 1/	0.53	12.42 ***	0.50	9.30 ***	0.65	11.17 ***	0.51	9.90 ***
CA_{t-1} 1/ x $1(CA_{t-1} < q.25)$	-0.01	-0.19			-0.11	-1.69 *		
CA_{t-1} 1/ x $1(CA_{t-1} > q.75)$			0.16	1.59			0.30	2.94 ***
Number of observations	1054		1054		1298		1298	

Source: Ghosh, Terrones and Zettelmeyer (2008); IMF staff estimates

Regression shows how the persistence of the current account balance depends on whether the current account is in large deficit (bottom quartile of the sample distribution) or in large surplus. Under floating exchange rate regimes, there are no significant threshold effects, and the persistence coefficient is around 0.5. Threshold effects are negative for deficit countries under intermediate regimes (and slightly negative under pegged exchange rate regimes), implying that a large deficit is subject to more abrupt correction (i.e., is less persistent) under these regimes.
Threshold effects are positive for surplus countries under pegged and intermediate exchange rate regimes, implying that a large surplus is more likely to persist under these regimes.
Example : an autoregressive coefficient of 0.21 (=0.66-0.44) for large deficits under intermediate regimes implies that the half-life of the current account deficit falls from 1.7 (=ln(0.5)/ln(0.66) years to 0.5 (=ln(0.5)/ln(0.21)) years.
1/ Autoregression of current account balance (in percent of GDP) on lagged current account balance, with threshold interactive terms for deficits in the lower quartile of the sample and for surpluses in the upper quartile of the sample of current account balances.
Asterisks indicate statistical significance at the 10(*), 5(**), and 1(***) percent levels respectively, based on robust/clustered standard errors; country fixed effects included but not reported.

International Trade

33.   One of the key attributes of a stable system of exchange rates, according to the Articles, is that it should facilitate the exchange of goods, services and capital. By reducing exchange rate uncertainty, pegged exchange rate regimes should lower the costs of cross-border transactions—particularly those that involve long horizons, such as foreign direct investment, where the uncertainty cannot be easily hedged (Werner, 1970). A first question, therefore, is whether less flexible exchange rate regimes indeed reduce real exchange rate volatility—and over what horizon. From Figure 3, pegged and intermediate exchange rate regimes exhibit lower real exchange rate volatility than floating regimes, with the volatility decreasing in the length of the horizon. Even at a one-year horizon, however, the volatility under floating regimes is close to twice the volatility under pegged or intermediate regimes (Mussa, 1986). But at very long horizons (four to five years), average volatility of the real exchange rate under floating regimes is actually slightly lower than under intermediate regimes—essentially because the floating exchange rate helps offset inflation differentials.

34.   The lower real exchange rate volatility under less flexible regimes translates into greater bilateral trade among countries that share an exchange rate peg (Table 8):

- Participation in a currency union (CU) is associated with increased bilateral trade by a factor of 1.3. This association holds for the full sample of countries, for advanced economy to non-advanced economy (i.e., EME and developing countries) trade, the EME/DC to EME/DC trade; it is weakest for advanced economy to EME/DC sample.

- Turning to other forms of direct peg (i.e., other than currency unions), the effect on raising bilateral trade is very similar, whereas indirect pegs have little or even negative effects.[27] The beneficial effect of a currency union or direct peg decreases with the distance between the trading partners. As such, pegs (or a currency union) may be particularly useful for countries seeking greater regional integration.[28]

- Part of the impact of the regime stems from lower real exchange rate volatility. The effect goes beyond the impact of lower volatility, however, since the pegged exchange rate dummy (*a fortiori*, the CU dummy) is significant even controlling for short-run and longer-

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[27] Country B and country C are said to have an indirect peg if they are both pegged to country A, but do not explicitly peg to each other. The estimates suggest a negative impact of an indirect peg on the bilateral trade between countries B and C, which may reflect trade diversion to country A.

[28] This conclusion is based on interactive distance-regime dummies, which are not reported in Table 8. Greater distance may imply less price convergence (despite a common currency) if countries are far apart because of the transportation costs of goods arbitrage, implying greater real exchange rate volatility.

term volatility.[29] This likely reflects reduced exchange rate *uncertainty* (as opposed to ex post volatility) and, in the case of a CU, lower transactions costs of a common currency. In addition, the volatility of the key currency exchange rates (dollar-euro, dollar-yen) itself has a depressive effect on global trade. [30]

