Crises and Exchange Rate Regimes: Time to break down the bipolar view?

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March 2013

Abstract: We revisit the link between crises and exchange rate regimes (ERR). Using a panel of 90 developed and developing countries over the period 1980-2009, we find that corner ERR are not more prone to crises compared to intermediate ERR. This finding holds for different types of crises (banking, currency and debt), and is robust to a wide set of alternative specifications. Consequently, we clearly break down the traditional bipolar view: countries that aim at preventing crisis episodes should focus less on the choice of the ERR, and instead implement sound structural macroeconomic policies.

Keywords: exchange rate regimes, economic crises, bipolar view

JEL Codes: C35, F33, G01

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I. Introduction

The choice of an exchange rate regime (ERR) has been so far the foremost battleground between the advocates of the exchange rate stability and those supporting the capacity of the exchange rate policy to handle real shocks. Up until the beginning of the 70s, a traditional view widely vehicled by the Bretton Woods monetary arrangements defended pegged regimes as the most workable exchange arrangement for promoting macroeconomic performance, including a low volatility of the exchange rate. The collapse of the Bretton Woods system and the emergence of several intermediate arrangements revived the issue relative to the choice of the appropriate ERR, all the more that the resurgence of crisis episodes revealed the vulnerability of hard pegs.[1] As pointed out by Fisher (2001), the virulence of East Asia and Latin American crises shifted the balance toward the choice of more flexible exchange rate systems. In addition, the worldwide feature of the recent crisis, irrespective of countries' ERR, tends to mitigate the vision relative to the safety of corner solutions compared to intermediated ERR, regarding the surge of crises. Consequently, one might reasonably ask if the choice of the ERR really matters for the incidence of crises, and moreover which ERR is more or less vulnerable to crises.

Although these questions were tackled already, the existing contributions failed to reach a consensus on the vulnerability of alternative ERR to crises. On the one hand, a major strand of the literature (see below; see also Fisher, 2001, for a survey) argues that extreme (fixed or floating) regimes are disciplinary, while intermediate regimes are crisis-prone, i.e. the well-known *bipolar view*, establishing a formal link between the ERR and the probability of crisis. On the other hand, several influential papers, including Burnside et al., (2001, 2004), support that fixed regimes are, by construction, vulnerable to speculative attacks and particularly sensitive to banking and currency crises.

Building upon this growing and controversial literature, our paper aims at exploring the choice of the appropriate ERR when it comes to gauging crises. First, we shed a fresh light on the stark controversy that plagues the literature relative to the crisis proneness of alternative ERR; to this end, we begin by contrasting the proponents and the critics of the bipolar view. Second, using a panel of developed and developing countries over the period 1980-2009, we conduct a systematic analysis of the vulnerability of the three core ERR to

[1] The crisis episodes in Mexico (1994), Thailand, Indonesia, and Korea (1997), Russia and Brazil (1998), Ecuador (1999), and Turkey (2000), led to the perception that adjustable fixed exchange rate regimes are inherently fragile and crisis-prone (see, for example, Fischer 2001; Ghosh et al., 2002). In addition, following the collapse of Argentina's Currency Board, the stability of hard pegs has been equally questioned (see, for example, Fisher, 2001).

different types of crises, namely banking, currency and debt crises, by properly accounting for different control variables for each type of crisis.

Our results are the following. First, our baseline estimations show that intermediate ERR are not more vulnerable to banking or currency crises than pegged or floating regimes. Consequently, these findings clearly break down the bipolar view that intermediate regimes are systematically more vulnerable to banking or currency crises. Second, we explore, for the first time to the best of our knowledge, the proneness of alternative ERR to sovereign debt crises. Our findings do not emphasize a significant difference between corner and floating ERR in terms of their vulnerability to debt crises, contradicting, once again, the bipolar view. Third, we show that our results are robust to a wide set of tests, namely (i) when taking into account the contagion effects between crises, (ii) when splitting the sample according to the level of economic development or the time period; (iii) when performing estimations with alternative methods; (iv) when controlling for different variables or (v) when using alternative definitions for the ERR or (vi) alternative databases for the main variables, namely ERR and crises.

The remainder of the paper is organized as follows. Section 2 reviews the related literature on the link between ERR and crises surge, Section 3 presents the empirical strategy and the data, Section 4 emphasizes and discusses our main results, Section 5 performs a wide robustness analysis, and Section 6 concludes.

II. Literature review

The modern literature on crises experienced a particular development starting the 80's, following several episodes of currency crises in Latin American and Asian economies. The abundant theoretical literature focusing on the determinants of currency crises (see the well-known contributions of Krugman, 1979, Obstfeld, 1986, and Chang and Velasco, 2000, for first, second, and respectively third-generation models of currency crises) fuelled a more recent empirical literature illustrating a wider perspective of crises.

If we stick to the relation between the exchange rate regime (ERR) and the likelihood of crises, several authors, including Arteta and Eichengreen (2000), Aghion et al. (2001) or Stiglitz (2002) conclude to the absence of any effect of ERR on crises.[2] Moreover, Esaka (2010a, b) and Asici (2011) do not establish a clear ranking of ERR, but instead assert that the

[2] According to these authors, crises have other determinants but the ERR, including, if we refer to banking crises, the rapid domestic credit growth, large bank liabilities relative to reserves and deposit rate decontrol. In addition, Haile and Pozo (2006) discuss the difference between de facto and de jure ERR for the surge of crises.

appropriateness of the chosen regime depends on structural characteristics of each country. Alternatively, an important strand of literature (see the upper part of Table 1) argues that corner solutions, which consist of pegging or floating, are less vulnerable to crises compared to intermediate ERR.

Table 1: The literature on crises and ERR

Authors	Type of crisis	Data features	Results	Analysis
The proponents of the bipolar view				
Eichengreen et al. (1994)	Speculative attacks	1967-1992, 22 countries, mostly OECD	IR are more prone to banking crises	Empirical
Domac and Peria (2000)	Banking crisis with dummy	1980-1997, developed and developing countries	Fixed ER diminish the likelihood of crisis	Empirical
Mendis (2002)	Banking crisis with crisis dummy	Developing economies	Flexible regimes reduce the likelihood of banking crises	Theoretical Empirical
Bubula and Otker Robe (2003)	Currency crisis with EMPI	1990-2001	IR are more crisis prone	Empirical
Angkinand and Willet (2006)	Banking crisis with dummy	1990-2003	Soft peg and IR are associated with higher probabilities of financial crises	Empirical
The critics of the bipolar view				
Corsetti et al. (1998)	Asian crises using crisis index		Expectations of inflationary financing cause the collapse of the currency	Theoretical Empirical
Eichengreen and Hausman (1999)			Pegged regimes are crisis-prone due to a moral hazard problem	Theoretical
Chang and Velasco (2000)	Banking crisis		Pegged regimes are more prone to banking crises. Flexible rates eliminate (bank) runs with appropriate policy	Theoretical
Fisher (2001)	Currency crises	1991-1999, developed and emerging markets	Softly-pegged ERR are crisis prone and not sustainable over the long period	Theoretical
Daniel (2001)	Currency crises		Pegged regimes are inevitably crisis-prone due to unsustainable fiscal policy	Theoretical
Mc Kinnon (2002)	Currency crisis	Emerging market economies	Floating regimes increase nations' vulnerability to currency crises through higher ER volatility	Theoretical
Burnside et al. (2004)	Banking and Currency crises		Government guarantees of the monetary regimes lead to self-fulfilling banking and currency crises	Theoretical
Rogoff (2005)	Debt crises	Developing Countries	Rigid ERR or excessive borrowing lead to debt problems under any system	Theoretical

Note: ER stands for exchange rate and IR stands for intermediate regimes.

However, this bipolar view was criticized by several papers, presented in the bottom part of Table 1. Overall, it seems that the existing literature has not yet provided clear-cut results regarding the eventual vulnerability to crises of alternative exchange rate regimes.

III. Empirical strategy and data

We first present the econometric specification and then discuss the data used in our study.

