CEP 11-12

Currency Crises, Exchange Rate Regimes, and Capital Account Liberalization: A Duration Analysis Approach

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November 2011

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September 2011

Abstract: This paper empirically analyzes the effect of exchange rate regimes and capital account liberalization policies on the occurrence of currency crises for 21 countries over the period of1970-1998. We examine changes of the likelihood of currency crises under *de jure*, and *de facto* exchange rate regimes. We also test whether the impact of the exchange rate regimes on currency stability would be different under free and restricted capital flows. Our findings show that the likelihood of currency crises changes significantly under *de facto* regimes. However, the results are sensitive to the choice of *de facto* exchange rate arrangements. Furthermore, in our sample, capital control policies appear to be helpful in preventing low duration currency crises. The results are robust to a wide variety of sample and models checks.

JEL classification: F31, F32, F33, G01.

Acknowledgment: I thank Carmen Reinhart, Kenneth Rogoff, Ethan Ilzetzki, Eduardo Levy-Yeyati, Federico Sturzenegger, Menzie Chinn, and Hiro Ito for making their data public.

1. Introduction

The links between the incidence of currency crises and the choice of exchange rate regimes as well as the impact of capital market liberalization policies on the occurrence of currency crises have been subject of considerable debates in recent years. It is of great interest to assess how exchange rate arrangements and financial liberalization will affect episodes of crisis. Policy makers also seek to know what type of exchange rate regime is more sustainable and whether controlling capital flows in fact contributes to the stability of currencies.

Yet, the literature is not clear on these issues and presents mixed views. Many economists argue that fixed exchange rates are a cause of currency crises while others find that the intermediate and/or flexible exchange regimes are more crisis prone. The role of capital market liberalization is even more controversial. The common view in the literature blames high capital mobility as an underlying cause of currency crises, especially when combined with fixed exchange rates. However, several studies hold that capital mobility restrictions are responsible for crises – as a contributing factor behind the crises – and advocate financial liberalization. It is evident that, for the time being, there is no consensus on these topics and more research is required before the controversies can be settled.

The main purpose of this paper is to systematically examine what type of exchange rate regimes are more susceptible to currency crises by investigating the data from twenty OECD countries and South Africa over the period of 1970-1998. We adapt the empirical models of the determinants of currency crises, which were presented in Karimi and Voia (2011b), as the benchmark models and examine how the likelihood of currency crises is influenced by *de jure* and *de facto* exchange rate regimes. We also study the role of capital mobility and test for currency stability under free and restricted capital flows. Finally, we examine whether the hazard of speculative attack changes under the different combinations of exchange rate regimes and the presence or absence of capital controls.

We employ two prominent *de facto* exchange rate regime classifications in the literature, those of Reinhart and Rogoff (2004), and Levy-Yeyati and Sturzenegger (2005), to identify the actual exchange rate arrangements. Our index for *de jure* exchange rate regimes is the IMF exchange rate classification. We also categorize capital mobility policies into restricted and open policies with the help of Chinn and Ito's (2005) index of financial openness.

As in Karimi and Voia (2011b), duration analysis is our methodology to study the probability of a currency crisis occurrence under different exchange rate regimes and capital mobility policies. Duration models rigorously incorporate the time factor into the likelihood functions and allow us to investigate

how the amount of time that a currency has already spent in the tranquil state affects the stability of the currency. This feature helps us to capture the unobservable determinants of currency stability that are embodied in the baseline hazard functions. We apply semi-parametric duration models to estimate the unrestricted baseline hazard of a currency exiting a tranquil state into a turbulence state. These models do not require any distribution assumptions about the timing of failures and can capably deal with both monotonic and non-monotonic duration dependence. Compared to other duration models, they are more realistic and can produce estimations that are more efficient.

The nonlinear nature of duration specification lets us investigate how the different exchange rate regimes or the presence and absence of capital controls can change the sensitivity of currency crises with respect to changes in a set of macroeconomic fundamentals and contagion channels. Furthermore, we use crisis episodes that are identified by extreme value theory to minimize the concerns regarding the accuracy of crisis episodes dating. We apply several robustness checks, including running our models on two different crisis episodes sets that are based on monthly and quarterly-type spells, to verify the reliability of our estimation results.

We find that there is a significant link between the choice of exchange rate regime and the incidence of currency crises in our sample. Nevertheless, the results are sensitive to the choice of the *de facto* exchange rate system. When we use Reinhart and Rogoff's (2004) *de facto* classification to categorize the exchange rate regimes, fixed exchange rate arrangements are least susceptible to speculative attacks. However, when we rely on Levy-Yeyati and Sturzenegger's (2005) *de facto* classification, intermediate exchange rate regimes will experience the smallest number of currency crisis incidences. On the other hand, we find that the impact of capital account policies on the occurrence of currency crises, in our sample, demonstrates different results. While the baseline hazard of open-type capital accounts is lower than the baseline hazard of restricted-type capital accounts, when we enter our set of control variables to the models, the hazard of open-type capital accounts appears to be higher than the hazard of restricted-type capital accounts. This relation is more significant at the low duration crisis episodes.

For the remainder of the paper we proceed as follows. Section 2 looks at the exchange rate regimes classifications and briefly introduces the two *de facto* exchange rate regime classifications that we use in this paper. It also quickly reviews the empirical literature on the links between exchange rate regimes and the occurrence of currency crises. Section 3 reviews the empirical literature and presents the links between capital control policies and occurrences of currency crises. Section 4 describes the empirical methodology and data. Section 5 presents the main empirical results and robustness tests. Section 6 discusses the results and concludes. Some detailed technical results are presented in the appendix.

2. Classification of exchange rate regimes and currency crises

2.1. Classifications

Since the collapse of the Bretton Woods system, a large empirical literature has developed to assess the performance of exchange rate regimes. The early literature – *e.g.* the influential work of Baxter and Stockman (1989) – compared the performance of key macroeconomic variables with fixed and flexible exchange rate arrangements. However, they found little significant differences across fixed and flexible regimes. There was a drawback in the way that they characterized the exchange rate regimes and this shortcoming affected negatively the early literature.

For many years, empirical studies relied on the International Monetary Fund's *de jure* classification of exchange rate regimes to measure the impact of exchange rate arrangements on economic performance.[1] This classification is a countries' self-declared index, which was published in the Fund's *Annual Report on Exchange Rate Arrangements and Exchange Restrictions*.[2] However, in a pioneering paper, Calvo and Reinhart (2002) noticed that in practice there is a substantial deviation between the officially reported and the actually prevailing exchange rate arrangements.[3] Therefore, the empirical results of those analyses based on the *de jure* classification could be misleading. This problem motivated researchers to devise alternative classifications to identify the *de facto* exchange rate regimes and categorize countries more accurately according to their actual practice rather than official statement.[4]

In this subsection, we briefly introduce two prominent alternative classifications in the literature: Reinhart and Rogoff (2004) and Levy-Yeyati and Sturzenegger (2005).[5] Reinhart and Rogoff (hereafter RR) rely on the IMF classification as their starting point and develop their own classification system based on a statistical analysis of the *ex post* behavior of exchange rates in the official, dual and/or parallel markets. For countries with only official rates they apply a broad variety of descriptive statistics (mostly exchange rate variability, variability with respect to the officially announced bands, and inflation) to verify whether the *de jure* classification is accurate. If not, they reclassify the exchange rate into the alternative

1. Ideally, the exchange-rate system classification ought to be based on the degree to which a system in a particular category constrains domestic monetary policy independence (Tavlas *et al.*; 2008).
2. The *de jure* classification roughly distinguished between three broad categories: pegged, limited flexibility, and more flexible. These three coarse categories could be extended into fifteen fine subcategories that cover a continuum of exchange rates regimes from hard fixes to free floats.
3. For example, several economies officially reported their currencies as pegs but often underwent frequent devaluations and, hence, in practice their regimes resembled a flexible more than a fixed. Alternatively, other countries officially committed to the flexible exchange rates, however, exhibited "fear of floating" and acted differently.
4. To address this and a few other shortcomings, the IMF has adopted a modified classification system based on the Fund's members' *de facto* regimes since 1999. Bubula and Ötker-Robe (2002) provide more details.
5. Tavlas *et al.* (2008) review the main methodologies that have been used to construct the *de facto* exchange rate regimes. They also survey the empirical literature that has been generated by the *de facto* classifications.

categories. For countries with dual and/or parallel rates, they classify the exchange rate based on the market-determined rates, which they argue are important indicators of the underlying monetary policy.

RR classify the exchange rates regimes into fourteen fine categories. Nevertheless, these categories can be aggregated into three coarse branches: fixed, intermediate, and float. The fixed branch includes: (1) regimes with no separate legal tender, (2) regimes with a pre-announced peg or currency board arrangements, (3) regimes with a pre-announced horizontal band that is narrower than or equal to plus/minus two percent, and, (4) regimes with a *de facto* peg. The intermediate branch contains: (5) pre-announced crawling pegs, (6) regimes with a pre-announced crawling band that is narrower than or equal to plus/minus two percent, (7) *de facto* crawling pegs, (8) regimes with a pre-announced crawling band that is wider than or equal to plus/minus two percent, (9) regimes with a *de facto* crawling band that is narrower than or equal to plus/minus two percent, (10) regimes with a *de facto* crawling band that is narrower than or equal to plus/minus five percent, (11) regimes with a moving band that is narrower than or equal to plus/minus two percent, and, (12) managed floating arrangements. Finally, the float branch includes: (13) freely floating exchange rates. The last category, (14) free falling regimes, can be reclassified into fixed, intermediate, or float on the basis of the provided chronologies.[6]

Levy-Yeyati and Sturzenegger (hereafter LYS) use cluster analysis and construct their alternative classification exclusively based on the official exchange rate and the evolution of foreign exchange reserves. They adopt the classic textbook definition of fixed and flexible exchange rates to classify the regimes. They categorize the exchange rate arrangements that are associated with low volatility in (1) nominal exchange rate level (σ_e) and, (2) changes in nominal exchange rate ($\sigma_{\Delta e}$) but high volatility in international reserves (σ_R) as fixed exchange rate regimes, while arrangements with high volatility exchange rate levels and exchange rate movements but stable international reserves are defined as flexible exchange rate regimes.