Table 8. Impact of Pegged Exchange Rates on Goods and Services Trade 1/

Dep. variable: bilateral exports	De Jure Classification				De Facto Classification			
	All countries	Advanced Advanced	Advanced EME/DC	EME/DC EME/DC	All countries	Advanced Advanced	Advanced EME/DC	EME/DC EME/DC
Currency union	0.240 ***	0.237 ***	0.117	0.350	0.193 **	0.271 ***	0.108	0.324
	(0.09)	(0.03)	(0.21)	(0.29)	(0.09)	(0.03)	(0.21)	(0.29)
Direct peg (excl. cu)	0.191 **	0.107	0.125 **	-0.606	0.143 *	0.159 **	0.102 *	-0.069
	(0.08)	(0.07)	(0.06)	(1.06)	(0.07)	(0.07)	(0.05)	(1.06)
Indirect peg	-0.095 ***	-0.002	-0.025	-0.077 **	-0.178 ***	0.043 **	0.092 ***	-0.185 ***
	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)
Short-run real exch. vol.	-0.009	-0.007	0.003	-0.113 ***	-0.010	-0.007	0.003	-0.118 ***
	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.01)	(0.03)
Long-run real exch. vol	-0.196 ***	-0.027	-0.129 ***	-0.202 ***	-0.194 ***	-0.027	-0.132 ***	-0.198 ***
	(0.02)	(0.02)	(0.02)	(0.04)	(0.02)	(0.02)	(0.02)	(0.04)
Distance	-1.629 ***	-0.425 ***	-0.660 ***	-2.353 ***	-1.623 ***	-0.427 ***	-0.670 ***	-2.396 ***
	(0.08)	(0.10)	(0.14)	(0.12)	(0.08)	(0.10)	(0.14)	(0.13)
Volatility of G-3 currencies	-0.020 ***	-0.040 ***	-0.018 **	0.003	-0.019 ***	-0.040 ***	-0.017 **	0.004
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Product of country-pair GDPs	1.283 ***	0.437 ***	0.481 ***	1.153 ***	1.283 ***	0.448 ***	0.481 ***	1.151 ***
	(0.03)	(0.05)	(0.04)	(0.04)	(0.03)	(0.05)	(0.04)	(0.04)
lrgdppc	-0.080 ***	0.770 ***	0.816 ***	-0.116 **	-0.077 **	0.754 ***	0.819 ***	-0.109 **
	(0.03)	(0.06)	(0.04)	(0.05)	(0.03)	(0.06)	(0.04)	(0.05)
Observations	157,621	7,767	64,946	84,908	157,621	7,767	64,946	84,908
Number of pairid	10,928	350	3,518	7,060	10,928	350	3,518	7,060

Source: IMF; staff estimates.

Regression shows the impact on bilateral trade of a currency union, other direct peg, or indirect peg. Countries B and C have an indirect peg if they both peg to country A, but do not explicitly peg to each other.
*Example:* coefficient of 0.24 for currency unions implies that trade between two countries in a currency union is 1.27 (=exp(0.24)) times greater (i.e., an increase of 27 percent) than between two countries that do not share a currency union.
1/ Regression of bilateral trade (exports of G&NFS) on currency union, direct, and indirect peg dummies, gravity determinants (distance and GDP), per capita GDP, short-run real exchange rate volatility (standard deviation of within-year monthly growth rates) and long-run (three-year moving standard deviation of annual growth rates) real exchange rate volatility, and dummies (not reported) for common language, common border, free-trade agreements, landlocked countries, common colonial relationship, current or former colony, robust standard errors in parenthesis; asterisks indicate statistical significance at the 10(*), 5(**), and 1(***) percent levels.

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[29] Note that long-run volatility is significant controlling for the regime but short-run volatility is not. From Figure 3, this probably reflects the much larger differences in volatility across regimes at short horizons than at longer horizons (so that including the exchange rate regime in the regression eliminates the independent effect of short-run real exchange rate volatility).

[30] The sharp increase in uncertainty about key exchange rates as the current crisis deepened may have been one factor behind the observed decline in international trade (though other factors, such as the lack of trade finance, were likely more important). For example, the forward-looking expectation of the standard deviation of changes in the exchange rate implied by at-the-money options for the dollar-euro and the dollar-yen more than tripled from 0.1 to 0.3 between August 2008 and October 2008; over the same period, the growth of world merchandise trade fell from 8 percent per year to -30 percent per year (Rancière, 2009).