3.1. Econometric specification and estimation strategies

To estimate the extent to which alternatives exchange rate regimes might be vulnerable to the occurrence of different types of crises, we adopt the following binary choice model

$$Crisis_{it} = \alpha_i + \mu_t + \beta ERR_{it-1} + \gamma X_{it-1} + \varepsilon_{it}, \quad (1)$$

where $Crisis$ is a dummy variable coded 1 if country i experiences a crisis at time t and 0 otherwise. The interest variable is the exchange rate regime; since we aim at contrasting intermediate with extreme regimes, ERR_{it} is defined as a dummy variable that equals 1 if country i is under pegged or floating regime at time t and 0 otherwise. According to the bipolar view, if intermediate regimes were more prone to crises, we should find a negative and significant effect of ERR. Finally, α_i and μ_t stand for country and time fixed effects, X_{it} is a vector of control variables (see below) and ε_{it} is the error term. We rely upon logit models to estimate equation (1). To mitigate possible endogeneity problems, we explain the likelihood of crisis in the current period using one subperiod-lagged variables, including the ERR.

3.2. Data

Our study is conducted within a panel of 90 countries over the period 1980-2009. The time span is subdivided into ten periods of three years each and variables are three-year-averaged.[3] To capture a crisis event, we built a dummy variable coded one if a given country experiences at least one crisis episode during the three years subperiod, and zero otherwise. The following subsections discuss extensively our main variables, namely the crisis and the ERR, and then present the set of control variables.

3.2.1. Definition of crises

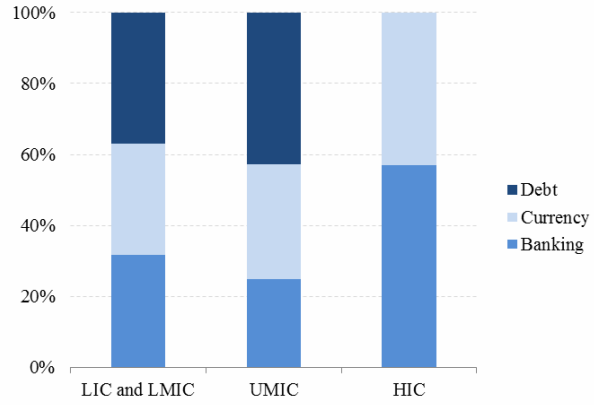
To capture crisis episodes, we use the crisis database developed by Reinhart and Rogoff (2011), combined with that of Leaven and Valencia (2012). According to these datasets, crisis episodes are defined as follows. First, *banking crisis* occur in two cases, namely when bank-runs lead to closure, merging or takeover by public sector of one or more financial institutions, and when, although there are no runs, the closure, merging, takeover or large-scale government assistance of an important financial institution marks the start of a string of similar outcome for other financial institutions. Second, a *currency crisis* refers to a situation where the depreciation (devaluation) of the local currency of a given country regarding the US dollar (the relevant anchor currency, e.g. historically the UK Pound, the French Franc or

[3] The empirical literature often drops out the observations following a crisis episode to avoid the reverse causality problem. Since this method is not exempted from criticisms in the sense that dropping out observations can raise an attrition bias and alter conclusions, we refrain from using it in the paper.

the Deutsch Mark) equals or exceeds 15%. Finally, we distinguish among external and domestic *debt crisis*. Regarding the former, a sovereign default is defined as the failure to meet principal or interest payments on the due date (or within the grace period), and also as episodes where rescheduling of debt is ultimately extinguished in less favorable terms than the original obligation. Regarding the definition of domestic debt crisis, Reinhart and Rogoff (2011) use roughly the same criteria, except that the debt holders are domestic; in addition, domestic debt crises involved the freezing of bank deposits and/or forcible conversions of such deposits from the US dollar to the local currency.[4]

We illustrate in Figure 1 the distribution of different types of crises among different groups of countries. For generality, we use the World Bank's country income level-based classification and distinguish among high income, including OECD, countries (HIC), upper middle income countries (UMIC) and low and lower middle income countries (LIC and LMIC respectively).[5] LIC, LMIC and UMIC experienced all types of crisis, with debt crisis being the most common. In addition, HIC suffered of currency and banking crisis, with no debt crises during the considered period 1980-2009.

Figure 1: Income level comparison of crises occurrence



3.2.2. Definition of exchange rate regimes (ERR)

We measure ERR using the exchange rate regimes *de facto* classification of the IMF (see Appendix 3).[6] Figure 2 illustrates the distribution of ERR using the income level-based classification of the World Bank. Pegged regimes, including exchange arrangements with no separate legal tender, currency boards, dollarization and currency unions, are the most popular

[4] Financial crises or bank collapses refer to banking crises; analogously, currency crashes correspond to currency crises; finally, debt crises and sovereign debt default are used interchangeably.

[5] The list of countries, the definition of variables and the sources of data, and some descriptive statistics are detailed in the Appendices 1 and 2.

[6] Since the use of *de jure* classification was found to engender misleading statistical inference in the assessment of the link between crises and ERR (Edwards and Sevestano, 1999, and Rogoff et al., 2004), we refrain from using it. In addition, we draw upon the *natural de facto* classification of Ilzetski, Reinhart and Rogoff (2010) in our robustness analysis.

monetary arrangements among LIC, LMIC and UMIC countries (roughly, 50% of them), while the remaining countries are divided between intermediate regimes (with crawling pegs, crawling bands and managed float, about 30%) and floaters (freely floating regimes with the exchange rate fully determined by the exchange market, about 20% of countries). In addition, the situation of HIC seems slightly different, with a more proportional distribution of the three core regimes mainly due to a higher proportion of floaters, while a consistent part of the pegged regimes are EMU countries, classified as fixed ERR.[7]

Figure 2: The distribution of exchange rate regimes (ERR)

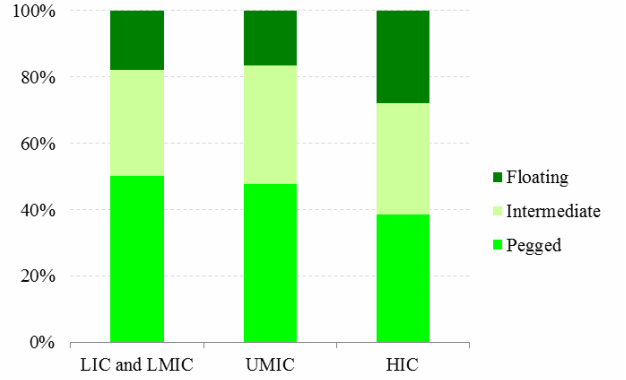


Table 2 displays the likelihood of different types of crises among the three core ERR, defined using the IMF de facto classification (the upper part) and the Ilzetski, Reinhart and Rogoff (2010, IRR) classification (the bottom part).

Table 2: Crises occurrence among ERR

	Banking crises			Currency crises			Debt crises		
IMF classification	No	Yes	Freq. (%)	No	Yes	Freq. (%)	No	Yes	Freq. (%)
Pegged	343	73	**45.6**	303	113	**50.2**	355	61	**57.5**
Intermediate	243	53	33.1	221	75	33.3	266	30	28.3
Floating	148	34	21.3	145	37	16.4	167	15	14.2
Total	734	160	17.8	669	225	25.2	788	106	11.9
IRR classification									
Pegged	246	46	33.6	233	59	33.5	257	35	42.7
Intermediate	352	75	**54.7**	324	103	**58.5**	386	41	**50**
Floating	42	16	11.7	44	14	8.0	52	6	7.3
Total	640	137	21.4	601	176	29.3	695	82	11.8

Note: The number of three-years periods is 894 (IMF) and 777 (IRR), divided for each crisis between crisis and non-crisis observations, with a total of 491 (IMF) and 395 (IRR) crisis observations. Bolded values represent, for each type of crisis, the ERR most frequently affected by crises.