LYS fine classification distinguishes five different regimes: (1) fixed regimes, 2) crawling pegs, (3) dirty floats, (4) floats, and, (5) inconclusive.[7] However, their coarse classification collapses into three categories: (1) fixed, (2) intermediate, and, (3) float. LYS purely rely on statistical methodology, hence, almost one third of the observations in their sample cannot be classified by their algorithm due to missing data or because the exchange rate was pegged to an undisclosed basket.

6. RR classify an exchange rate arrangement as a free falling regime if the 12-month inflation rate is equal to or exceeds 40 percent per annum. The regime is also considered to be free falling during the six months immediately following a currency crisis and there is a transition from a peg or a quasi-peg regime to a managed or independent float regime. See the Appendix in Reinhart and Rogoff (2004) for more details.

7. Inconclusive regimes include those exchange rates that experience low volatility with respect to all three characteristics or for which there is no information about the classifying variables. Nearly two percent of the regimes were classified as inconclusive in the latest update of LYS.

RR and LYS's *de facto* exchange rate regimes are very popular among alternative classifications and the series that they provide have been widely used in the empirical literature. The latest update of RR dataset provides monthly *de facto* exchange rate regimes for 227 countries from January 1940 through December 2007, while the latest update of LYS dataset provides annual *de facto* exchange rate regimes for 183 countries from 1974 through 2004.

Both RR and LYS classifications have made a significant contribution to the *de facto* exchange regimes literature. Nevertheless, there are two concerns regarding the alternative classification. First, there is no empirical evidence on how to choose among the existing alternative systems. Second, there is no commonly accepted test – indeed few studies have been performed – to verify the reliability of these classifications and accordingly the studies that use them. In a recent paper, Eichengreen and Razo-Garcia (2011) investigate the disagreement between *de facto* exchange rate regimes.[8] They find that there is a good amount of agreement across the classifications; however, the disagreements are not negligible. Their results show that the disagreement is more pronounced in the case of emerging and developing countries.

2.2. Exchange rate regimes and currency crises

The wave of currency crisis incidences in the 1990's and early 2000's has stimulated the debates on the potential links between the choice of an exchange rate regime and the occurrence of crises. Fischer (2001) and Williamson (2002), among others, view fixed exchange rate regimes as crisis prone and argue that, in a world of integrated financial markets, rigid exchange rates are more susceptible to speculative attacks.

Yet, during the major currency crisis events, intermediate exchange rate regimes (soft pegs and tightly managed floats) have been the main targets of speculative attacks. Therefore, some researchers suggest that such regimes are not viable and support for the "bipolar view" of exchange rate regimes. The proponents of the bipolar view claim that the intermediate regimes suffer from a lack of verification and transparency. Moreover, they argue that high capital mobility leaves little room for the governments to follow inconsistent internal and external policies. Thus, in a world of free international capital mobility, countries will be forced to abandon the intermediate regimes and choose between the two extreme exchange rate regimes: either hard pegs or freely floating regimes (see *e.g.*, Eichengreen, 1994; and Fischer, 2001).

Nevertheless, many economists have challenged the bipolar view. Calvo and Reinhart (2002) demonstrated empirically that many intermediate regimes have not vanished and have maintained their

8. They use data from three popular classification schemes: RR, LYS, and Bubula and Ötker-Robe (2002), which has been extended by Anderson (2009).

existence. They pointed out that the bipolar systems do not necessarily enhance the credibility of monetary-exchange rate policies and can even destabilize the financial system. Williamson (2000 and 2002) advocates intermediate regimes and proposes certain types of them (*i.e.* band, basket, and crawl) as the arrangements that can stabilize the real effective exchange rate and improve the sustainability of the exchange system. He argues these regimes can help preventing misalignments and provide greater flexibility to cope with shocks, whereas hard pegs and free floats can cause misalignments and damage the sustainability of the system.

Some researchers have empirically studied the links between the exchange rate regimes and the occurrence of currency crises. Ghosh *et al.* (2003) statistically examine the impact of exchange rate regimes on currency crises for the IMF country members from 1972 to 1999. Using the IMF's *du jure* exchange rate regimes and their own constructed *de facto* classification, they find that crises are more likely under floating regimes.

Bubula and Ötker-Robe (2003) investigate the links between the exchange rate regime and the incidence of currency crises among IMF country members from 1990 to 2001. Their logit model estimation results, obtained on the basis of the *de facto* exchange rate regimes of Bubula and Ötker-Robe (2002), provide some support for the bipolar view. During their sample period, the likelihood of crises for the intermediate regimes was significantly higher than that of hard pegs and floating regimes.

Rogoff *et al.* (2004) and Husain *et al.* (2005), using the *de facto* classification of Reinhart and Rogoff (2004), estimate the probability of currency crises for IMF country members. According to their results, over the 1970 to 2000 period, currency crises tended to occur more frequently in the intermediate regimes. Applying an alternative measure of currency crises, they find floating regimes have a significantly lower risk of entering into a crisis compared to pegs and intermediate regimes.

Haile and Pozo (2006) apply probit models to test whether the exchange regime in place has an impact on the vulnerability of countries to currency crises. Their sample includes 18 developed countries from 1974 to 1998. When they use Levy-Yeyati and Sturzenegger's (2005) *de facto* exchange rate regimes, their results show that the *de facto* exchange arrangements play no role in determining crisis periods. However, when they use the IMF *de jure* classification, they find that the probability of currency crises is higher for the declared pegged regimes than for intermediate or floating regimes.

Esaka (2010a, b) examines how *de facto* exchange rate regimes affect the occurrence of currency crises in 84 countries from 1980 to 2001. His probit model estimation results, obtained by employing the *de facto* classification of Reinhart and Rogoff (2004), demonstrate no significant increase in the likelihood of

currency crises for the intermediate regimes compared with the hard pegs and free floating regimes (Esaka, 2010a). He finds pegged regimes significantly decrease the likelihood of currency crises compared with floating regimes (Esaka, 2010b). He also found that hard pegs with liberalized capital account significantly decrease the probability of currency crises compared to the floating and intermediate regimes with capital control.

3. Capital markets liberalization and currency stability

The link between capital markets liberalization and macroeconomic instability is one of the key topics in international economics. Many economists and policymakers believe that large and volatile capital flows make the international financial system unstable and cause currency crises. In their view, the liberalization of international capital flows, especially when combined with fixed exchange rates, will lead to financial disruptions (see *e.g.*, Radelet and Sachs, 2000; Stiglitz, 2002).

On the other hand, capital mobility restrictions may also undermine the stability of financial system and contribute to the occurrence of crises. Imposing capital controls will induce investment irreversibility, result in a net capital outflow, and worsen financial instability (Dooley and Isard, 1980). Moreover, restricted capital accounts can create distortions, signify inconsistent policies, and exhibit the potential vulnerabilities of the financial system, which may induce capital flight and trigger currency crises (Bartolini and Drazen, 1997).

In addition to the lack of consensus on the links between capital market liberalization and the occurrence of currency crises, the potential interdependence of capital account policies with the choice of exchange rate regime makes the issue at stake even more complicated. It is widely recognized that under high capital mobility, monetary policies cannot easily focus on both maintaining fixed exchange rates and accommodating with real shocks effectively. This is usually referred to as the "impossible trinity".[9] It points to the argument that policymakers in open economies may concentrate only on two of three conflicting objectives: capital mobility, monetary independence, and the stable fixed exchange rate.[10] This argument implies there could be interdependence between the choices of exchange rate regimes and capital account policies.

As a direct implication of the impossible trinity, one can expect, due to the current trend of financial liberalization, monetary policies will increasingly become inconsistent with the sustainability of fixed

9. However, Lavoie (2001) counters the impossible trinity claim and argues that even under capital mobility can maintain their monetary policy autonomy. Partially based on his argument, Frenkel and Rapetti (2007) analyze the macroeconomic evolution of Argentina during the (2001) crisis and question the validity of impossible trinity.
10. Obstfeld and Taylor (2005) elaborate the role of impossible trinity on the evolution of the international financial system.

exchange rates and make this type of exchange rate arrangement more crises prone (this conclusion is incompatible with the bipolar view). Furthermore, wide financial and trade integration, rapid financial innovations, and deep financial developments have gradually reduced the effectiveness of capital controls and consequently the monetary policy-exchange rate stability dilemma is now evident even in the countries that are willing to impose capital controls.

Several studies empirically investigate the impact of capital control policies on insulating countries from the macroeconomic instability and currency crises. Edwards (1989) investigates the role of capital controls in 39 devaluation episodes for 24 developing countries from 1961 to 1982. His findings show that these countries typically employed intensified capital controls programs in the year before the devaluation to slow down the unavoidable balance of payment crises. Demirgüç-Kunt and Detragiache (1997) estimate the probability of a systemic crisis for both industrial and developing countries over the period of 1980-1994. Their results indicate that capital account liberalization can contribute to the macroeconomic instability and the occurrence of banking crises.

On the other hand, Glick and Hutchison (2005) study the link between capital controls and currency stability for 69 emerging and developing countries from 1975 to 1997. Their probit estimation results show that restrictions on capital flows are unable to efficiently protect countries from currency crises. Their findings provide no evidence that countries with high capital mobility are more prone to speculative attacks. Glick, Guo, and Hutchison (2006) address concerns about self-selection bias and attempt to revise their earlier work accordingly.[11] The outcome of their analysis suggests that even after controlling for the sample selection bias, countries with liberalized capital accounts experience a lower likelihood of speculative attacks. Glick and Hutchison (2010) present a new version of their earlier study. They expand the time coverage from 1975 to 2004 and apply duration-adjusted measures of capital control intensity to allow for changes in control programs over time. Their results re-emphasize their previous findings and assert that countries with less restrictive capital controls and more liberalized financial markets appear to be less vulnerable to speculative pressures.

A possible cause of these mixed empirical results could be attributed to the complexity of properly measuring the degree of openness or restrictions in cross-border financial transactions. The underlying source of data for conventional measures of quantifying financial openness is based upon the IMF's *de jure* classifications, which are published in the *Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER)*. However, this information is overly aggregated to fully capture the dynamics of

11. Self-selection bias points to the non-random choice of capital control programs. Countries that are facing considerable amount of pressure in their exchange markets are more likely to impose capital control programs and accordingly a positive correlation between capital controls and speculative attacks will be observed.

actual capital controls. Moreover, it is almost impossible to distinguish between *de jure* and *de facto* controls on capital account transactions. Consequently, the indices that are constructed to quantify the capital account restrictions, especially those that are dichotomous, fail to account for the intensity of capital controls. It is well known that measuring the extent of openness on capital account transactions is very complicated.