Figure 3. Real Exchange Rate Volatility (in percent per year)
at Alternative Horizons (in months)
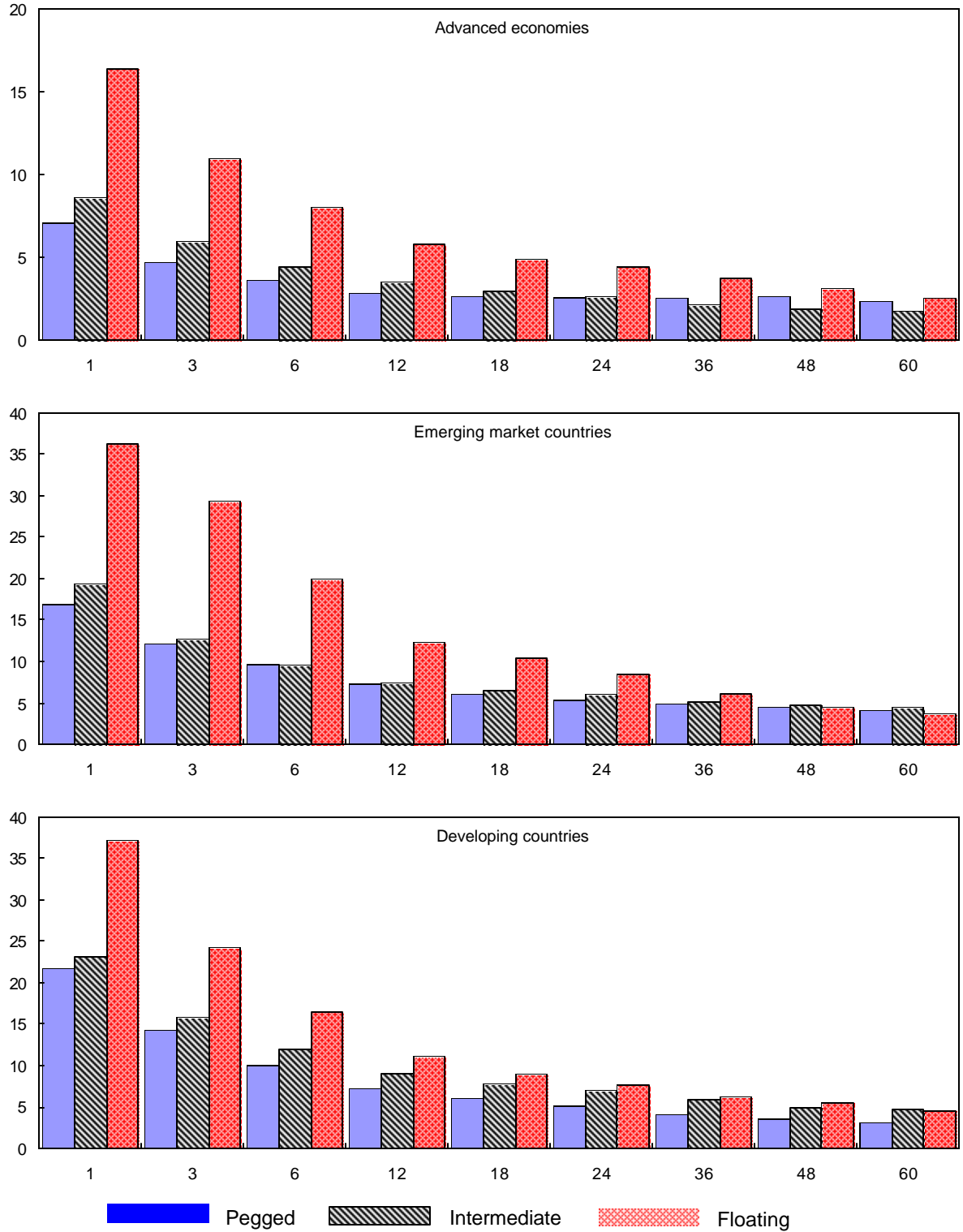
Source: IMF; INS database and staff estimates

Capital Flows

35.   In addition to the exchange of goods and services, a stable system of exchange rates should also facilitate the exchange of capital among countries—but in a manner that promotes economic and financial stability. Capital flows should therefore help mitigate the effects of shocks, not exacerbate them. While a full examination of the nature and characteristics of capital flows is beyond the scope of this paper, a simple metric of the consumption-smoothing effects of capital flows is given by the ratio of the volatility of consumption growth to the volatility of "national cash flow"— output net of investment and government consumption (see Ghosh and Ostry (1997)).[31] In practice, there are two reasons why capital flows may not smooth consumption: first, if capital flows are limited, including because the capital account is not open, they may be unable to fulfill this consumption-smoothing role; second, if capital flows are in fact destabilizing—either because they are procyclical (positively correlated with national cash flow) or because they represent an independent source of volatility.

36.   Table 9 reports the average volatility (three-year centered standard deviation) of the growth of private consumption (in constant, local currency prices) and of national cash flow (GDP minus investment and government consumption, deflated by the GDP deflator) both expressed in per capita terms. Episodes of currency or financial crises are not excluded as a susceptibility to crisis might be one of the ways in which the regime adds instability to capital flows. Across regimes, not surprisingly, the volatility of national cash flow is lower for advanced economies followed by emerging market countries with developing countries exhibiting the highest volatility. More interestingly, the ratio of consumption growth volatility to national cash flow volatility is lowest for advanced economies, with developing and emerging market economies exhibiting broadly similar ratios (though somewhat higher for the latter). It is also noteworthy that, across the sample, the volatility of consumption growth is generally greater than the volatility of national cash flow, suggesting that risk sharing is far from perfect and that capital flows typically do not help smooth consumption.[32]

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[31] This is related to, but distinct from, efficient risk-sharing in perfectly integrated global financial markets; see Dell'Ariccia et al. (2008).