Based on the IMF classification, 160 (namely 17.8%) out of the 894 available observations are associated to banking crises, and out of the total of these crises episodes almost half (namely 73) concern countries with pegged ERR. Pegged arrangements are also the most

[7] Since according to the European Commission (Directorate-General for Trade) the trade volume is stronger within the EMU compared to other non-EMU partners, it is plausible to consider EMU countries as being under a pegged rather than a floating regime.

affected by currency and debt crises (more than 50%), which occurred in 1 out of 4 and 9 periods respectively, according to the IMF classification. Although the use of the IRR classification reduces the number of available observations, the distribution among the different types of crises is comparable for debt crises, with 4 percentage points more (less) for banking (currency) crises. However, one significant difference is that most of crises occur in intermediate ERR when using the IRR classification.

3.2.3. Control variables

Our analysis distinguishes among three types of crises, namely banking, debt and currency crises; consequently, when selecting control variables, we focused on the most appropriate variables for each type of crisis.

Regarding *banking crisis*, the first control variable is the domestic credit to the private sector.[8] Following Demirgüç-Kunt and Detragiache (1997) and Arteta and Eichengreen (2000), credit expansion is a salient feature in the occurrence of crises, as highlighted by the recent financial crisis. A rapid development of banking credit reflects either a credit market with sufficiently safe borrowers or a situation of risk misassessment. This latter case can be very damaging for the stability of the financial system, since it favors the growing up of financial bubbles arising from rapid credit growth with lenders seeking permanently for more profits. Such a situation is unsustainable, and the collapse of the bubble weakens the financial system and can trigger panic/bank runs. Therefore, we expect a positive effect of the domestic credit on the probability of banking crises. The second control variable is the volatility of the domestic credit, measured by the standard deviation of domestic credits. High credit volatility can have damaging effects by leading to credit misallocation and by blurring private agents' foresights. Consequently, we expect credit volatility to increase the odds of banking crisis. The third control variable is the sum between the claims on the domestic real nonfinancial sector by the Central Bank and the private credit by deposit money banks and other financial institutions, as a GDP ratio. It allows capturing differences in the size of the financial sector. On the one hand, a sizeable financial sector with complex financial products and multiple market players can be thought as detrimental because of greater exposure to financial imbalances. On the other hand, a large size of the financial sector can increase the risk-sharing opportunity. Therefore, the expected impact of the size of the financial sector on the probability of banking crises is ambiguous. Fourth, a variable of intermediation, built as the ratio between private credit supply and private deposits, proxies the ability of transforming

[8] We define it as financial resources provided to the private sector, such as loans, purchases of non-equity securities, trade credits, and other accounts that establish a claim for repayment.

deposits into credits, i.e. the intermediation capacity of the banking sector. The expected sign is positive. Finally, in addition to these four fundamental determinants of banking crises, we consider a variable that may affect banking crises' probability, namely the regulation of the credit market. Intuitively, we expect a negative influence since authorities' regulation of the credit market tends to lower the risk taken by bankers and therefore reduces the likelihood of crises.

Let us now turn our attention to *currency crises* fundamentals. First, the variable reserves money growth measures seigniorage revenues. Based on Buiter (2007), we define seigniorage as resources appropriated by monetary authorities through their capacity to issue zero interest fiat money, and measure it as the variation in the monetary base in percentage of GDP. This variable is particularly relevant in first-generation crises models, concluding that the main cause of currency crashes is the financing of fiscal deficits using seigniorage. Second, to reveal the fiscal stance of the government, and more widely the design of the fiscal policy, we consider the primary fiscal balance (FB), defined as the difference between fiscal revenues and expenditures. Large fiscal deficits may be an indirect source of financial imbalances, by generating inconsistency between fiscal and exchange rate policies (see first-generation crises models) and therefore leading to currency and/or banking crises, as equally defended by the FTC hypothesis. Finally, in addition to these fundamentals, we consider subsequent variables that could affect the probability of currency crisis, namely the domestic credit to the private sector, broad money and the current account (Esaka, 2010a, b).

To evaluate the likelihood of *debt crises*, we consider first public debt, as a GDP ratio. Given that public debt is a prominent variable to predict sovereign debt defaults, its expected effect is positive. In addition, according to a recent literature emphasizing non-linear effects (see, for example, Ardagna et al., 2006), we equally account for the square of the debt to GDP ratio. Second, inflation may be a salient feature in predicting the occurrence of debt crises. While inflation may reduce the odds of domestic debt default, it also may increase the burden of the foreign currency-denominated debt when it leads to a nominal depreciation. Therefore the expected sign is ambiguous. Third, political institutions could also predict the likelihood of debt crises. We account for it by controlling whether there exist any constraints on the executive; if so, the odds of debt crises are expected to decrease, as the room for the incumbent government to overspend is somewhat reduced. Finally, some external conditions, as the aid flows, could influence the occurrence of debt crisis. Since these flows can be used to face the debt burden (in terms of interests and capital repayment) and therefore mitigate the probability of debt default, we expect a negative sign on the likelihood of debt default.

The set of controls also includes variables that are common to all type of crises. On the one hand, output growth is assumed to negatively influence the occurrence of banking, currency or debt crisis. The output growth may help avoid banking disturbances by providing additional resources for the private sector and strengthening its capacity to meet credit reimbursement commitments. Regarding currency crises, the output growth leads to an increase in foreign exchange reserves and allows authorities supporting the fixity of the exchange rate or at least postponing the collapse of the peg. The same rationale prevails for debt crises, as in times of growth the increase of the resources of the government enhances its capacity to meet its commitments. On the other hand, as suggested by Glick and Hutchison, (2005) and Glick et al. (2006), the capital account openness captures the influence of the restrictions (or liberalization) of the capital account on the probability of banking, currency and debt crises.

IV. Estimation results: the likelihood of crises

Table 3.1 illustrates our baseline estimations of the likelihood of *banking crises*. To directly test the bipolar view, we focus on the variable *Peg or float*, which is a dummy coded one if a country is under pegged or floating regime and zero if the regime is qualified as intermediate (see Appendix 3 for details).

Table 3.1: Likelihood of banking crises

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Peg or float	**-0.049**	**-0.097**	**-0.130**	**-0.055**	**-0.075**	**-0.067**	**-0.132**	**-0.279**
	(0.835)	**(0.689)**	**(0.587)**	**(0.833)**	**(0.773)**	**(0.798)**	**(0.622)**	**(0.323)**
Domestic credit		0.013***	0.009**	0.011**	0.013**	0.013**	0.013**	0.015**
		(0.001)	(0.018)	(0.041)	(0.021)	(0.028)	(0.029)	(0.015)
Volatility of DC			0.062***	0.060***	0.055***	0.056***	0.051***	0.047**
			(0.000)	(0.002)	(0.005)	(0.004)	(0.010)	(0.019)
Size of the FS				-0.129	-0.364	-0.188	-0.231	-0.509
				(0.835)	(0.568)	(0.779)	(0.735)	(0.491)
Intermediation					0.001**	0.001*	0.001*	0.001*
					(0.035)	(0.068)	(0.091)	(0.090)
CM regulation						-0.163**	-0.139*	-0.168*
						(0.035)	(0.081)	(0.057)
Growth							-0.082**	-0.083**
							(0.034)	(0.044)
KA open								-0.057
								(0.652)
Obs. (countries)	893 (90)	893	892 (90)	840 (88)	839 (88)	759 (83)	759 (83)	691 (76)
Pseudo-R^2	0.035	0.039	0.037	0.051	0.046	0.040	0.045	0.038
Wald-stat (*Chi-2*)	36.21	44.52	51.87	47.53	49.44	48.71	51.45	48.52
Wald (*p-value*)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Log likelihood	-381.4	-374.6	-367.2	-339.3	-336.9	-319.8	-317.4	-283.7
% Obs. correctly called	78.0	76.2	77.8	78.2	78.5	76.4	76.1	78.2

Significance: * 10%; ** 5% and *** 1%. P-values in brackets. All specifications include time dummies. Coefficients displayed are marginal effects. Hausman specification test suggested random effects with the Logit estimator. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b).