Nonetheless, many studies rely on the IMF's *AREAER* attempt to quantify the degree of financial openness and measure the impact or determinants of capital controls. Chinn and Ito (2005) present an index for measuring the degree of capital account openness. The Chinn-Ito index is based on a five-year moving average of the *de jure* binary dummy variables that codify the tabulation of restriction on cross-border transactions. This index attempts to measure the intensity of capital controls. The latest update of this index covers 182 countries for the period of 1970-2009. The index is constructed in such a way that the series has a mean of zero and country values range from -1.844 to 2.478, where the higher values indicate a greater intensity of restrictions on capital account transactions. Chinn and Ito (2008) provide details on how their index is constructed and compare it with other existing measures in the literature.

4. Data and methodology

This paper analyzes the incidence of currency crises for 21 countries with the help of an unbalanced panel of quarterly data over the period of 1970 through 1998. The countries in our sample includes: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Iceland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, and the UK. These countries share common similarities and provide higher frequency data for our empirical models.

Episodes of currency crises come from Karimi and Voia (2011a); "*Identifying Extreme Values of Exchange Market Pressure*". These episodes correspond to the extreme values of exchange market pressure indices. The indices are constructed on the basis of monthly and quarterly data. Accordingly, two different types of crisis episodes are obtained: monthly-type and quarterly-type.[12]

We employ the empirical models of the determinants of currency crises, which are presented in Karimi and Voia (2011b) – "*Empirics of Currency Crises: A Duration Analysis Approach"* – as the benchmark and examine how the likelihood of currency crises change under *de jure* and *de facto* exchange rate regimes. We also study the role of capital mobility and test for currency stability under free and restricted capital flows. In particular, we investigate the impact of different combinations of exchange rate

12. Since little monthly data is available to run our empirical models, the monthly incidences of crisis are expanded to contain the relevant quarters. Hence, the monthly-type crisis episodes suggest that at least one month within that quarter is recognized as the incidence of a crisis.

arrangements and capital controls on the hazard of speculative attacks. The continuous semi-parametric Cox proportional hazard models are our main methodology in pursuing these objectives.

Our index for *de jure* exchange rate regimes is the same as the IMF's classification. For the choice of a *de facto* regimes index, we have some options available. However, there is no systemic methodology to choose and/or evaluate the existing alternative systems. Moreover, as Eichengreen and Razo-Garcia (2011) point out, during periods of currency volatility, different *de facto* classifications tend to produce different results. Hence, they advise investigators to be particularly careful when attempting to link *de facto* regimes to financial crises. Thus, considering the time coverage of the *de facto* regimes, we employ both RR and LYS classifications in an attempt to capture the probable discrepancies. We adopt the coarse classification of RR and LYS and divide the exchange rate arrangements into three categories: (1) fixed, (2) intermediate, and; (3) floating regimes.[13] On this ground, we construct the categorical variables of exchange rate regimes: $Fix_{i,t}$, $Intermediate_{i,t}$, and $Float_{i,t}$.[14] Each country (*i*) at time *t* is assigned to one of these categories based on RR or LYS classifications.

We utilize the Chin-Ito index as our measure of capital account restrictions. This index, to some extent, can capture the intensity of capital mobility restrictions and enjoys a wide coverage across counties and time. On the basis of this index, we construct a dummy variable for capital controls ($CapControls_{i,t}$). A capital account is classified as open – $CapControls_{i,t}$ takes the value of one – if the value of the Chinn-Ito index is more than the average of similar countries during that period of time.[15] Otherwise, it is classified as restricted and $CapControls_{i,t}$ takes the value of zero.[16]

To examine the impact of different exchange rate regimes under the presence or absence of capital controls, we combine the exchange rate classifications with the capital account policies and categorize our sample into six different regimes (three different exchange rate classifications with two capital account choices). Consequently, we construct two series of six categorical variables (one for RR-based and the other for LYS-based classifications), which are introduced in the following section.

Before we move on to our empirical results, we should point out that we are fully aware of the problems of reverse causation. This paper deals with the impact of exchange rate regimes and capital account

13. RR and LYS datasets are respectively available at: http://www.carmenreinhart.com/research/publications-by-topic/exchange-rates-and-dollarization/, and: http://www.utdt.edu/ver_contenido.php?id_contenido=4643&id_item_menu=8006.
14. Since we have two indexes for exchange rate regimes, RR and LYS, we construct two series of categorical variables.
15. All countries in our sample are categorized as advanced economies except for South Africa and some years in case of Greece and Portugal, which are categorized as emerging economies. The average value of the Chinn-Ito index for industrialized countries equals 0.257, 0.804, and 2.152 over the periods of 1970-79, 1980-89, and 1990-99, respectively.
16. The Chinn-Ito index dataset is available at http://web.pdx.edu/~ito/Chinn-Ito_website.htm.

policies on the occurrence of currency crises, not the other way around. To mitigate the potential problem of reverse causality (the impact of crises on exchange rate and capital regimes), we use lagged variables. Hence, the exchange rate regimes and capital account openness variables enter into the models with at least a one-period lag. This remedy to the potential problem of reverse causality is also useful to treat the potential interdependence between the choice of exchange rate regimes and capital account liberalization policies. In order to deal with this concern, we recognize and control for the duration of the policy mix composed of the exchange rate regimes and capital control programs. It is in line with the recent studies in the literature.

5. Empirical results

In this section, first, we empirically investigate the links between the probability of a currency crisis and the choice of exchange rate regimes. Then, we evaluate the impact of capital mobility on the stability of exchange rates. Finally, we examine how the likelihood of currency crises changes under different combinations of exchange rate regimes and capital controls.

5.1. Exchange rate regimes and currency crises

As a first step, we find how the incidences of different exchange rate regimes are distributed across our sample. As Table 1 presents, the IMF *de jure* system classifies major portion of the sample as the intermediate regimes compared to the fixed and floating arrangements. The same pattern is even more pronounced under the RR *de facto* classification (it should not be surprising knowing that RR relies on the IMF classification). However, LYS *de facto* system assigns more quarters to the corner regimes – fixed or floats –than the intermediate regimes.

In the next step, we figure out how the monthly and quarterly-type of currency crisis episodes are jointly scattered with the exchange rate arrangements and calculate the unconditional probability of currency crisis under different exchange rate regimes. From the reported results in Table 2, it is evident that when the regimes are categorized based upon *de jure* classification the differences between the calculated probabilities for currency crisis incidences under different exchange rate regimes are negligible. Yet, the probabilities that are calculated under *de facto* classifications show significant results, but different according to the chosen classification. When regimes are categorized by the LYS classification, the intermediate exchange rate arrangements are the least susceptible regime to the speculative attacks. However, when regimes are categorized by the RR classification, the fixed arrangements are the most sustainable exchange rates. To verify that the results are statistically significant and not random or due to differences in sample sizes, we run Chi-square independence test (not reported) and log-rank test. Both

Table 1. Incidence of Exchange Rate Regimes under different classifications

	de jure (IMF)		*de facto (LYS[•])*		*de facto (RR)*	
	quarters	*share* (%)	*quarters*	*share* (%)	*Quarters*	*share* (%)
Fix	696	28.57	796	45.64	615	25.25
Intermediate	1040	42.69	344	19.72	1654	67.90
Float	700	28.74	604	34.63	167	6.86
Total	2436	100.00	1744	100.00	2436	100.00

•LYS classification starts from 1974 and contains several unclassified observations.

Table 2. Unconditional probability of crisis under different Exchange Rate Regime classifications

	monthly-type			*quarterly-type*		
	IMF	*LYS*	*RR*	*IMF*	*LYS*	*RR*
Fix (t-1)	9.91	9.57	5.63	7.18	5.87	4.03
Intermediate (t-1)	10.14	7.87	12.11	6.24	4.37	8.3
Float (t-1)	10.39	12.69	6.10	7.79	10.02	4.27
Log-rank test[•]	1.36	5.81	18.63	1.39	11.70	11.25
P-value	0.51	0.06	0.00	0.50	0.00	0.00

Probabilities are calculated by dividing the number of crises under a particular regime to the total number of regime-quarters. All numbers are in percent, except for the Long-rank test results.

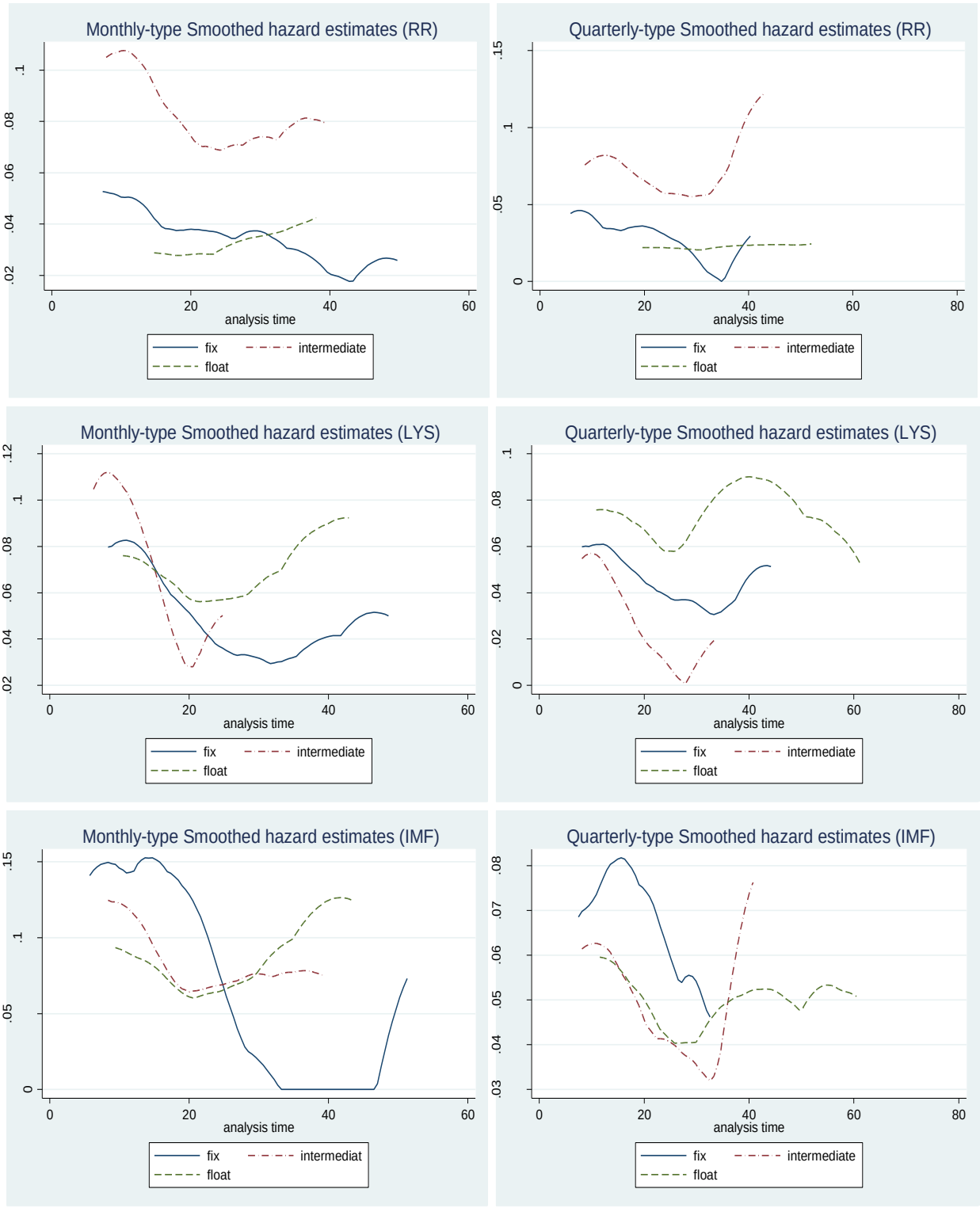
•The null hypothesis of log-rank test is whether the hazard functions are equal across different groups.