[32] If crisis episodes are excluded, the relative volatility of consumption is lower in more financially open economies, except for emerging market countries under floating regimes.

Table 9: Consumption Smoothing Capital Flows Under Alternative Exchange Rate Regimes

	De Jure Classification						De Facto Classification					
	Full Sample			Open Capital Account 4/			Full Sample			Open Capital Account 4/		
	s(?c) 1/	s(?z) 2/	s(?c)/ s(?z) 3/	s(?c) 1/	s(?z) 2/	s(?c)/ s(?z) 3/	s(?c) 1/	s(?z) 2/	s(?c)/ s(?z) 3/	s(?c) 1/	s(?z) 2/	s(?c)/ s(?z) 3/
[1] All countries												
All regimes	0.05	0.06	1.35	0.04	0.05	1.33	0.05	0.06	1.31	0.04	0.05	1.29
Pegged regimes	0.06	0.08	1.25	0.05	0.07	1.32 **	0.06	0.08	1.23	0.05	0.08	1.26
Intermediate regimes	0.04	0.06	1.29 **	0.04	0.06	1.22 **	0.04	0.06	1.30	0.03	0.05	1.25 *
Floating regimes	0.04	0.04	1.60	0.03	0.03	1.52	0.03	0.03	1.61	0.02	0.02	1.44
[2] Advanced economies												
All regimes	0.02	0.02	1.23 *	0.01	0.02	1.25	0.02	0.02	1.26	0.01	0.02	1.28
Pegged regimes	0.01	0.02	0.86 *	0.01	0.02	0.95	0.01	0.02	0.92	0.01	0.02	1.00
Intermediate regimes	0.02	0.03	1.30	0.02	0.02	1.28	0.02	0.02	1.39	0.02	0.02	1.36
Floating regimes	0.01	0.01	1.30	0.01	0.01	1.36	0.01	0.01	1.38	0.01	0.01	1.41
[3] Emerging market countries												
All regimes	0.04	0.04	1.40	0.04	0.04	1.47	0.04	0.04	1.34	0.04	0.04	1.48
Pegged regimes	0.05	0.05	1.62	0.05	0.05	1.75	0.04	0.05	1.40	0.05	0.05	1.48
Intermediate regimes	0.04	0.05	1.25	0.04	0.05	1.32	0.04	0.05	1.20	0.03	0.05	1.32
Floating regimes	0.03	0.03	1.63	0.02	0.02	1.55	0.03	0.02	2.06	0.03	0.02	2.07
[4] Developing countries												
All regimes	0.06	0.08	1.37	0.06	0.09	1.31 **	0.06	0.09	1.32	0.06	0.09	1.18 **
Pegged regimes	0.07	0.10	1.25 *	0.07	0.09	1.35 **	0.07	0.10	1.27	0.07	0.11	1.32 **
Intermediate regimes	0.06	0.08	1.30 *	0.05	0.09	1.08 *	0.05	0.07	1.32	0.05	0.07	1.08
Floating regimes	0.07	0.07	1.81	0.06	0.06	1.72	0.07	0.06	1.67	0.06	0.06	0.95

Source: IMF; staff estimates

Ratio of volatility of consumption growth-to-volatility of national cashflow growth indicates the extent to which capital flows are consistent with consumption-smoothing. Regression of this ratio on pegged and intermediate exchange rate regime dummies indicates whether consumption smoothing under these regimes differs significantly from the consumption smoothing under floating exchange rate regimes (the omitted category).

1/ ?c is the growth in real consumption per capita; s(?c) is a three-year moving standard deviation, excluding cases where the exchange rate regime changed during the three-year period

2/ National cash flow, z, is defined as z = (GDP-investment-government consumption)/GDP deflator expressed in per capita terms ?z is the corresponding growth rate in z; s(?z) is a three-year moving standard deviation, excluding cases where the exchange rate regime changed during the three-year period

3/ Asterisks represent significance level for the rejection of the null hypothesis that the coefficients of pegged or intermediate regimes is equal to the floating regime (omitted category) in the following regression: s(?c)/s(?z)= b0 + b1Peg + b2Int + e, with country and time fixed effects.

4/ Observations with above-median score on the IMF AREAR-based Chinn-Ito capital account openness index.

37.   Turning to the effect of the exchange rate regime, across the full sample of countries, the relative volatility of consumption growth is (statistically significantly) higher under floating regimes compared to pegged or intermediate regimes. This suggests that capital flows under floating regimes may be more volatile and less driven by fundamentals than under other exchange rate regimes. This pattern holds across country income groups—except for the more financially open developing countries under the de facto classification. Of course, an important exception to this finding is crisis episodes, with the discussion above suggesting that EMEs with open capital accounts and less flexible regimes are more susceptible to crisis; however, such crises are sufficiently infrequent that they do not overturn the result that, on average (i.e., including both crisis and non-crisis periods), capital flows allow a greater degree of consumption smoothing under pegged and intermediate regimes than under floating regimes.