Starting from regression (1), we explore the sensitivity of the effect of ERR on the probability of banking crises by progressively adding relevant control variables. Notice that a 1 percentage point increase in domestic credit (DC) or in its volatility increases the incidence of banking crises by roughly 1 and 5-6 percentage points respectively, a result consistent with Demirgüç-Kunt and Detragiache (1997). Instead, as shown by columns (5)-(8), better credit market (CM) regulation, higher growth and a lower intermediation ratio reduce the probability of banking crises. Irrespective of the control variables used, the coefficient of the variable *Peg or float* is statistically not significant in regressions (1)-(8). These results clearly fail to support the bipolar view, since intermediate regimes are not more prone to *banking* crises than corner, namely pegged or floating, regimes.[9]

Let us now discuss the results for *currency crises*, depicted in Table 3.2. As shown by columns (5)-(8), the seigniorage increases the odds of currency crises, confirming the fiscal theory of currency crises. We also notice that the capital account openness decreases the probability of currency crises (column 8), as it offers more flexibility in the implementation of the monetary policy for countries under fixed regimes (Esaka, 2010a, b). Finally, the fiscal balance (FB) does not matter in the prediction of currency crises: what matters is not whether governments generate fiscal deficits, but rather the way they finance such deficits.

Table 3.2: Likelihood of currency crises

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Peg or float	**0.073**	**0.166**	**0.360**	**0.349**	**0.339**	**0.333**	**0.277**	**0.418**
	(0.764)	**(0.510)**	**(0.277)**	**(0.296)**	**(0.363)**	**(0.378)**	**(0.468)**	**(0.297)**
Seigniorage		0.002	0.006	0.006	0.009*	0.009*	0.008*	0.010*
		(0.348)	(0.159)	(0.150)	(0.072)	(0.073)	(0.084)	(0.052)
FB			-0.021	-0.020	-0.014	-0.014	-0.007	-0.010
			(0.501)	(0.510)	(0.684)	(0.683)	(0.831)	(0.777)
Domestic credit				0.004	0.007	0.007	0.007	0.018**
				(0.530)	(0.339)	(0.340)	(0.344)	(0.022)
Broad money					-0.038	-0.038	-0.038	-0.037
					(0.251)	(0.250)	(0.247)	(0.263)
Growth						-0.005	-0.029	0.020
						(0.924)	(0.607)	(0.742)
Current account							-0.046	-0.013
							(0.130)	(0.689)
KA open								-0.789***
								(0.000)
Obs. (countries)	893 (90)	820 (83)	552 (73)	552 (73)	491 (66)	491 (66)	491 (66)	485 (65)
Pseudo-R^2	0.126	0.136	0.138	0.130	0.144	0.144	0.148	0.148

[9] Our findings are unchanged when performing regressions (1)-(8) by holding the number of observations constant (results are provided in the Supplementary Material section at the end of the manuscript).

Wald-stat (*Chi-2*)	58.79	56.92	36.61	36.44	26.59	26.58	28.14	38.78
Wald (*p-value*)	0.000	0.000	0.000	0.000	0.021	0.032	0.030	0.001
Log likelihood	-417.2	-386.2	-261.0	-260.8	-213.7	-213.7	-212.5	-198.5
% Obs. correctly called	67.7	68.9	69.0	68.3	67.4	68.3	69.2	71.8

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Hausman specification test suggested random effects with the Logit estimator. Coefficients displayed are marginal effects. Once we introduce the variable Seigniorage in our models (from specification [3]), we drop Cameroon, Republic of Congo, Cote d'Ivoire, Gabon, Senegal, Sudan, Suriname, Syria and Zimbabwe from the sample due to outliers. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b).

The non-significance of the variable *Peg or float*, whatever the control variables considered, breaks down the bipolar view, as there is no evidence that intermediate regimes are more prone to *currency* crises than pegs or floats.

Finally, the Table 3.3 focuses on *debt crises*. Unlike the two previous crises (banking and currency), empirical evidence on the determinants of debt crises is remarkably scarce.

Table 3.3: Likelihood of debt crises

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Peg or float	**0.597**	**0.545**	**0.546**	**0.567**	**0.337**	**0.399**	**0.354**	**0.222**
	(0.106)	**(0.142)**	**(0.147)**	**(0.144)**	**(0.396)**	**(0.343)**	**(0.396)**	**(0.644)**
Public debt		0.005	-0.004	0.001	-0.003	-0.006	-0.003	0.006
		(0.105)	(0.577)	(0.889)	(0.745)	(0.593)	(0.757)	(0.634)
Public debt squared			0.662**	0.496	0.637*	0.760**	0.753**	0.468
			(0.023)	(0.178)	(0.077)	(0.043)	(0.034)	(0.216)
Inflation				0.067	0.060	0.058	0.046	0.041
				(0.396)	(0.430)	(0.439)	(0.530)	(0.617)
Growth					-0.183***	-0.200***	-0.214***	-0.211***
					(0.000)	(0.000)	(0.000)	(0.001)
Executive constraint						-0.111	0.047	-0.014
						(0.285)	(0.650)	(0.907)
Aid							-0.111**	-0.146**
							(0.024)	(0.022)
KA open								-0.377
								(0.107)
Obs. (countries)	893 (90)	875 (90)	875 (90)	855 (90)	855 (90)	798 (86)	597 (66)	517 (58)
Pseudo-R^2	0.230	0.229	0.234	0.242	0.239	0.244	0.181	0.214
Wald-stat (*Chi-2*)	40.45	42.34	44.90	44.56	50.21	50.11	49.50	42.83
Wald (*p-value*)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Log likelihood	-236.8	-234.4	-230.6	-223.2	-216.7	-200.7	-183.7	-153.9
% Obs. correctly called	88.1	87.7	87.7	87.8	87.6	87.0	82.7	82.7

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Hausman specification test suggested random effects with the Logit estimator. Coefficients displayed are marginal effects. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b).

Among the most important fundamentals, macroeconomic imbalances in terms of unsustainable public debt affect the occurrence of debt crises. The positive sign of the squared term suggests that a large share of public debt to GDP increases the odds of debt default, with some non-linearity. On the contrary, output growth reduces significantly the incidence of

default[10] Finally, results in column (7) support the use of aid flows as a hedge against sovereign debt default, since higher aid significantly decreases the odds of debt crises. Coming back to our main analysis, we follow the strategy emphasized earlier and contrast intermediate regimes with corner regimes. As emphasized by columns (1)-(8), there is no support that intermediate regimes matter for *debt* crisis compared to fixed or peg exchange rate regimes.[11] In short, we clearly break down the bipolar view, as the occurrence of banking, currency or debt crises was not found to be related to the presence of a particular exchange rate regime.

V. Sensitivity Analysis

The goal of this section is to explore the robustness of our results. For each type of crises, we consider the widest specification, namely column (8) from Tables 3.1, 3.2 and 3.3 above. In addition, to better focus our analysis and keep the paper short, we present all along this sensitivity section only interest coefficients (full results are at the end of the manuscript as supplementary material).

5.1. Accounting for contagion effects

A strand of influential papers, including Kaminsky and Reinhart (1999) or Reinhart and Rogoff (2011), emphasized the importance of contagion effects between different types of crises in a given country. We present in Table 4 results for the influence of the ERR on the likelihood of crises, when controlling for such contagion effects.

Table 4: Likelihood of crises and contagion effects

Banking crises			Currency crises			Debt crises		
Peg or float	**-0.260**	**-0.331**	**Peg or float**	**0.439**	**0.395**	**Peg or float**	**0.255**	**0.282**
	(0.337)	**(0.232)**		**(0.270)**	**(0.328)**		**(0.593)**	**(0.564)**
Currency crises	0.701**		Banking crises	0.523		Banking crises	1.231***	
	(0.016)			(0.175)			(0.004)	
Debt crises		1.015***	Debt crises		2.449***	Currency crises		2.017***
		(0.004)			(0.000)			(0.000)
Obs. (countries)	691 (76)	691 (76)	Obs. (countries)	485 (65)	485 (65)	Obs. (countries)	517 (58)	517 (58)
Pseudo-R^2	0.018	0.025	Pseudo-R^2	0.124	0.106	Pseudo-R^2	0.196	0.157
Wald-stat (*Chi-2*)	55.28	56.10	Wald-stat (*Chi-2*)	40.05	49.26	Wald-stat (*Chi-2*)	47.02	50.09
Wald (*p-value*)	0.000	0.000	Wald (*p-value*)	0.002	0.000	Wald (*p-value*)	0.000	0.000
Log likelihood	-281.0	-279.9	Log likelihood	-197.6	-187.8	Log likelihood	-149.7	-144.3
% Obs. corr. called	77.8	77.7	% Obs. corr. called	70.8	76.1	% Obs. corr. called	83.9	85.1

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. Hausman specification test suggested random effects with the Logit estimator. All specifications include time dummies. Coefficients displayed are marginal effects. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b). The full table is reported as supplementary material at the end of the manuscript.