tests produce similar results and confirm our findings. The same structure is observable for both of the monthly and quarterly-type spells.

In addition, to obtain a visual understanding of the dynamics of the hazards under different exchange rate regimes, we present the smoothed estimations of the non-parametric hazards in Figure 1. In the diagrams of this figure, the vertical axis measures the probability that a currency exits a tranquil state and enters into a crisis state, while the horizontal axis represents the successive number of quarters spent in tranquility. The presented diagrams reconfirm the pattern that we observed in Table 2. When regimes are categorized based on the RR classification, the hazard of crises is at the highest level for the intermediate regimes. However, when regimes are classified under the LYS alternative system, the outcomes inverted and the intermediate regimes enjoy the lowest probability of attack (especially for the quarterly-type spells). Similar to the Table 2 results, the hazards that are built upon the IMF classification do not show a clear pattern. It should also be useful to mention that the observed non-monotonic nature of the hazards in Figure 1 validates our choice of semi-parametric Cox models.

Now, we apply the Cox proportional hazard models to evaluate formally the contribution of the choice of exchange rate regimes to the occurrence of currency crises. We adapt the models that are used in Karimi

Figure 1. Monthly and quarterly-type smoothed hazards under different exchange rate regimes



and Voia (2011b) by entering the exchange rate regime categorical variables. As in our previous paper, we run four different models for each monthly and quarterly-type spells. Variables in models 1 and 2 are contemporaneous while in models 3 and 4 they are lagged by one quarter. In models 1 and 3 the variables of each country are measured on their own, while all time-varying variables in models 2 and 3 are measured relative to the reference countries – Germany or the U.S. The results related to the RR and LYS classifications are presented in tables 3 through 6.[17] The results related to the IMF classification are not statistically significant whether monthly or quarterly-type models are being used, and hence are not reported here.

Tables 3 and 4 present the estimation results for monthly-type models of RR and LYS classifications.[18] An examination of the reported results in Table 3 reveals that the hazard of fixed exchange rate regimes is significantly lower than the hazard of intermediate exchange rate regimes in all of the four RR-based monthly-type models. The hazard of fixed regimes is also lower than the hazard of float regimes; however, in two of these models the difference is statistically significant. On the other hand, the results of Table 4 show that the hazard of intermediate exchange rate regimes is significantly lower than the hazard of fixed exchange rate regimes in two of the four LYS-based monthly-type models. Furthermore, in three of these models, the hazard of intermediate regimes is significantly lower than the hazard of float regimes. In both Tables 3 and 4, some control variables (trade linkages, inflation, unemployment volatility, and the financial account ratio to GDP) are repeatedly significant in all models and have the expected sign.

Tables 5 and 6 provide the estimation results for quarterly-type models of RR and LYS classifications. The results that they present are similar to those reported in Tables 3 and 4. Table 5 shows that when the episodes of currency crisis are identified with lower frequency data, the hazard of fixed exchange rate regimes is significantly lower than the hazard of intermediate exchange rate regimes in three of the four RR-based models. However, in all LYS-based quarterly-type models, the hazard of intermediate regimes is significantly lower than that of fixed and floating exchange regimes. Among the control variables, inflation is statistically significant in most of the models.

It is clear that in our sample there is a statistically significant link between the choice of an exchange rate regime and the occurrence of currency crises. Nevertheless, the results are sensitive to the choice of *de facto* exchange rate system. Fixed exchange rate regimes are the least susceptible exchange arrangement to speculative attacks, if the exchange rate regimes are determined by the RR classification, while

17. From what we perceived in Figure 1, the Fix exchange rate regimes are chosen as the base in our RR-based categorical variables while the Intermediate exchange rate regimes are assigned as the base for LYS-based categorical variables.
18. The models are interacted with different linear and non-linear time functions. The presented estimation results are the outcome of the interaction with a logarithmic form of time.

Table 3. Cox proportional hazard estimation (monthly-type spells) under RR de facto classifications

Variable	*Contemporaneous*		*Lagged*	
	Model (I)	*Model (II)*	*Model (III)*	*Model (IV)*
Fix is the base				
Intermediate	1.37*	1.5*	1.11*	1.15*
	(1.9)	(1.79)	(1.65)	(1.71)
Float	1.69*	2.15**	0.68	1.22
	(1.91)	(2.27)	(078)	(1.28)
Unemployment volatility	0.03	0.04**	0.05**	0.07**
	(1.38)	(2.22)	(2.03)	(2.45)
Previous crises				0.4*
				(1.68)
Size of economy	0.83**		0.76**	1.04**
	(2.39)		(2.1)	(2.52)
Whole period GDP growth		0.02**	0.02	0.01
		(2.1)	(1.38)	(1.25)
GDP growth rate	0.00	-0.01	-0.06	-0.07
	(-0.05)	(-0.17)	(-0.79)	(-0.87)
Inflation	0.26***	0.23**	0.04	0.2**
	(3.21)	(2.3)	(0.45)	(2.24)
Unemployment rate	0.00	-0.02	-0.01	-0.03
	(0.11)	(-0.98)	(-0.4)	(-1.15)
Share price index growth	-0.03***	-0.01	-0.01	0.01
	(-3.34)	(-0.64)	(-0.62)	(0.7)
Real effective exchange rate	0.00	0.01	0.01*	0.01**
	(-0.17)	(0.31)	(1.71)	(2.53)
Money growth	-0.03**	-0.05***	0.01	-0.01
	(-2.44)	(-3.4)	(0.48)	(-0.61)
Real domestic credit growth	0.04***	0.05***	0.02	0.02*
	(3.61)	(3.6)	(1.23)	(1.68)
Trade openness	0.29	0.04**	0.13	0.03
	(0.69)	(2.59)	(0.28)	(1.58)
Current account / GDP	-0.02	0.00	-0.09*	0.00
	(-0.46)	(-1.63)	(-1.96)	(-0.61)
Capital account / GDP	0.28	0.00	-0.74	0.00
	(0.84)	(-0.42)	(-0.85)	(-0.51)
Financial account / GDP	0.07**	0.00**	-0.11*	0.00***
	(2.3)	(-2.08)	(-1.92)	(-2.88)
Budget deficit / GDP	0.02**	0.00	0.02	0.00
	(2.54)	(0.16)	(1.38)	(-0.13)
Trade linkages	0.11**	0.14**	0.12**	0.14*
	(2.43)	(2.47)	(2.28)	(1.88)
Financial linkages	-0.02	-0.02	0.00	0.00
	(-0.93)	(-0.88)	(-0.1)	(-0.13)
Macroeconomic similarities	0.05	0.06	0.01	-0.03
	(1.03)	(1.00)	(0.11)	(-0.38)
Log likelihood	-184.78	-136.55	-185.68	-132.83

The values in parentheses below estimates are the corresponding z-statistics.
***, (**), [*] imply estimates are significant at 1, (5), and [10] percent.

Table 4. Cox proportional hazard estimation (monthly-type spells) under LYS de facto classifications

Variable	*Contemporaneous*		*Lagged*	
	Model (I)	*Model (II)*	*Model (III)*	*Model (IV)*
Intermediate is the base				
Fix	1.45**	0.89	1.15	1.82**
	(2.19)	(1.16)	(1.64)	(2.3)
Float	1.03*	0.83	1.3**	1.39*
	(1.66)	(1.1)	(1.97)	(1.72)
Unemployment volatility	0.07**	0.03	0.06**	0.09**
	(2.51)	(1.44)	(2.27)	(2.52)
Previous crises				-0.04
				(-0.21)
Size of economy	1.44**		0.92*	1.34**
	(2.47)		(1.71)	(2.4)
Whole period GDP growth		0.01	-0.00	-0.01
		(0.48)	(-0.06)	(-0.35)
GDP growth rate	-0.05	-0.15	0.04	-0.03
	(-0.44)	(-1.41)	(0.32)	(-0.31)
Inflation	0.48***	0.13	0.3**	0.44***
	(4.06)	(0.87)	(2.28)	(2.78)
Unemployment rate	0.03	0.01	0.03	0.03
	(1.17)	(0.36)	(1.05)	(0.92)
Share price index growth	-0.03**	0.00	-0.02	0.02
	(-2.65)	(0.2)	(-1.16)	(1.08)
Real effective exchange rate	0.01	0.00	0.02**	0.03***
	(1.27)	(-0.01)	(2.16)	(3.33)
Money growth	-0.03**	-0.04**	-0.04	-0.03
	(2.39)	(-2.46)	(-0.94)	(-1.17)
Real domestic credit growth	0.04***	0.05***	0.02	0.03*
	(3.41)	(3.04)	(1.01)	(2.14)
Trade openness	0.3	0.07***	0.36	0.04
	(0.58)	(3.3)	(0.61)	(1.09)
Current account / GDP	0.01	0.00	-0.1*	0.00
	(0.13)	(-1.41)	(-1.66)	(-0.73)
Capital account / GDP	0.12	0.00	-1.82	0.00
	(0.38)	(0.26)	(-1.22)	(-0.86)
Financial account / GDP	0.06*	0.00*	-0.12**	0.00**
	(1.7)	(-1.79)	(-2.04)	(-2.46)
Budget deficit / GDP	0.02**	0.00	0.01	0.00
	(2.37)	(0.05)	(0.89)	(-1.45)
Trade linkages	0.12**	0.14**	0.18**	0.21***
	(2.32)	(2.07)	(2.18)	(3.4)
Financial linkages	-0.01	0.01	0.01	0.01
	(-0.25)	(0.48)	(0.59)	(0.5)
Macroeconomic similarities	0.05	0.08	-0.06	-0.08
	(1.16)	(1.18)	(-0.76)	(-1.6)
Log likelihood	-118.28	-91.9	-124.01	-95.29

The values in parentheses below estimates are the corresponding z-statistics.
***, (**), [*] imply estimates are significant at 1, (5), and [10] percent.