38.   Why should floating regimes be associated with less consumption-smoothing capital flows? As discussed above, real exchange rate volatility is generally greater under more flexible regimes, which may be both a manifestation and a cause of more volatile capital flows. The greater volatility of capital flows under floating regimes is likely to be reflected in greater real exchange rate volatility, while the real exchange rate uncertainty deters capital flows that require longer-term real exchange rate stability (such as foreign direct investment). It turns out that net portfolio investment inflows (as a share of total net capital inflows) are indeed higher under floating regimes, except for developing countries under the de facto classification. Although portfolio flows are not necessarily more unstable than direct foreign investment or other types of investment flows (or more likely to be "hot money" that is not driven by fundamentals), the correspondence between higher consumption volatility and this pattern of inflows is suggestive. Overall, though the evidence is not conclusive, capital flows under pegged and intermediate regimes appear to be more conducive to consumption smoothing than flows under floating regimes.

Structure of Net Capital Inflows (in percent of net portfolio, direct, and other inflows)						
	De Jure			De Facto		
	Peg	Int	Flt	Peg	Int	Flt
Portfolio flows						
Advanced	45.5	28.2	37.1	43.5	27.0	38.4
Emerging market	7.9	13.5	45.5	8.2	18.1	37.4
Developing	5.3	3.7	5.1	5.6	3.9	-1.1
Direct investment						
Advanced	18.7	20.6	20.8	18.8	20.3	21.3
Emerging market	67.1	54.5	60.8	61.5	52.8	72.4
Developing	41.5	57.8	69.9	46.9	55.6	68.7

C.   Implications for the Choice of Regime

39.   The empirical findings underscore that the optimal regime depends very much on the macroeconomic challenges facing the country and its circumstances. Indeed, a key difference between this paper and earlier IMF reviews is not only its more comprehensive look at the evidence, but also its more nuanced message. With this in mind, are there broad generalizations about how a country might choose its exchange rate regime?

40.   For developing and emerging market countries that face persistent inflationary dynamics, lack policy credibility (or institutions and mechanisms to impart such credibility), or are trying to disinflate against a history of high inflation, pegging the nominal exchange rate may bring significant benefits. Two points are noteworthy in this regard: first, the inflation benefits of pegging hold even with relatively low inflation (less than 5 percent per year, Table 3[5]); second, as inflation differentials narrow around the globe, the benefit from pegging to a low-inflation anchor currency diminishes. A potential nuance to this story is that inflation differentials have picked up recently, but the likely persistence of this going forward in unclear, and would depend inter alia on the effectiveness of the full gamut of economic policies in dealing with the financial crisis, the credibility of exit strategies, and the aftermath of the earlier food and fuel price shock.

Inflation (in percent per year)
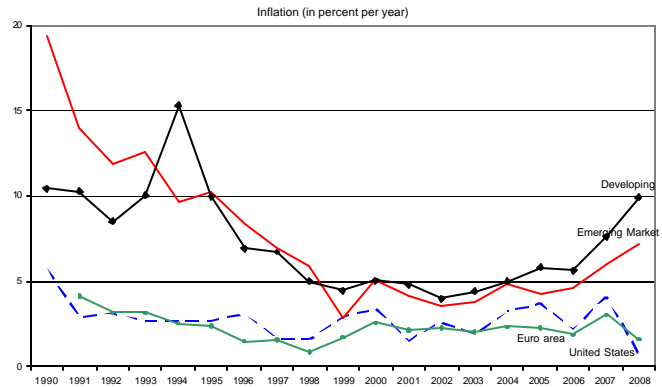
41.   In choosing to peg of course, countries limit their scope to adopt countercyclical policy measures, though such constraints may be appropriate when policies otherwise lack credibility or the central bank is battling entrenched expectations. Reaping the credibility benefits, however, requires a *formal* commitment to the peg—simply intervening in the foreign exchange market to keep the exchange rate constant does not suffice. In addition, a clear exception to the inflation dividend from pegging are cases where the country faces persistently large current account surpluses that cannot be durably sterilized.

42.   If a country chooses a pegged exchange rate regime, it faces two questions: against which currency to peg? And how hard a peg to adopt? The choice of anchor currency depends on its expected performance (which, given the current financial turmoil and the need to unwind the massive easing that has taken place across the major currency regions, is now more uncertain) and the country's trading patterns.[33] In light of this uncertainty, and since most countries trade with all of the major trading blocs and would not want to lose competitiveness through cross currency movements, there may be a case for basket pegs. In general, however, basket pegs provide a smaller inflation dividend than single currency pegs, partly because they are less transparent (especially if the basket is not publicly known). Therefore, if a basket peg is adopted, its weights should be publicly announced or an established basket (e.g., SDR) should be used. As regards the "hardness" of the peg, while inflation performance is strongest under currency board arrangements, inasmuch as few

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[33] Particular issues arise in the case of major oil producers, given the structure of the economy and the dollar pricing of oil in world markets; see IMF (2008), Frankel (2003), Habib and Stráský (2008), Ghosh and Kim (2007), and Setser (2007) for a discussion of the issues.

regimes are truly permanent, an important consideration is the difficulty of engineering a graceful exit from hard pegs—unless the country has a "natural" exit such as monetary union.