[10] Manasse and Roubini (2009) provide an interesting discussion regarding the economic growth mechanism as a necessary but not sufficient condition to avoid debt default.

[11] The inclusion of the variable aid in regressions (7)-(8) decreases the sample size, mainly since high income countries do not receive aid flows and are therefore excluded. Despite that, our main results remain unchanged.

The burst of other types of crises increases the probability of having a banking, currency or debt crisis (except for the effect that transits from banking to currency crises, which is found not significant). However, even when accounting for the presence of such important contagion effects, we find yet again no support for an influence of ERR on the probability of experiencing a banking, currency or debt crisis.

5.2. Is the proneness of the regimes influenced by the level of development or the time period?

An important criticism of our analysis may be related to the possible heterogeneities in the effect of the ERR on the likelihood of crises, depending on the level of economic development. For example, one should account for the absence of debt crises for high income countries during the period we consider. One alternative to tackle this shortcoming is to include the GDP per capita, capturing the level of economic development, as an additional explanatory variable.[12] However, a better solution is to perform individual regressions for each group of countries, according to their level of development (Table 5.1). For generality, we draw upon the World Bank's country income level classification and distinguish among high income, including OECD, countries (HIC), upper middle income countries (UMIC) and low and lower middle income countries (LIC and LMIC respectively).

Table 5.1: Likelihood of crises: Income level comparisons

	Banking crises			Currency crises			Debt crises	
	LIC & LMIC	UMIC	HIC	LIC & LMIC	UMIC	HIC	LIC & LMIC	UMIC
Peg or float	**-0.144**	**-1.797***	**0.684**	**0.694**	**0.930**	**0.498**	**0.525**	**-0.818**
	(0.688)	**(0.063)**	**(0.380)**	**(0.178)**	**(0.472)**	**(0.728)**	**(0.367)**	**(0.482)**
Obs. (countries)	328 (38)	132 (14)	231 (24)	236 (33)	111 (13)	138 (19)	361 (41)	135 (14)
Pseudo-R^2	0.006	0.056	0.011	0.076	0.134	0.000	0.230	0.121
Wald-stat (*Chi-2*)	28.86	9.666	26.29	22.70	14.33	20.38	24.13	12.49
Wald (*p-value*)	0.035	0.917	0.069	0.159	0.644	0.255	0.116	0.769
Log likelihood	-134.8	-46.56	-69.14	-96.20	-36.23	-29.30	-100.4	-32.50
% Obs. corr. called	54.7	67.7	70.4	61.9	60.6	53.1	82.2	80.2

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Hausman specification test suggested random effects with the Logit estimator. Coefficients displayed are marginal effects. No debt crises for HIC during the period of our analysis. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b). The full table is reported as supplementary material at the end of the manuscript.

Irrespective of the considered crisis, extreme ERR do not exert a statistically different effect on the probability of experiencing a crisis, compared to intermediate ERR. Thus, our analysis performed on groups of countries located at different stages of economic development concludes, yet again, against the bipolar view, in line with our main findings.

[12] We report that the coefficients of the variable Peg or float (together with their p-values) for the regressions (8) from Tables 3.1, 3.2 and 3.3 augmented with the variable GDP per capita are respectively 0.130 (0.629), 0.061 (0.874) and 0.249 (0.537).

In addition to this analysis, our results might be biased by time heterogeneity. Therefore, we check the stability of our findings by performing estimations on two sub-periods, namely before and after 1990. This splitting was chosen to reflect the worldwide major institutional changes related to the end of the Cold War. Whatever the crisis considered, the variable of interest is never significant (Table 5.2). Therefore, our results show that the rejection of the bipolar view is not specific to a period.

Table 5.2: Likelihood of crises: Period comparisons

	Banking crises		Currency crises		Debt crises	
	Before 1990	After 1990	Before 1990	After 1990	Before 1990	After 1990
Peg or float	**-0.325**	**-0.410**	**0.443**	**-0.561**	**-1.088**	**0.693**
	(0.448)	**(0.320)**	**(0.403)**	**(0.495)**	**(0.220)**	**(0.303)**
Obs. (countries)	254 (69)	437 (76)	294 (65)	191 (60)	320 (58)	197 (53)
Pseudo-R^2	0.014	0.050	0.090	0.157	0.309	0.111
Wald-stat (*Chi-2*)	14.06	37.94	14.09	17.81	15.43	12.43
Wald (*p-value*)	0.230	0.000	0.367	0.0861	0.281	0.332
Log likelihood	-117.5	-156.7	-116.3	-81.67	-62.18	-84.55
% Obs. corr. called	78.0	79.1	64.3	72.0	70.4	83.1

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Hausman specification test suggested random effects with the Logit estimator. Coefficients displayed are marginal effects. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b). The full table is reported as supplementary material at the end of the manuscript.

5.3. Are the results robust to the estimation method?

In the following, we allow for alternative methods of estimation of the effect of the ERR on the likelihood of crises.

Table 6.1: Likelihood of crises: Alternative binary estimation methods

	Banking crises		Currency crises		Debt crises	
	Logit FE	Probit	Logit FE	Probit	Logit FE	Probit
Peg or float	**-0.115**	**-0.166**	**0.710**	**0.232**	**0.598**	**0.117**
	(0.733)	**(0.295)**	**(0.128)**	**(0.311)**	**(0.308)**	**(0.658)**
Obs. (countries)	516 (54)	691 (76)	339 (44)	485 (65)	262 (27)	517 (58)
Pseudo-R^2	0.198	0.038	0.362	0.150	0.344	0.218
Wald (*Chi-2*)	76.10	52.76	92.61	43.16	68.66	46.55
Wald (*p-value*)	0.000	0.000	0.000	0.000	0.000	0.000
Log likelihood	-154.5	-283.2	-81.54	-198.3	-65.49	-153.5
% Obs. correctly called	35.8	76.9	36.5	70.1	43.3	81.6

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Coefficients displayed are marginal effects. The Probit models are estimated with random effects. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b). The full table is reported as supplementary material at the end of the manuscript.

Table 6.2: Likelihood of crises: OLS estimations

	Banking crises			Currency crises			Debt crises		
	Pooled	FE	RE	Pooled	FE	RE	Pooled	FE	RE
Peg or float	**-0.047**	**-0.008**	**-0.036**	**0.008**	**0.035**	**0.021**	**0.009**	**0.018**	**0.014**
	(0.137)	**(0.837)**	**(0.276)**	**(0.849)**	**(0.463)**	**(0.629)**	**(0.782)**	**(0.627)**	**(0.668)**
Obs. (countries)	691	691 (76)	691 (76)	485	485 (65)	485 (65)	517	517 (58)	517 (58)
R-squared	0.101	0.113	0.0998	0.144	0.187	0.132	0.128	0.148	0.118
Fischer-stat	4.447	4.469		4.615	5.457		4.294	4.500	
(p-value)	(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)	
Wald-stat			75.66			89.93			78.31
(p-value)			(0.000)			(0.000)			(0.000)

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Coefficients displayed are marginal effects. The full table is reported as supplementary material at the end of the manuscript.