Table 5. Cox proportional hazard estimation (quarterly-type spells) under RR de facto classifications

Variable	*Contemporaneous*		*Lagged*	
	Model (I)	*Model (II)*	*Model (III)*	*Model (IV)*
Fix is the base				
Intermediate	1.2*	1.95*	1.45*	0.43
	(1.7)	(1.95)	(1.75)	(0.47)
Float	1.27	1.99*	1.51	0.17
	(1.52)	(1.87)	(1.5)	(0.16)
Unemployment volatility	0.01	0.00	0.00	0.02
	(0.26)	(-0.18)	(0.04)	(0.64)
Previous crises				-0.4
				(-1.21)
Size of economy	0.39		0.44	0.36
	(1.1)		(1.11)	(0.83)
Whole period GDP growth		0.00	0.00	0.01
		(0.33)	(-0.02)	(0.49)
GDP growth rate	-0.04	0.02	0.07	0.06
	(-0.41)	(0.2)	(0.81)	(0.6)
Inflation	0.2**	0.16*	0.1	0.21*
	(2.04)	(1.85)	(1.15)	(1.66)
Unemployment rate	0.01	0.1	0.03	0.04
	(0.39)	(0.49)	(1.23)	(1.45)
Share price index growth	-0.01	0.00	-0.02*	0.00
	(-1.62)	(-0.34)	(-1.68)	(-0.51)
Real effective exchange rate	0.00	-0.01	0.01	0.01*
	(-0.41)	(-0.24)	(1.44)	(1.74)
Money growth	-0.02	-0.04***	-0.01	0.00
	(-1.43)	(-2.61)	(-0.45)	(-0.02)
Real domestic credit growth	0.03*	0.01	0.04	0.04
	(1.92)	(0.02)	(1.54)	(1.35)
Trade openness	0.01	0.02	0.18	0.04*
	(0.31)	(0.83)	(0.4)	(1.9)
Current account / GDP	0.02	0.00	0.02	0.00
	(0.72)	(0.43)	(0.36)	(0.05)
Capital account / GDP	0.19	0.00	-2.28**	0.00
	(0.39)	(0.8)	(-2.19)	(0.8)
Financial account / GDP	-0.01	0.00	-0.02	-0.02
	(-0.39)	(0.24)	(-0.32)	(-0.71)
Budget deficit / GDP	0.01	0.00	0.00	0.00
	(1.19)	(0.73)	(0.45)	(0.49)
Trade linkages	0.1	0.15	0.13	0.22
	(0.84)	(1.55)	(1.25)	(1.35)
Financial linkages	0.00	0.00	0.00	0.00
	(-1.41)	(-0.95)	(-1.46)	(-0.84)
Macroeconomic similarities	0.05	-0.15	0.05	-0.09
	(0.43)	(-0.16)	(0.43)	(-0.56)
Log likelihood	-124.79	-106.2	-114.47	-95.74

The values in parentheses below estimates are the corresponding z-statistics.
***, (**), [*] imply estimates are significant at 1, (5), and [10] percent.

Table 6. Cox proportional hazard estimation (quarterly-type spells) under LYS de facto classifications

Variable	*Contemporaneous*		*Lagged*	
	Model (I)	*Model (II)*	*Model (III)*	*Model (IV)*
Intermediate is the base				
Fix	3.14***	2.57***	-2.89**	3.53***
	(3.17)	(3.21)	(-2.09)	(-3.56)
Float	2.8***	2.8***	3.33**	2.74***
	(2.94)	(3.82)	(2.48)	(3.34)
Unemployment volatility	0.04	0.01	0.03	0.02
	(1.46)	(0.41)	(0.9)	(0.83)
Previous crises				-0.76**
				(-2.18)
Size of economy	0.74*		0.76	0.68
	(1.68)		(1.15)	(1.5)
Whole period GDP growth		-0.01	-0.04	-0.02
		(-0.63)	(-1.61)	(-0.96)
GDP growth rate	0.04	0.05	0.08	0.17*
	(0.36)	(0.48)	(0.65)	(1.95)
Inflation	0.49***	0.3***	0.42**	0.27**
	(4.05)	(2.8)	(2.7)	(2.06)
Unemployment rate	0.04	0.03	0.12***	0.6**
	(1.44)	(1.07)	(3.067)	(2.27)
Share price index growth	-0.01	0.01	-0.02**	-0.02
	(-1.26)	(0.44)	(-2.09)	(-1.39)
Real effective exchange rate	0.02	0.01	0.02**	0.02**
	(1.47)	(0.98)	(2.27)	(2.23)
Money growth	-0.05*	-0.05***	-0.01	-0.02
	(-1.79)	(-2.9)	(-0.25)	(-0.9)
Real domestic credit growth	-0.01	0.00	0.06**	0.05*
	(-0.19)	(-0.03)	(2.04)	(1.85)
Trade openness	0.03*	0.02	1.11	0.03
	(1.79)	(0.81)	(1.15)	(1.14)
Current account / GDP	-0.01	0.00	-0.02	0.00
	(-0.15)	(1.02)	(-0.24)	(-0.36)
Capital account / GDP	0.16	0.00	-3.06**	0.00
	(0.51)	(1.02)	(-2.27)	(0.55)
Financial account / GDP	-0.01	0.00	-0.03	0.00
	(-0.56)	(0.38)	(-0.46)	(0.95)
Budget deficit / GDP	0.01	0.00	0.00	0.00
	(0.81)	(0.86)	(0.81)	(-0.98)
Trade linkages	0.19	0.35***	0.19	0.09
	(1.02)	(2.9)	(1.33)	(0.84)
Financial linkages	0.00	0.00	0.00	0.00
	(-0.6)	(0.01)	(-1.07)	(-0.76)
Macroeconomic similarities	-0.02	-0.12	0.08	0.11
	(-0.13)	(-1.08)	(0.62)	(1.02)
Log likelihood	-76.1	-75.9	-67.35	-66.49

The values in parentheses below estimates are the corresponding z-statistics.
***, (**), [*] imply estimates are significant at 1, (5), and [10] percent.

intermediate exchange rate regimes will experience the least number of currency crisis incidences, if the exchange rate regimes are determined with the help of the LYS classification. The Akaike Information Criterion (AIC) indicates a better fitness of data for all LYS-based models compared to RR-based models. However, determining the outcome of which *de facto* system is more appropriate, definitely, requires a methodology that is more comprehensive and, ideally, looks to determine how close these systems are to the "true" regimes.

We run several robustness tests to verify whether our adopted methodology is appropriate and the obtained results are consistent. In the first step, we run four different models on each of monthly and quarterly-type spells. The observed consistency of the results is a sign of the stability of the models and the reliability of their results. Then, we run Schoenfeld residual test to check whether the hazards are truly proportional and, hence, if applying Cox models is appropriate. The test results (not reported) show that almost in all monthly and quarterly-type models (both RR-based and LYS-based) all covariates are proportional and, thus, confirm that it is appropriate to apply the Cox models to be applied to our sample. We also checked the sensitivity of our results with respect to the tied spells and ran our models with two alternative methods: the Efron and marginal calculations. The obtained results (not reported) from both methods are similar and do not indicate any significant issue related to the tied spells. Finally, we examined our results for the existence of unobservable heterogeneity. The test results did not show any unobservable heterogeneity between the countries in our sample.

5.2. Capital mobility and currency crises

We start our investigation by examining the types of capital accounts, which are categorized with the help of the Chinn-Ito index, and figuring how the restricted and open-type of capital accounts have been distributed across our sample. As Table 7 presents, open and restricted-type of capital accounts have almost an equal share in our sample. However, the unconditional probability of currency crisis episodes with different types of capital accounts shows that more incidences of speculative attack have taken place during the periods of time that are categorized as restricted-type of capital accounts. We also run log rank test and Chi-square independence test (not reported) and verify that observed differences between the calculated probabilities of currency crises for different types of capital accounts are statistically significant. Table 7 reports the results.

Figure 2 visualizes the hazards of currency crises for different types of capital accounts. The presented diagrams confirm the observed pattern in Table 7 for both monthly and quarterly-type spells. We also run the Cox proportional hazard models (the restricted-type model being chosen as the base) without any control variables. The results (reported in Table 7) are in line with our previous findings and indicate that

Table 7. Distribution of Capital Account Type and incidences of currency crisis

	Chinn-Ito index		*monthly-type spells*		*quarterly-type spells*	
	quarters	*share* (%)	*probability*	*stcox*	*probability*	*stcox*
Restricted	1116	48.69	0.12		0.08	
Open	1176	51.31	0.08	-0.32**	0.06	-0.28*
				(-2.34)		(-1.73)
Log-rank test[a]			6.42		3	
P-value			0.01		0.08	

[a] *The null hypothesis of log-rank test is whether the hazard functions are equal across different groups.*
For the Cox proportional hazard estimations, the restricted-type is the base.
The values in parentheses below estimates are the corresponding z-statistics.
***, (**), [*] imply estimates are significant at 1, (5), and [10] percent.

the baseline hazards of open-type capital accounts are lower than the baseline hazards of restricted-type. However, when we apply the Cox proportional hazard models with our set of control variables, strikingly, the obtained results will be different from what we found in Table 7 and Figure 2. According to the results presented in Tables 8 and 9, the hazards of open-type capital accounts are higher than the hazards of restricted-type capital accounts, although this relation is statistically significant only in the monthly-type spells (models 1, 2, and 3). Similar to our previous estimation results, some control variables such as inflation, trade linkages, unemployment volatility, and financial account ratio to GDP, are repeatedly significant and have the expected sign.