43.   Turning to output growth, there appears to be no trade-off between inflation and sustained growth: low inflation and price volatility are associated with faster output growth. Although the evidence is not as definitive, growth performance appears to be stronger under less flexible exchange rate regimes (intermediate regimes and, if overvaluation can be avoided, pegged exchange rate regimes). Pegged exchange rates (*a fortiori*, currency unions) also help foster greater cross-border trade, and could thus be particularly helpful for countries seeking closer regional integration. There is also some evidence that less flexible regimes are associated with a greater share of "consumption-smoothing" capital flows.

44.   The major tradeoff in choosing a relatively inflexible versus relatively flexible exchange rate regime is therefore not between inflation and growth, but rather between those two measures of economic performance on the one hand, and the ease of external adjustment and risk of financial crisis on the other:

- While not a detriment to sustained growth over the medium run, relatively inflexible regimes seem more prone to currency and financial crises. This highlights the importance of other country fundamentals—including the fiscal balance, level of external debt, and reserves coverage of short-term debt—as potential offsets to mitigate the risk of crisis in the case where a country chooses to adopt a relatively inflexible exchange rate regime.

- Large imbalances (deficits and surpluses) are more likely under inflexible regimes, and the unwinding of large deficits is more costly—in terms of foregone growth—under such regimes; this highlights the need for other adjustment mechanisms (e.g., labor market flexibility) to address external imbalances under such regimes.

The experience of European emerging market countries over the past few years may be illustrative in this regard. While many of the countries with less flexible regimes enjoyed strong growth in the years leading up to the present crisis, they also built up large external imbalances, increasing their vulnerability to abrupt and disruptive adjustment as well as to financial crisis. Less flexible regimes have also tended to limit the scope for countercyclical macroeconomic policies in the face of the current global crisis.

45.   Finally, large surpluses are also less likely to be unwound in a timely manner under inflexible regimes and, if they arise in countries that are systemically important, they are likely to amplify systemic risks. Together with the finding that domestic performance (especially inflation) is not ameliorated by a rigid exchange rate regime in the presence of large external surpluses, the findings underscore the benefits of greater exchange rate flexibility to both reap domestic economic benefits and to reduce systemic risks.

III. CONCLUSIONS

46.   Each member of the International Monetary Fund undertakes to collaborate with the Fund and other members to assure orderly exchange arrangements and promote a stable system of exchange rates. This is served by countries adopting exchange rate regimes that best help them address their particular macroeconomic challenges, with due regard to the stability of the overall international monetary system.

47.   With respect to individual countries' choice of exchange rate regime, the message of the present study is more nuanced than those of previous reviews. In particular, while the 1999 review stressed the bipolar view of the exchange rate regime choice (either full flexibility or full commitment to a hard peg), and the 2003 review argued even more strongly in favor of flexible arrangements for EMEs, this study finds some important benefits from pegged and intermediate regimes for both EMEs and developing countries. At the same time, there may be significant trade-offs in adopting such regimes, both at the individual country level and, in some cases, from the viewpoint of systemic stability more broadly.

48.   Much of the benefit from pegged regimes appears to derive from the enhanced commitment to a stable nominal anchor offered by an explicit (de jure) peg, which results in lower inflation. Among emerging market countries, inflation is lower in countries with pegged regimes both relative to other regimes and in comparison with inflation targeters. However, countries with a pegged exchange rate that are running large current account surpluses (perhaps due to a peg at an undervalued rate) actually face higher inflation, as upward pressure on the real exchange rate is manifested via increases in the domestic price level. In addition, pegged regimes are associated with very significant constraints on policy activism (both fiscal and monetary), suggesting that the additional policy discipline required to sustain the peg comes at the cost of reduced ability to offset shocks via other policy tools.

49.   The analysis also suggests that intermediate regimes are associated with higher economic growth in emerging markets. The channels are, however, less obvious than in the case of inflation, reflecting broader uncertainties about what drives economic growth in this and other segments of the IMF's membership. This being said, intermediate regimes appear less prone to bouts of overvaluation that tend to undercut growth under pegged regimes, while also achieving lower inflation and real volatility than floating regime cases.

50.   As stressed in the IMF Articles, a stable system of exchange rates should facilitate the exchange of goods, services and capital. Pegged exchange rate regimes unambiguously reduce risk and uncertainty associated with cross-border transactions, and hence would tend to strongly underpin trade flows. Pegged exchange rates (*a fortiori*, currency unions) therefore appear particularly useful for countries seeking greater regional integration. Turning to capital flows, floating regimes appear to be associated with less fundamentals-driven financial flows than other regimes.