According to Table 6.1, the use of fixed, instead of random, effects logit or of probit estimators has no qualitative effects on the coefficients of our interest variable *Peg or float*, which remain statistically not significant. In addition, the significance of these coefficients is not improved when considering OLS, instead of binary, estimators in Table 6.2. Consequently, our previous findings of non-systematic vulnerability of intermediate ERR to banking, currency and sovereign debt crises are robust to alternative estimation methods, contradicting yet again the bipolar view.

5.4. Alternative definitions of the ERR variable

In our main regressions, we differentiated among corner ERR, namely peg or float ERR, and intermediate regimes. In the following, we refine this classification by specifically differentiating among peg and float ERR, while still keeping the intermediated regimes as reference (see Appendix 3).

Table 7: Pair comparison of the likelihood of crises

	Banking crises			Currency crises			Debt crises		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Peg	**-0.143**		**-0.068**	**-0.298**		**-0.340**	**-0.150**		**0.174**
	(0.686)		**(0.847)**	**(0.584)**		**(0.497)**	**(0.791)**		**(0.763)**
Float		**-0.399**	**-0.487**		**0.721**	**0.991****		**0.183**	**0.118**
		(0.274)	**(0.167)**		**(0.173)**	**(0.045)**		**(0.815)**	**(0.849)**
Obs. (countries)	491 (70)	505 (63)	691 (76)	347 (59)	357 (55)	485 (65)	402 (57)	334 (46)	517 (58)
Pseudo R	0.020	0.041	0.039	0.122	0.154	0.137	0.196	0.180	0.213
Wald (*stat*)	28.69	37.75	48.43	33.39	29.93	40.64	29.63	23.38	42.95
Wald (*p-value*)	0.037	0.002	0.000	0.010	0.026	0.001	0.029	0.137	0.000
Log likelihood	-219.5	-215.0	-283.2	-143.6	-146.0	-195.9	-131.9	-96.01	-153.9
Test 1 [Peg]=[Float]			0.99			5.21			0.01
Chi-2 (*p-value)*			0.319			0.022			0.936
Test 2 [Peg]=[Float]=0			1.96			5.90			0.10
Chi-2 (*p-value)*			0.376			0.052			0.950
% Obs. corr. called	73.3	73.6	78.0	71.2	65.5	72.0	81.8	83.8	82.3

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Hausman specification test suggested random effects with the Logit estimator. Coefficients displayed are marginal effects. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b). The full table is reported as supplementary material at the end of the manuscript.

According to column (1) in Table 7, peg regimes are not found to significantly increase the probability of experiencing a banking crisis, compared to intermediate regimes. The same holds when comparing floating regimes with intermediate regimes, as emphasized by column (2). These findings are supported by the results illustrated in column (3), where we simultaneously account for the effect of peg and floating ERR on the likelihood of banking crises. Moreover, the high p-values of the equality tests between the coefficients of peg and float variables confirm that the effect of alternative corner ERR, namely peg or floating, on the likelihood of banking crises is statistically identical, supporting our strategy of considering them jointly in our main analysis. While the results are more mitigated for currency crises (columns 4-6), the evidence for debt crises (columns 7-9) confirms once again the absence of significant differences between the effects of corner and intermediate ERR on the likelihood of crises.

In the following, we go one step further, by additionally decomposing our corner ERR variable. As emphasized by Table 8 based on IMF's classification, the variable Peg or float is the one used in our main analysis. Starting from this benchmark, we restrict the definition of corner ERR regimes by progressively dropping conventional peg and managed float ERR (Peg or Float1), currency union and EMU regimes (Peg or Float2) and currency boards (Peg or Float3). Notice that following this logic, the variable Peg or Float3 corresponds to the most narrow definition of corner ERR regimes, since it includes only extreme forms of pegs (another currency as legal tender, for example dollarization) and extreme forms of floating (floating regimes, namely freely floating). The rationale is that the more extreme the ERR, the bigger the room for finding a significant effect on the likelihood of crises for these extreme ERR compared to intermediate ERR.

Table 8: Alternative definitions of corner EER based on IMF's classification

Fine	Coarse	**Peg or float**	**Peg or float1**	**Peg or float2**	**Peg or float3**
another currency	Peg	1	1	1	1
currency board		1	1	1	excluded
currency union/emu		1	1	excluded	excluded
conventional peg		1	excluded	excluded	excluded
conventional basket	Intermediate	0	0	0	0
band peg		0	0	0	0
forward cp		0	0	0	0
forward cb		0	0	0	0
backward cp		0	0	0	0
backward cb		0	0	0	0
other managed		0	0	0	0
managed float	Floating	1	excluded	excluded	excluded
floating		1	1	1	1

Note: Fine classifications are fully detailed in Appendix 3.

Table 9.1: Alternative definitions of the ERR variable: banking crises

	[1]	[2]	[3]	LIC & LMIC	UMIC	HIC
Peg or float1	**-0.308**			**-0.517**	**-1.949**	**1.422***
	(0.395)			**(0.268)**	**(0.100)**	**(0.097)**
Peg or float2		**-0.162**				
		(0.705)				
Peg or float3			**-0.175**			
			(0.693)			
Obs. (countries)	528 (74)	439 (65)	435 (65)	221 (36)	102 (14)	205 (24)
Pseudo-R^2	0.024	0.029	0.029	0.000	0.047	0.014
Wald (*stat*)	32.43	28.24	29.22	22.80	8.921	24.53
Wald (*p-value*)	0.0133	0.0422	0.0326	0.156	0.943	0.106
Log likelihood	-228.1	-200.2	-195.7	-88.09	-36.99	-64.64
% Obs. correctly called	72.3	70.6	70.8	50.9	68.5	69.3

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Hausman specification test suggested random effects with the Logit estimator. Coefficients displayed are marginal effects. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b). The full table is reported as supplementary material at the end of the manuscript.

Table 9.2: Alternative definitions of the ERR variable: currency crises

	[1]	[2]	[3]	LIC & LMIC	UMIC	HIC
Peg or float1	**-0.066**			**0.504**	**-2.451**	**1.134**
	(0.918)			**(0.571)**	**(0.701)**	**(0.442)**
Peg or float2		**0.165**				
		(0.823)				
Peg or float3			**0.265**			
			(0.736)			
Obs. (countries)	360 (62)	324 (57)	320 (57)	157 (31)	75 (11)	120 (18)
Pseudo-R^2	0.153	0.164	0.172	0.050	0.155	0.000
Wald (*stat*)	27.84		27.05	12.00	14.85	17.97
Wald (*p-value*)	0.0468		0.0574	0.800	0.606	0.391
Log likelihood	-142.8	-128.4	-124.3	-60.96	-18.79	-28.33
% Obs. correctly called	72.8	71.6	73.1	58.1	55.9	62.8

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Hausman specification test suggested random effects with the Logit estimator. Coefficients displayed are marginal effects. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b). The full table is reported as supplementary material at the end of the manuscript.

Table 9.3: Alternative definitions of the ERR variable: debt crises

	[1]	[2]	[3]	LIC & LMIC	UMIC
Peg or float1	**-0.457**			**-0.036**	**-1.074**
	(0.527)			**(0.972)**	**(0.379)**
Peg or float2		**-0.678**			
		(0.452)			
Peg or float3			**-0.774**		
			(0.413)		
Obs. (countries)	373 (56)	303 (48)	299 (48)	245 (39)	108 (14)
Pseudo-R^2	0.123	0.161	0.140	0.124	0.011
Wald (*stat*)	29.59	26.61	26.07	13.68	9.086
Wald (*p-value*)	0.0295	0.0640	0.0731	0.690	0.938
Log likelihood	-114.5	-96.39	-93.56	-66.05	-27.82
% Obs. correctly called	84.7	82.8	83.6	83.6	78.5

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Hausman specification test suggested random effects with the Logit estimator. Coefficients displayed are marginal effects. No debt crises for HIC during the period of our analysis. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b). The full table is reported as supplementary material at the end of the manuscript.