The impact of capital account policies on the occurrence of currency crises demonstrates different results in our sample. While baseline hazard of open-type capital accounts are lower than the baseline hazard of

Figure 2. Monthly and quarterly-type smoothed hazards under different exchange rate regimes

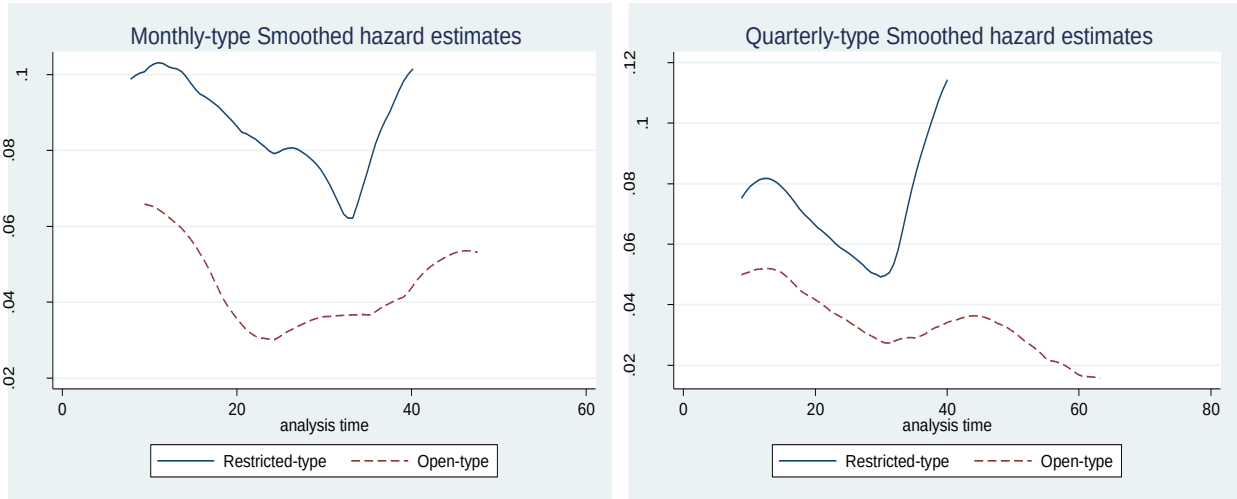


Table 8. Cox proportional hazard estimation (monthly-type spells) under capital mobility

Variable	*Contemporaneous*		*Lagged*	
	Model (I)	*Model (II)*	*Model (III)*	*Model (IV)*
Restricted-type is the base				
Open-type	0.87*	0.89*	0.77**	0.46
	(1.67)	(1.82)	(1.9)	(1.02)
Unemployment volatility	0.04**	0.04**	0.05***	0.07***
	(1.65)	(2.33)	(2.79)	(2.88)
Previous crises				0.19
				(1.08)
Size of economy	0.72**		0.59*	0.9**
	(1.97)		(1.77)	(2.29)
Whole period GDP growth	0.02	0.03***	0.02*	0.02
	(1.15)	(2.66)	(1.76)	(1.47)
GDP growth rate	0.03	-0.04	-0.04	-0.09
	(0.4)	(-0.53)	(-0.62)	(-1.11)
Inflation	0.33***	0.4***	0.09	0.24***
	(3.9)	(3.27)	(1.25)	(2.64)
Unemployment rate	0.00	-0.01	0.01	-0.01
	(-0.38)	(-0.36)	(0.23)	(-0.44)
Share price index growth	-0.03***	-0.01	-0.01	0.001
	(-3.41)	(-0.61)	(-0.9)	(0.51)
Real effective exchange rate	0.01	0.04	0.02**	0.02***
	(0.94)	(0.94)	(2.59)	(3.38)
Money growth	-0.01	-0.05***	0.01	-0.01
	(-0.95)	(-2.89)	(0.56)	(-0.6)
Real domestic credit growth	0.03**	0.05***	0.02	0.03*
	(2.09)	(3.33)	(1.32)	(1.98)
Trade openness	-0.12	0.04**	-0.04	0.03*
	(-0.27)	(2.5)	(-0.1)	(1.65)
Current account / GDP	-0.03	0.00*	-0.1***	0.00
	(-0.62)	(-1.94)	(-3.28)	(-0.45)
Capital account / GDP	0.14	0.00	-0.72	0.00
	(0.43)	(-0.14)	(-1.37)	(-0.48)
Financial account / GDP	0.09*	0.00**	-0.12*	0.00**
	(1.79)	(-2.24)	(-1.81)	(2.46)
Budget deficit / GDP	0.01	0.00	0.01	0.00
	(1.62)	(0.2)	(0.66)	(0.24)
Trade linkages	0.12**	0.16***	0.14**	0.14*
	(2.3)	(3.05)	(2.15)	(1.84)
Financial linkages	0.01	0.00	0.01	0.01
	(-0.32)	(-0.05)	(0.19)	(0.25)
Macroeconomic similarities	0.03	0.04	0.02	-0.03
	(0.61)	(0.76)	(0.45)	(-0.45)
Log likelihood	-152.25	-136.67	-152.02	-131.22

The values in parentheses below estimates are the corresponding z-statistics.
***, (**), [*] imply estimates are significant at 1, (5), and [10] percent.

Table 9. Cox proportional hazard estimation (quarterly-type spells) under capital mobility

Variable	*Contemporaneous*		*Lagged*	
	Model (I)	*Model (II)*	*Model (III)*	*Model (IV)*
Restricted-type is the base				
Open-type	0.21	0.61	0.44	0.72
	(0.41)	(1.23)	(0.77)	(1.47)
Unemployment volatility	0.05*	0.03	0.5*	0.05
	(1.92)	(1.08)	(1.8)	(1.46)
Previous crises	-0.26		-0.5*	-0.45
	(-1.12)		(-1.9)	(-1.28)
Size of economy	0.51	0.23	0.44	0.32
	(1.38)	(0.63)	(1.15)	(0.9)
Whole period GDP growth		0.01		0.01
		(0.6)		(0.61)
GDP growth rate	0.02	0.04	0.08	0.05
	(0.17)	(0.57)	(0.95)	(0.61)
Inflation	0.23***	0.25**	0.2**	0.31**
	(2.85)	(2.32)	(2.1)	(2.44)
Unemployment rate	0.02	0.02	0.6**	0.04**
	(1.09)	(0.76)	(2.29)	(1.98)
Share price index growth	-0.01	0.00	-0.01	-0.01
	(-1.19)	(-0.34)	(-1.31)	(-0.58)
Real effective exchange rate	0.01	0.00	0.02**	0.01***
	(0.81)	(0.15)	(2.32)	(3.63)
Money growth	-0.01	-0.02*	-0.02	-0.03
	(-1.02)	(-1.76)	(-0.88)	(-1.56)
Real domestic credit growth	0.03*	-0.01	0.06***	0.07***
	(1.71)	(0.34)	(2.81)	(3.84)
Trade openness	0.24	0.02	0.3	0.04*
	(0.66)	(1.25)	(0.06)	(1.93)
Current account / GDP	0.00	0.00	0.02	0.00
	(0.1)	(0.07)	(0.28)	(0.18)
Capital account / GDP	0.08	0.00	-2.21**	0.00
	(0.21)	(1.2)	(-2.05)	(0.97)
Financial account / GDP	-0.01	0.00	0.00	0.00
	(-0.27)	(0.45)	(-0.05)	(0.27)
Budget deficit / GDP	0.01	0.00	0.01	0.00
	(0.96)	(0.4)	(0.74)	(1.02)
Trade linkages	0.13	0.19**	0.17*	0.19*
	(1.11)	(2.24)	(1.73)	(1.71)
Financial linkages	0.00	0.00	0.00	0.00
	(-0.78)	(-0.17)	(-1.59)	(-1.37)
Macroeconomic similarities	0.03	-0.06	0.05	-0.07
	(0.25)	(-0.55)	(0.47)	(-0.61)
Log likelihood	-132.42	-112.35	-117.76	-98.29

The values in parentheses below estimates are the corresponding z-statistics.
***, (**), [*] imply estimates are significant at 1, (5), and [10] percent.

restricted-type capital accounts, when we enter the set of control variables to our models, the hazard of open-type capital accounts appear to be higher than the hazard of restricted-type capital accounts. This relation is often statistically significant when the episodes of currency crises are identified with higher frequency – monthly – data. It can be taken as a sign that capital control policies could help in preventing low duration crises. The obtained results are robust to a variety of samples and models. We ran different models and received consistent results for both monthly and quarterly-type models. The results of Schoenfeld residual test (reported in Appendix A) show that a few covariates in some models do not individually pass the proportionality test; however, all models jointly pass the proportionality test. We also did sensitivity checks for the tied spells and found no significant differences between the results of the Efron and the marginal calculations. Finally, we tested our results for the existence of unobservable heterogeneity. The test results did not show any unobservable heterogeneity at the country level in our sample.

5.3. Exchange rate regimes, capital mobility, and currency crises

As the last step in our study, we examine how the hazard of speculative attack may change under different combinations of exchange rate regimes and capital account liberalization policies. We combine the exchange rate classifications with the capital control policies to construct two series of different categorical variables. The first series of categorical variables is based on RR and the second series is based on LYS classifications.

In the first series, the categorical variables are constructed as: (1) Regime 1 (fixed with capital controls), (2) Regime 2 (fixed with no capital controls), (3) Regime 3 (intermediate with capital controls), (4) Regime 4 (intermediate with no capital controls), and, (5) Regime 5 (float with capital no controls).[19] While in the second series, the categorical variables are constructed as: (1) Regime 1 (intermediate with capital controls), (2) Regime 2 (intermediate with no capital controls), (3) Regime 3 (fixed with capital controls), (4) Regime 4 (fixed with no capital controls), (5) Regime 5 (float with capital controls), and, (6) Regime 6 (float with no capital controls).