51.   Set against the findings that less flexible regimes are associated with better inflation and growth performance is their generally greater susceptibility to financial crisis and reduced facility in

unwinding external imbalances. Less flexible regimes are associated with a higher incidence of currency crises and, in developing and emerging market countries with open capital accounts, with greater likelihood of (home-grown) financial crises. Accordingly, countries that do choose to peg their exchange rates, including to reap the inflation benefits, need to ensure their fundamentals are sufficiently strong to help offset the greater risk of crisis. Finally, the empirical analysis suggests that less flexible regimes tend to have larger and more persistent current account surpluses, as well as greater likelihood of an abrupt and more costly reversal of large deficits.

52.   What are the implications of these findings for the IMF's diverse membership? The principal conclusion is that—in contrast to the earlier studies—a thorough analysis of the cross-country data does not support any single 'prescription.' There are clear tradeoffs—relevant from an individual country's viewpoint and from the standpoint of spillovers to other countries and systemic stability—among the goals of achieving nominal stability and sustained economic growth, reducing crisis risk, easing external adjustment, encouraging integration, and securing broad systemic stability.

Appendix 1

Regime classifications

1.   Any empirical study of exchange rate regimes must contend with issues of regime classification. Early work used a de jure classification—the regime declared by national authorities in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions (AREAR)*.[34] Thereafter, "de facto" classifications that seek to categorize the regime according to the behavior of the exchange rate or the behavior of the central bank have been developed in the literature.[35]

2.   The distinction between de facto and de jure classifications is sometimes characterized as "deeds versus words"—with the implication that de facto classifications are better, since deeds presumably count for more than words. What this overlooks, however, is that the de jure classification captures the central bank's *commitment* (for example, to a peg). As the policy credibility literature stresses, such commitments can affect expectations and hence economic outcomes (just as adoption of an inflation targeting framework should affect inflationary expectations). De jure and de facto classifications thus capture different aspects of the exchange rate regime—and both are informative.

3.   To date, however, empirical analysis has been hampered by two problems. First, the source and methodology underlying de jure and de facto classifications is usually quite different, making it difficult to judge whether different findings reflect substantive differences between de jure and de facto classifications or simply the variety of samples and methodologies employed in different studies. Second, relatedly, there is little agreement *between* de facto classifications, with correlations between them ranging from 0.13 to 0.4, making it hard to know whether results are driven by genuine differences in performance across regimes or simply idiosyncrasies of the classification.

Regime classification used in this paper

4.   To address these problems, this paper uses both the IMF's de jure and its de facto classification, to capture *both* the stated and implemented policies of the central bank.[36] The de jure

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[34] Ghosh, Gulde, Ostry and Wolf (1997a) use a de jure classification but separately categorize pegs with frequent parity adjustments.

[35] There are mainly four de facto classifications based on measurable outcomes of the exchange rate behavior and one based on assessing the central bank behavior. For the former type of de facto classification: (i) Ghosh, Gulde and Wolf (2003) who base their de facto classification on the behavior of the exchange rate; (ii) Levy-Yeyati and Sturzenegger (2003) who use data on the exchange rate, reserves, and interest rates to characterize intervention policy; (iii) Reinhart and Rogoff (2004) who use data on the exchange rate supplemented by information on parallel market rates; and (iv) a two-way classification by Shambaugh (2004) who bases it on the behavior of the exchange rate against an identified reference currency. The Fund's de facto classification based on the 1997 IMF system is the only classification assessing central bank behavior.

[36] Until 1999, the Fund used a de jure classification. Starting in 2000, the AREAR discontinued the de jure classification and adopted a de facto classification; it now publishes both. Babula and Otker-Robe (2002) expanded the de facto classification for the period 1990-2000. More recently, the de jure and de facto classifications have been extended further backwards to

(continued…)

classification is based on self-assessment of member countries and official statements of policy published by the monetary authorities or recorded in the literature. The de facto classification is based on a variety of primary and secondary sources. The primary source is the information

obtained through bilateral IMF surveillance, country teams' regular communication with the authorities, and provision of technical assistance to member countries. Supplementary information includes press reports and articles, as well as other relevant papers (such as case studies from other multinational organizations and documents from economic research