According to the first column of Table 9.1, the use of an alternative definition for corner ERR does not change our previous findings: more restrictive ERR, namely with conventional peg and managed float excluded, are not found to be more prone to banking crises compared to intermediate regimes. Moreover, as emphasized by columns (2)-(3), the use of a more narrow definition for our interest variable, by additionally excluding currency unions and then currency boards, still refutes the bipolar view. In addition, we disentangle the variable Peg of float1 according to the level of income, using the same classification from section 5.2 above. As reported by the last three regressions, accounting for the level of economic development does not allow capturing a significantly different effect of ERR on the likelihood of banking crises, compared to intermediate ERR. Finally, for robustness issues, we perform the same analysis for currency crises (Table 9.2) and debt crises (Table 9.3); yet again, we fail to observe significant differences between corner and intermediate ERR.[13] To summarize, this analysis confirms the robustness of our main results when considering alternative ERR classifications.[14]

5.5. Alternative databases for the main variables: crises and exchange rate regimes

One criticism for our main results may arise from combining data from Reinhart & Rogoff (2011) with data from Leaven and Valencia (2012) to define crises episodes. To tackle this point, we present in the following results based on the use of crises episodes from Reinhart and Rogoff's database alone. Due to gaps in their database, the number of countries in our sample falls from 90 to 59 countries.[15]

Table 10.1: Alternative databases for crises and ERR: banking crises

	IMF classification					IRR classification			
	[1]	[2]	[3]	[4]		[5]	[6]	[7]	[8]
Peg or float	**0.125**				**Peg_or_float**	**0.030**			
	(0.620)					**(0.899)**			
Peg or float1		**0.326**			**Peg_or_float_1**		**-0.018**		
		(0.381)					**(0.944)**		
Peg or float2			**0.298**		**Peg_or_float_2**			**-0.072**	
			(0.447)					**(0.796)**	
Peg or float3				**0.344**	**Peg_or_float_3**				**0.262**
				(0.407)					**(0.439)**

[13] Besides, accounting for the level of income for each of the two remaining corner ERR variables, namely Peg or float2 and Peg or float3, and for each of the three types of crises, still supports our main findings (these estimations are fully reported as supplementary material).

[14] All our findings are established by holding the group of intermediate ERR identical (see Table 8). For robustness issues, we performed estimations in which the group of intermediate ERR is extended with the ERR excluded from the definition of Peg or float variables. These results, available upon request, equally refute the bipolar view.

[15] The countries dropped are: Benin, Botswana, Burkina Faso, Burundi, Cameroon, Congo Republic, Dominica, Dominican Republic, Ethiopia, Gabon, Gambia, Israel, Jamaica, Jordan, Kuwait, Lesotho, Madagascar, Malawi, Mali, Nepal, Niger, Pakistan, Papua New Guinea, Senegal, Sierra Leone, Sudan, Suriname, Swaziland, Syrian Arab Republic, Togo and Uganda.

Obs. (countries)	496 (53)	377 (53)	351 (52)	347 (52)	Obs. (countries)	491 (53)	453 (53)	453 (53)	453 (53)
Pseudo-R^2	0.000	0.000	0.003	0.003	Pseudo-R^2	0.000	0.002	0.002	0.003
Wald (*stat*)	44.82	33.11	29.77	31.16	Wald (*stat*)	42.72	38.91	38.98	39.07
Wald (*p-value*)	0.000	0.010	0.028	0.019	Wald (*p-value*)	0.000	0.001	0.001	0.001
Log likelihood	-267.8	-202.3	-191.9	-187.3	Log likelihood	-262.9	-237.8	-237.8	-237.5
% Obs. corr. called	59.4	57.2	57.2	58.2	% Obs. corr. called	59.4	61.5	61.1	61.5

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Hausman specification test suggested random effects with the Logit estimator. Coefficients displayed are marginal effects. The IMF and IRR classifications of ERR lead to different definitions of corner ERR variables. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b). The full table is reported as supplementary material at the end of the manuscript.

The first four columns of Table 10.1 report estimations based on the IMF's classification of ERR. For robustness issues, we disentangle the interest variable in several alternative variables measuring corner ERR, following the definitions used previously. As emphasized by columns (1)-(4) of Table 10.1, the coefficient of our interest variable is statistically not significant, supporting our previous findings that corner exchange rate regimes are not more prone to banking crises compared to intermediate regimes.

In the following, we investigate the robustness of our results to the use of an alternative classification for our main variable, namely ERR. To do so, we draw upon the Ilzetski, Reinhart and Rogoff's (2010) natural de facto classification of ERR, and define the following dummies. Peg_or_float is the widest measure of corner ERR, since it includes all forms of peg (namely hard pegs and de facto pegs) and all forms of floating (namely managed and freely floating), as reported by Table 11 and Appendix 4. By so doing, the variable Peg_or_float aims at matching, to the extent to which this is possible given the use of two different databases, the variable Peg or float based on the IMF database.

Table 11: Alternative definitions of corner EER based on IRR's classification

Fine	Coarse	**Peg_or_float**	**Peg_or_float_1**	**Peg_or_float_2**	**Peg_or_float_3**
no separate	Hard peg	1	1	1	1
currency board		1	1	1	1
defacto peg	Peg	1	1	excluded	excluded
crawling peg		0	0	0	0
crawling band		0	0	0	0
defacto cp		0	0	0	0
defacto cb	Intermediate	0	0	0	0
wider cb		0	0	0	0
defacto cb narrower		0	0	0	0
moving band		0	0	0	0
managed float	Floating	1	1	1	excluded
freely floating		1	1	1	1
freely falling		0	excluded	excluded	excluded

Note: Fine classifications are fully detailed in Appendix 4.

Using the variable Peg_or_float as benchmark, we refine it as follows. Peg_or_float_1 includes the same corner regimes, but we exclude freely falling observations from intermediate regimes. According to IRR, freely falling observations refer to countries that

present inflation rates above 40%, irrespective of their ERR. Next, we restrict the definition of corner ERR by progressively dropping de facto pegs (Peg_or_float_2) and managed float regimes (Peg_or_float_3). As previously, the rationale is that restricting at most the definition of corner ERR might unveil a significant effect compared to intermediate ERR.

The results based on the use of the IRR database for the ERR are illustrated in columns (5)-(8) in Table 10.1. Despite alternative measures of extreme ERR, we fail to reveal a significantly different effect of such regimes on the likelihood of banking crises, compared to intermediate regimes. In addition, excluding observations for countries with inflation rates above 40% does not alter our findings, thus confirming previous evidence based on the IMF's classification of ERR.

Table 10.2: Alternative databases for crises and ERR: currency crises

	IMF classification					IRR classification			
	[1]	[2]	[3]	[4]		[5]	[6]	[7]	[8]
Peg or float	**0.477**				**Peg_or_float**	**-0.151**			
	(0.200)					**(0.686)**			
Peg or float1		**0.413**			**Peg_or_float_1**		**0.104**		
		(0.493)					**(0.774)**		
Peg or float2			**0.428**		**Peg_or_float_2**			**0.178**	
			(0.476)					**(0.649)**	
Peg or float3				**0.542**	**Peg_or_float_3**				**-0.087**
				(0.398)					**(0.870)**
Obs. (countries)	353 (48)	266 (46)	263 (46)	259 (46)	Obs. (countries)	350 (48)	310 (48)	310 (48)	310 (48)
Pseudo-R²	0.037	0.056	0.055	0.061	Pseudo-R²	0.048	0.019	0.016	0.021
Wald (*stat*)	49.50	37.38	36.60	35.73	Wald (*stat*)	49.01	38.68	39.02	38.30
Wald (*p-value*)	0.000	0.002	0.003	0.004	Wald (*p-value*)	0.000	0.001	0.001	0.002
Log likelihood	-178.1	-130.0	-129.9	-126.0	Log likelihood	-175.3	-158.4	-158.4	-158.5
% Obs corr. called	65.7	65.7	65.0	66.0	% Obs corr. called	66.8	64.8	64.8	65.8

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Hausman specification test suggested random effects with the Logit estimator. Coefficients displayed are marginal effects. The IMF and IRR classifications of ERR lead to different definitions of corner ERR variables. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b). The full table is reported as supplementary material at the end of the manuscript.