Tables 10 through 12 report the estimation results of the Cox proportional hazard models. According to the presented results in Tables 10 and 12 for the monthly and quarterly-type spells of the first and second series, the hazard of Regime 1is lower than the hazard of Regime 3 and this relation is often statistically significant. Regime 1 has also often a lower hazard compared to Regimes 4 and 5; however, these

19. Since the total observations for the "float with capital controls" combination in the first series are less than one percent of the sample, this combination is dropped from our categorical variables in the first series.

Table 10. Cox proportional hazard (monthly-type spells) under RR classification & capital policies

Variable	*Contemporaneous*		*Lagged*	
	Model (I)	*Model (II)*	*Model (III)*	*Model (IV)*
Regime 1 is the base				
Regime 2	omitted	omitted	omitted	omitted
Regime 3	1.58*	1.47*	1.33*	1.27
	(1.86)	(1.77)	(1.78)	(1.57)
Regime 4	0.49	0.00	-0.10	0.64
	(0.51)	(0.01)	(-0.11)	(0.66)
Regime 5	1.54	1.74*	-0.03	0.86
	(1.47)	(1.79)	(-0.04)	(1.1)
Unemployment volatility	0.04	0.05**	0.06**	0.07**
	(1.49)	(2.33)	(2.26)	(2.46)
Previous crises				0.41*
				(1.7)
Size of economy	0.98**		0.90**	1.12**
	(2.47)		(2.18)	(2.45)
Whole period GDP growth		0.03***	0.03**	0.02
		(2.67)	(2.34)	(1.39)
GDP growth rate	-0.02	-0.03	-0.07	-0.10
	(-0.28)	(-0.4)	(-0.97)	(-1.1)
Inflation	0.38***	0.43***	0.04	0.21*
	(3.67)	(3.15)	(0.43)	(1.88)
Unemployment rate	0.02	-0.02	0.00	-0.02
	(0.91)	(-0.8)	(-0.15)	(-0.7)
Share price index growth	-0.03***	0.00	-0.01	0.01
	(-3.32)	(0.01)	(-0.87)	(0.85)
Real effective exchange rate	0.00	0.02	0.02**	0.02**
	(-0.26)	(0.49)	(2.35)	(2.42)
Money growth	-0.04	-0.11***	0.02	-0.01
	(-1.53)	(-3.18)	(0.63)	(-0.4)
Real domestic credit growth	0.06**	0.09***	0.02	0.03
	(2.01)	(3.28)	(0.9)	(1.21)
Trade openness	0.06	0.04**	-0.66	0.03*
	(0.13)	(2.42)	(-1.04)	(1.65)
Current account / GDP	-0.03	0.00	-0.12**	0.00
	(-0.56)	(-1.19)	(-2.23)	(-0.27)
Capital account / GDP	0.36	0.00	-1.08	0.00
	(1.08)	(-0.64)	(-0.99)	(-0.49)
Financial account / GDP	0.07*	0.00*	-0.11	0.00**
	(1.84)	(-1.79)	(-1.54)	(-2.16)
Budget deficit / GDP	0.02**	0.00	0.01	0.00
	(2.32)	(0.34)	(0.83)	(-0.05)
Trade linkages	0.14**	0.18**	0.14**	0.16
	(2.32)	(2.54)	(2.14)	(0.27)
Log likelihood	-112.01	-86.06	-116.06	-90.83

The values in parentheses below estimates are the corresponding z-statistics.
***, (**), [*] imply estimates are significant at 1, (5), and [10] percent.

Table 11. Cox proportional hazard (monthly-type spells) under LYS classification & capital policies

Variable	*Contemporaneous*		*Lagged*	
	Model (I)	*Model (II)*	*Model (III)*	*Model (IV)*
Regime 1 is the base				
Regime 2	-1.08	-0.98	-0.86	-1.16
	(-0.76)	(-0.57)	(-0.5)	(-0.69)
Regime 3	1.44*	0.5	1.35	1.38
	(1.67)	(0.45)	(1.39)	(1.21)
Regime 4	omitted	omitted	omitted	omitted
Regime 5	0.94	0.62	1.43	0.87
	(1.14)	(0.578)	(1.53)	(0.79)
Regime 6	-0.49	-0.77	0.79	0.7
	(-0.42)	(-.53)	(0.59)	(0.52)
Unemployment volatility	0.06**	0.03	0.06**	0.08**
	(1.98)	(1.36)	(1.97)	(2.31)
Previous crises				0.04
				(0.16)
Size of economy	1.35**		1.04	1.3**
	(2.07)		(1.59)	(2.09)
Whole period GDP growth		0.00	-0.01	-0.01
		(0.19)	(-0.39)	(-0.53)
GDP growth rate	-0.08	-0.15	0.07	-0.08
	(-0.64)	(-1.27)	(0.52)	(-0.64)
Inflation	0.54***	0.16	0.28**	0.48***
	(3.99)	(0.74)	(2.05)	(2.72)
Unemployment rate	0.04*	0.02	0.04	0.03
	(1.68)	(0.54)	(1.32)	(0.84)
Share price index growth	-0.03**	0.00	-0.01	0.02
	(-2.39)	(0.1)	(-0.96)	(1.3)
Real effective exchange rate	0.1	0.00	0.03***	0.03***
	(1.34)	(0.05)	(2.6)	(2.88)
Money growth	-0.03**	-0.09**	-0.04	-0.04
	(-2.03)	(-2.53)	(-0.99)	(-1.05)
Real domestic credit growth	0.04***	0.09***	0.3	0.04
	(3.34)	(3.1)	(1.00)	(1.38)
Trade openness	0.26	0.11***	0.22	0.04
	(0.47)	(3.18)	(0.32)	(1.31)
Current account / GDP	-0.02	0.00	-0.19**	0.00
	(-0.33)	(-0.78)	(-2.05)	(-0.15)
Capital account / GDP	0.11	0.00	-3.55*	0.00
	(0.34)	(0.21)	(-1.73)	(-0.75)
Financial account / GDP	0.05	0.00*	-0.16**	0.00*
	(1.42)	(-1.94)	(-2.3)	(-1.7)
Trade linkages	0.12**	0.18**	0.24*	0.19**
	(2.21)	(2.17)	(1.84)	(2.13)
Log likelihood	-114.94	-55.49	-76.26	-63.74

The values in parentheses below estimates are the corresponding z-statistics.
***, (**), [*] imply estimates are significant at 1, (5), and [10] percent.

Table 12. Cox proportional hazard (quarterly-type spells) under RR classification & capital policies

Variable	*Contemporaneous*		*Lagged*	
	Model (I)	*Model (II)*	*Model (III)*	*Model (IV)*
Regime 1 is the base				
Regime 2	omitted	omitted	omitted	omitted
Regime 3	1.48*	2.16**	1.27	0.49
	(1.72)	(2.14)	(1.52)	(0.53)
Regime 4	0.61	0.85	0.48	-0.42
	(0.58)	(0.77)	(0.45)	(-0.42)
Regime 5	0.43	1.86*	1.06	0.05
	(1.35)	(1.7)	(0.99)	(0.5)
Unemployment volatility	0.03	0.01	0.03	0.05
	(1.06)	(0.4)	(1.21)	(1.58)
Previous crises				-0.45
				(-1.35)
Size of economy	0.46		0.51	0.38
	(1.13)		(1.16)	(0.81)
Whole period GDP growth		0.01	0.01	0.01
		(0.85)	(0.41)	(0.76)
GDP growth rate	-0.02	-0.03	0.04	0.03
	(-0.26)	(-0.4)	(0.43)	(0.35)
Inflation	0.22***	0.24**	0.15*	0.31**
	(2.67)	(2.57)	(1.89)	(2.34)
Unemployment rate	0.02	0.02	0.04	0.04
	(0.86)	(0.85)	(1.48)	(1.57)
Share price index growth	-0.01	0.00	-0.01	-0.01
	(-1.2)	(0.01)	(-1.3)	(-0.48)
Real effective exchange rate	0.00	-0.01	0.01*	0.01
	(0.01)	(0.85)	(1.79)	(1.64)
Money growth	-0.02	-0.04**	-0.03	-0.03
	(-1.01)	(-2.03)	(-1.04)	(-0.93)
Real domestic credit growth	0.02	0.00	0.07**	0.08**
	(1.39)	(-0.08)	(2.39)	(2.54)
Trade openness	0.26	0.02	-0.13	0.03*
	(0.59)	(1.29)	(-0.23)	(1.74)
Current account / GDP	0.00	0.00	0.02	0.00
	(0.05)	(0.07)	(0.31)	(0.29)
Capital account / GDP	0.18	0.00	-2.35**	0.00
	(0.45)	(0.55)	(-2.02)	(0.85)
Financial account / GDP	-0.01	0.00	-0.01	-0.01
	(-0.29)	(0.5)	(-0.1)	(-0.46)
Budget deficit / GDP	0.01	0.00	0.02	0.00
	(0.62)	(0.46)	(0.22)	(0.67)
Trade linkages	0.10	0.16	0.17	0.21
	(0.81)	(1.34)	(1.44)	(1.4)
Log likelihood	-102.84	-85.11	-92.31	-77.95

The values in parentheses below estimates are the corresponding z-statistics.
***, (**), [*] imply estimates are significant at 1, (5), and [10] percent.

relations are scarcely statistically significant. The relation between Regime 1 and Regime 2 is problematic and omitted. These results are in line with our previous findings for the RR-based exchange rate regimes.

Table 11 presents the results for the monthly-type spells of the second series. The results show that the hazard of Regime 1 is lower than the hazard of Regime 2 although the relation is not statistically significant. It implies that for the LYS-based models, the intermediate regimes may demonstrate lower hazard while there is less capital control. The hazard of Regime 1 is lower than the hazards of Regimes 3 and 5 although scarcely statistically significant. The hazard of Regime 1 does not show a clear relation compared to the hazard of Regime 6. In general, these results are in line with our previous findings. The relation between Regime 1 and Regime 4 is problematic and omitted. The estimation of quarterly-type spells of the second series models are often not converging and not reported.