Index of Similarity between Exchange Rate Regime Classifications

firms and investment banks), and supported by an analysis of observed exchange rate and reserves behavior and relevant indicators. Sources are weighed to determine what best explains the behavior of the indicators. Under the assumption that exchange rate variability and flexibility are not the same, the present system makes no a priori assumptions about the behavior of currencies under different regimes or at different stages of market or economic development.[37]
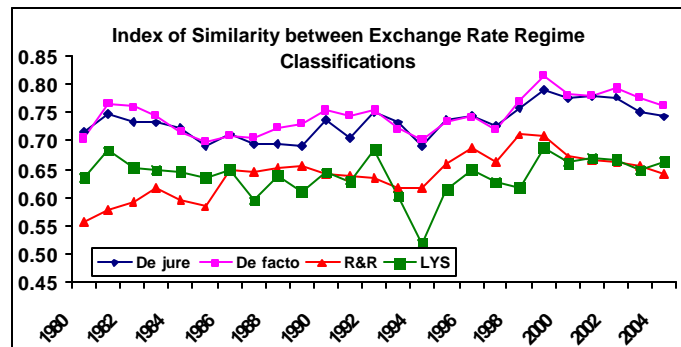
5.   Using the IMF's de jure and its de facto classification has two advantages. First, the empirical results under the de jure and de facto classifications are more comparable as they are based on a common source. Second, the IMF's de facto classification is less idiosyncratic than others—in the sense that, observation by observation, a higher proportion of the other classifications agree with the IMF's classification than with any other classification—giving confidence that the empirical results are likely to be robust and not driven by idiosyncrasies of the classification. Figure 1 compares the IMF's de facto and de jure classifications with other classification methods. The IMF's classifications receive a higher consensus score, suggesting that the IMF's classifications are more similar to the comparator classifications.[38]

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cover the period 1945-1989 (and brought up to date) by Mr. Harald Anderson (see Anderson 2009), who generously agreed to share his data.

[37] The main drawbacks of the de facto classification system are the reliance on primary sources; reliance on due diligence which makes current (non-historical) assessments very difficult (as, in practice, most de facto reclassifications are made with a lag); and the quality and availability of primary and secondary sources (particularly for earlier periods), which makes weighing different sources more difficult.

[38] The consensus score is calculated for the Fund's de jure and de facto classification, the Reinhart-Rogoff classification, and the Levy-Yeyati classification. For each observation (country-year), the classification receives a score of 0.25 for each of the other classifications that agrees with it, using a three-way categorization (pegged, intermediate, float). The Fund's de facto classification receives a score of 74 percent (70 percent if the de jure classification is dropped from the "other" classifications)—compared to around 62 percent for the Reinhart-Rogoff and Levy-Yeyati classifications. A low score means that most other classification methods would classify that observation differently—while that does not necessarily imply that the classification is "wrong," a low average score suggests that any empirical results obtained using such a classification are unlikely to be robust.

6.   The IMF's de jure and de facto classifications group exchange rate regimes into eight categories: *exchange arrangement with no separate legal tender*, *currency board arrangement*, *conventional pegged arrangement*, *pegged exchange rates within horizontal bands, crawling peg, crawling band, managed float with no predetermined path for the exchange rate, and, independently floating arrangement*. For the empirical work regimes are classified into three categories—pegged, intermediate, and floating (Table 1).

7.   Table 1 shows the distribution of observations across the three aggregate groups for both de jure and de facto classifications. The share of intermediate regimes is the highest and that of floating the lowest across both classifications. Similarly, the share of intermediate regimes has decreased, of floating regimes has increased, and that of pegged regimes has remained broadly constant from 1980-89 to 2000-07 (while falling in 1990-99) in both classifications. Pegged regimes have increased mainly in advanced economies (as a result of the formation of the EMU), while the share of floating regimes has increased in both advanced and emerging economies. However, a noticeable difference between the two classifications is the proportion of pegged and floating regimes: the former is persistently lower and the latter persistently higher in the de jure vis-à-vis de facto classification. The overall degree of correlation between the two classifications is 0.76.

Table 1. Classification of Exchange Rate Regimes
(in percent of observations) 1/

	Full Sample	Sub-samples			Full Sample	Sub-samples		
	1980-2007	1980-1989	1990-1999	2000-2007	1980-2007	1980-1989	1990-1999	2000-2007
	De Jure classification				De Facto classification			
Pegged regimes	**35.5**	**39.2**	**30.8**	**37.1**	**42.7**	**46.1**	**37.1**	**46.2**
(1) Hard pegs	19.9	15.6	18.6	25.7	19.2	14.8	17.9	25.3
(2) Conventional pegs	15.6	23.6	12.2	11.4	23.5	31.2	19.2	20.9
Intermediate regimes	**45.2**	**52.1**	**46.0**	**37.1**	**45.8**	**50.1**	**49.7**	**36.6**
(3) Basket pegs	11.8	19.3	11.4	4.7	10.5	16.9	10.3	4.2
(4) Pegged within bands	10.8	15.1	10.1	7.3	6.2	8.1	7.5	2.7
(5) Floats with rule-based intervention	2.6	3.2	3.0	1.4	11.8	17.6	12.6	4.8
(6) Floats with discretionary intervention	20.0	14.5	21.5	23.7	17.3	7.5	19.3	24.8
Floating regimes	**19.4**	**8.7**	**23.3**	**25.8**	**11.5**	**3.9**	**13.2**	**17.2**
(7) Independent floats	19.4	8.7	23.3	25.8	11.5	3.9	13.2	17.2

Source: IMF, AREAR; Andersen (2009); staff estimates
1/ Total sample of de jure classification: 4,896; total sample of de facto classification 4,719

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