Table 10.3: Alternative databases for crises and ERR: debt crises

	IMF classification					IRR classification			
	[1]	[2]	[3]	[4]		[5]	[6]	[7]	[8]
Peg or float	**0.115**				**Peg_or_float**	**-0.345**			
	(0.807)					**(0.485)**			
Peg or float1		**-1.371**			**Peg_or_float_1**		**-0.430**		
		(0.123)					**(0.465)**		
Peg or float2			**-1.371**		**Peg_or_float_2**			**-0.755**	
			(0.123)					**(0.240)**	
Peg or float3				**-1.441**	**Peg_or_float_3**				**-0.889**
				(0.121)					**(0.237)**
Obs. (countries)	313 (34)	211 (34)	211 (34)	207 (34)	Obs. (countries)	310 (34)	262 (34)	262 (34)	262 (34)
Pseudo-R²	0.100	0.099	0.099	0.089	Pseudo-R²	0.109	0.089	0.094	0.095
Wald (*stat*)	51.56	32.26	32.26	31.22	Wald (*stat*)	50.97	38.76	38.67	39.09
Wald (*p-value*)	0.000	0.014	0.014	0.018	Wald (*p-value*)	0.000	0.001	0.001	0.001
Log likelihood	-133.8	-91.04	-91.04	-90.13	Log likelihood	-131.6	-105.2	-104.7	-104.7
% Obs. corr. called	72.5	73.9	73.9	72.4	% Obs. corr. called	71.9	74.8	73.6	73.2

Significance: * 10%; ** 5% and *** 1%. P-values are given in brackets. All specifications include time dummies. Hausman specification test suggested random effects with the Logit estimator. Coefficients displayed are marginal effects. The IMF and IRR classifications of ERR lead to different definitions of corner ERR variables. The predictive power is calculated using a cutoff point of 25% as in Esaka (2010b). The full table is reported as supplementary material at the end of the manuscript.

Finally, Tables 10.2 and 10.3 perform the same analysis for currency and debt crises respectively.[16] Irrespective of the database used to classify ERR, namely IMF or Ilzetski, Reinhart and Rogoff, or of the way corner ERR are defined, we still fail to find a significantly different effect of extreme ERR on the occurrence of currency and debt crises, compared to intermediate ERR. Consequently, our former findings of no bipolar view persist, and are equally robust to the sample selection bias analyzed in this subsection.

VI. Conclusion

This paper offers an overview on the link between crises and exchange rate regimes. Based on a panel of developing and developed countries over the period 1980-2009, we show that the type of exchange rate regime is unimportant when it comes to explaining the likelihood of crises. This result holds to a wide set of robustness specifications. First, our findings do not characterize a specific type of crisis, but they are common to banking, currency and debt crises, and also when controlling for appropriate determinants of each type of crisis. Second, accounting for contagion effects between the three types of crises or controlling for the level of economic development leaves our results unchanged. Third, our results are robust to the use of alternative definitions of corner ERR. Finally, conducting the analysis on alternative databases for our main variables, namely ERR and crises, has no impact on our findings. Consequently, our results vigorously contradict the view that intermediate exchange rate regimes are more prone to crises than hard pegs and independently floating regimes. In other words, although the likelihood of crises might depend of fiscal, financial and monetary variables, it is not related to the exchange rate regime in place. Thus, we clearly break down the bipolar view.

The policy implications of this paper appear straightforward. Our main findings show that crises and ERR are not systematically interrelated. Therefore, countries aiming at preventing economic crises should not focus on the choice of an appropriate exchange rate regime alone, and instead proceed to structural reforms by implementing sound macroeconomic and financial policies to safeguard against crises-conducting behaviors, such as reckless credit expansion, unsustainable fiscal policy or exploding debt paths policies.

[16] As previously, we performed for robustness issues estimations in which the group of intermediate ERR is extended with the ERR excluded from the definition of Peg_or_float variables, without however identifying qualitative changes in the effect of corner ERR on the likelihood of crises (results are available upon request).

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Appendices

Appendix 1: The list of countries by income level

Low and Lower Middle Income Countries (LIC and LMIC): Benin, Bolivia, Burkina Faso, Burundi, Cameroon, Congo, Rep., Cote d'Ivoire, Egypt, El Salvador, Ethiopia, Gambia, Ghana, Guatemala, Honduras, India, Indonesia, Kenya, Lesotho, Madagascar, Malawi, Mali, Morocco, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Papua New Guinea, Paraguay, Philippines, Senegal, Sierra Leone, Sri Lanka, Sudan, Swaziland, Syrian Arab Republic, Togo, Uganda, Zambia, Zimbabwe.

Upper Middle Income Countries: Argentina, Botswana, Brazil, Chile, China, Colombia, Costa Rica, Dominica, Dominican Republic, Ecuador, Gabon, Jamaica, Jordan, Malaysia, Mauritius, Mexico, Panama, Peru, South Africa, Suriname, Thailand, Tunisia, Turkey, Uruguay, Venezuela.

High Income Countries: Australia, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea Rep., Kuwait, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States.

Appendix 2: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max	Source
Domestic credit	900	43.737	39.167	0	243.996	World Bank, World Development Indicators (WDI) 2011
Volatility of DC	898	3.622	6.078	0	77.488	
Inflation	880	0.857	1.733	-8.156	49.29	
Seigniorage	897	38.278	336.733	-54.687	8038.996	
GDP per capita	900	8984.905	12611.32	36.699	65669.99	
Official development assistance (Aid)	670	6.109	7.415	-0.200	50.186	
Output growth	900	3.298	3.367	-17.320	19.618	
Broad money	838	43.90289	395.956	0.0001	5784.176	
Current account balance	897	-2.795	7.713	-60.506	43.472	
Public debt	881	66.948	53.743	2.748	967.851	Ali Abbas et al., (2010) Historical Public Debt database
Primary fiscal balance	595	-3.153	5.589	-25.636	37.208	IMF, IFS 2011
Credit market regulation	820	6.715	2.116	0	10	Economic Freedom Network dataset, 2011
Size of the financial sector	845	0.506	0.316	0.033	2.374	Beck and Demirgüc-Kunt, Financial Structure dataset, 2010
Bank credits/bank deposit (Intermediation)	877	7.538	70.158	0.100	942.291	
Executive constraint	837	4.752	2.241	1	7	Polity IV project database, 2010
Capital account openness	804	0.088	1.498	-1.843	2.477	Chinn and Ito database, 2008

Appendix 3: IMF classification of exchange rate regimes (ERR)

Codes	IMF fine classification	Coarse classification
1	Another currency as legal tender	**Peg**
2	Currency board	
3	Currency union	
4	Economic union/Monetary coordination agreement	
5	Conventional fixed peg to a single currency	
6	Conventional fixed peg to a basket	**Intermediate**
7	Pegged within horizontal bands	
8	Forward-looking crawling peg	
9	Forward-looking crawling band	
10	Backward-looking crawling peg	
11	Backward-looking crawling band	
12	Other tightly managed floating	
13	Managed floating with no predetermined path for the exchange rate	**Floating**
14	Independently floating	

Note: No observation in category 4 in our sample.

Appendix 4: Ilzetzki, Reinhart and Rogoff (2010) classification of ERR

Codes	Fine classifications	Coarse classification
1	No separate legal tender	**Pegged**
2	Pre announced peg or currency board arrangement	
3	Pre announced horizontal band that is narrower than or equal to +/-2%	
4	De facto peg	
5	Pre announced crawling peg	**Intermediate**
6	Pre announced crawling band that is narrower than or equal to +/-2%	
7	De factor crawling peg	
8	De facto crawling band that is narrower than or equal to +/-2%	
9	Pre announced crawling band that is wider than or equal to +/-2%	
10	De facto crawling band that is narrower than or equal to +/-5%	
11	Moving band that is narrower than or equal to +/-2% (i.e. it allows for both appreciation and depreciation over time)	
12	Managed floating	**Floating**
13	Freely floating	
14	Freely falling	**Other**
15	Dual market in which parallel market data is missing	

Note: No observation in category 3 in our sample. Due to controversies around their definition, we exclude from our sample observations from category 15.