6. Conclusion

In this paper, we investigated whether there is a link between the choice of exchange rate regimes and the occurrence of currency crises. Our adopted methodology is duration analysis and the incidences of currency crisis come from 21 countries over the period 1970-1998. With the help of Cox proportional models, we tested how the likelihood of currency crises changes under the *de jure* and *de facto* exchange rate classifications. We also examined the role of capital mobility on the sustainability of the currencies.

Our data indicates that there exists a meaningful link between the choice of exchange rate regime and the occurrence of currency crises. Nevertheless, the results are sensitive to the choice of the *de facto* exchange rate classification. While RR-based models show that fixed exchange rate arrangements are least susceptible to speculative attacks, LYS-based models point to the intermediate exchange rate regimes as the least crisis prone. Until a reliable methodology or empirical test is devised to evaluate the current *de facto* classifications, in a systematic way, it remains difficult to determine objectively which *de facto* classification is most appropriate. In the meantime, researchers can rely on the characteristics of individual countries and scrutinize the monetary system of the countries under surveillance to determine more precisely the classification of their exchange rate regimes.

The data also shows that the impact of capital account policies on the occurrence of currency crises takes different directions. While the baseline hazard of open-type capital accounts is lower than the baseline hazard of restricted-type capital accounts, when we enter our set of control variables into the models, the hazard of open-type capital accounts appears to be higher than the hazard of restricted-type capital accounts. This relation is more significant for low duration crisis episodes and can be interpreted as a sign that capital control policies could help preventing currency crises.

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Appendix: Schoenfeld residual test results for Capital Mobility models

1. Test of proportional-hazard assumption for Model 1 (monthly-type)

Time: Rank(t)

	rho	chi2	df	Prob>chi2
0b.lfinop	.	.	1	.
1.lfinop	-0.00663	0	1	0.9593
UnempgStdt~e	0.07839	0.45	1	0.5001
tgdpg	-0.01001	0.01	1	0.9352
econsize	0.14409	1.1	1	0.2943
newGDPg	0.00205	0	1	0.9848
newreer	0.1657	1.53	1	0.2163
newUnempR	0.014	0.02	1	0.8994
newCPI1	-0.02943	0.05	1	0.8262
newcShareP	-0.05446	0.17	1	0.6763
newMQMg	0.02345	0.05	1	0.831
newRDMCRg	-0.00685	0	1	0.9538
newOPs	-0.21498	1.98	1	0.1591
newCAGDP	-0.05256	0.06	1	0.8046
newCPGDP	-0.00232	0	1	0.987
newFAGDP	0.05039	0.11	1	0.7411
newBDGDP	-0.0182	0.02	1	0.9
newcompeti~n	-0.09666	0.69	1	0.4067
newfinance	-0.12236	1.48	1	0.2237
newmacsimi~P	0.09018	0.65	1	0.4211
global test		8.15	19	0.985

2. Test of proportional-hazard assumption for Model 2 (monthly-type)

Time: Rank(t)

	rho	chi2	df	Prob>chi2
0b.lfinop	.	.	1	.
1.lfinop	-0.05859	0.27	1	0.6011
UnempgStdt~e	0.00957	0.01	1	0.9314
tgdpg	0.00891	0.01	1	0.9233
newdGDPg	0.04962	0.5	1	0.4816
newdreervol	0.12546	1.25	1	0.2629
newdUnempR	-0.04184	0.12	1	0.7318
newdCPI1	0.00559	0	1	0.9485
newdcShareP	0.02742	0.11	1	0.7401
newdMQMg	0.0418	0.28	1	0.5973
newdRDMCRg	-0.01431	0.03	1	0.8641
newdOPsg	-0.00156	0	1	0.9873
newdCAGDP	-0.00536	0	1	0.9719
newdCPGDP	-0.08228	0.19	1	0.666
newdFAGDP	0.02259	0.05	1	0.8261
newdBDGDP	-0.02044	0.06	1	0.8085
newcompeti~n	0.03663	0.06	1	0.8085
newfinance	-0.14868	2.91	1	0.0879
newmacsimi~P	0.02337	0.04	1	0.8447
global test		10.65	18	0.9087

3. Test of proportional-hazard assumption for Model 3 (monthly-type)

Time: Rank(t)

	rho	chi2	df	Prob>chi2
0b.lfinop	.	.	1	.
1.lfinop	0.06161	1.05	1	0.3059
UnempgStdt~e	-0.11276	4.51	1	0.0337
tgdpg	-0.01546	0.03	1	0.8552
econsize	-0.09165	0.76	1	0.3831
newlGDPg	0.02367	0.06	1	0.8081
newlreer	0.13003	2.74	1	0.0977
newlUnempR	0.02933	0.09	1	0.7583
newlCPI1	-0.10371	0.95	1	0.3307
newlcShareP	-0.1288	2.84	1	0.0919
newlMQMg	-0.04661	0.58	1	0.4454
newlRDMCRg	0.06423	2.47	1	0.1163
newlOPs	-0.20579	3.13	1	0.0768
newlCAGDP	0.03758	0.74	1	0.3913
newlCPGDP	-0.00734	0.01	1	0.9402
newlFAGDP	-0.06897	0.8	1	0.3698
newlBDGDP	-0.0554	1.68	1	0.1949
newcompeti~n	-0.17811	6.66	1	0.0099
newfinance	-0.08823	2.44	1	0.118
newtmacsim~g	0.18251	7.06	1	0.0079
global test		14.2	19	0.7718

4. Test of proportional-hazard assumption for Model 4 (monthly-type)

Time: Rank(t)

	rho	chi2	df	Prob>chi2
0b.finop	.	.	1	.
1.finop	-0.12775	0.63	1	0.4287
UnempgStdt~e	-0.01059	0.01	1	0.9289
tgdpg	-0.06641	0.22	1	0.6355
PCris	-0.00593	0	1	0.9699
econsize	0.07831	0.32	1	0.5709
newldGDPg	0.06657	0.2	1	0.656
newldreer	0.11689	0.5	1	0.4792
newldUnempR	0.08418	0.31	1	0.5787
newldCPI1	-0.11895	0.44	1	0.5047
newldcShareP	0.03233	0.07	1	0.7861
newldMQMg	0.02466	0.03	1	0.858
newldRDMCRg	0.04577	0.2	1	0.6508
newldOPs	-0.06564	0.29	1	0.5896
newldCAGDP	-0.10531	0.38	1	0.5394
newldCPGDP	0.04185	0.05	1	0.821
newldFAGDP	0.057	0.09	1	0.7669
newldBDGDP	-0.01488	0	1	0.951
newcompeti~n	-0.10164	0.84	1	0.3582
newfinance	-0.19402	3.4	1	0.0652
newtmacsim~g	0.09867	0.81	1	0.3687
global test		9.43	20	0.9774

5. Test of proportional-hazard assumption for Model 1 (quarterly-type)

Time: Rank(t)

	rho	chi2	df	Prob>chi2
0b.lfinop	.	.	1	.
1.lfinop	-0.10148	0.6	1	0.4401
UnempgStdt~e	-0.16607	1.45	1	0.2279
econsize	0.03504	0.07	1	0.7968
PCris	0.09942	0.56	1	0.4526
newGDPg	-0.10848	0.86	1	0.355
newreer	0.06815	0.22	1	0.6424
newUnempR	-0.05109	0.19	1	0.6622
newCPI1	-0.09154	0.61	1	0.4356
newcSharep	0.05064	0.12	1	0.7273
newMQMg	0.01251	0.01	1	0.9184
newRDMCRg	-0.03257	0.05	1	0.8231
newOPs	-0.06036	0.15	1	0.7002
newCAGDP	0.1138	0.16	1	0.6937
newCPGDP	-0.06437	0.31	1	0.5798
newFAGDP	-0.02114	0.01	1	0.9292
newBDGDP	-0.07772	0.28	1	0.5988
newcompeti~n	-0.04177	0.12	1	0.7332
newfinance	-0.03494	0.09	1	0.7677
newtmacsim~g	0.02876	0.05	1	0.8195
global test		7.56	19	0.9906

6. Test of proportional-hazard assumption for Model 2 (quarterly-type)

Time: Rank(t)

	rho	chi2	df	Prob>chi2
0b.lfinop	.	.	1	.
1.lfinop	-0.04808	0.2	1	0.6551
UnempgStdt~e	-0.19967	2.6	1	0.1066
tgdpg	0.04942	0.39	1	0.5331
econsize	-0.08683	0.53	1	0.4649
newdGDPg	-0.06373	0.57	1	0.45
newdreer	0.16446	2.46	1	0.1165
newdUnempR	0.0168	0.05	1	0.83
newCPI1	-0.02341	0.18	1	0.6753
newdcShareP	0.00635	0	1	0.9617
newdMQMg	0.0767	0.41	1	0.5228
newdRDMCRg	-0.09718	0.87	1	0.3522
newdOPsg	-0.02585	0.07	1	0.788
newCAGDPg	-0.11329	2.42	1	0.1196
newCPGDPg	-0.13149	0.51	1	0.474
newFAGDPg	-0.06994	0.76	1	0.3821
newBDGDPg	0.09508	0.39	1	0.5336
newcompeti~n	-0.16364	4.04	1	0.0443
newfinance	-0.10802	2.74	1	0.0977
newtmacsim~g	0.15968	3.31	1	0.0687
global test		19.8	19	0.4067

7. Test of proportional-hazard assumption for Model 3 (quarterly-type)

Time: Rank(t)

	rho	chi2	df	Prob>chi2
0b.lfinop	.	.	1	.
1.lfinop	-0.08482	0.34	1	0.5577
UnempgStdt~e	-0.18905	1.8	1	0.18
PCris	-0.02733	0.04	1	0.8323
econsize	0.02727	0.03	1	0.8574
newlGDPg	0.12993	0.95	1	0.3286
newlreer	0.03209	0.05	1	0.8153
newlUnempR	-0.0192	0.02	1	0.8988
newlCPI1	0.10181	0.45	1	0.5028
newlcShareP	-0.03724	0.07	1	0.7874
newlMQMg	0.01769	0.02	1	0.8998
newlRDMCRg	-0.00493	0	1	0.9762
newlOPs	0.00214	0	1	0.9892
newlCAGDP	0.09937	0.25	1	0.6157
newlCPGDP	0.13228	0.53	1	0.4648
newlFAGDP	-0.03229	0.07	1	0.7984
newlBDGDP	0.03348	0.04	1	0.8438
newcompeti~n	-0.05931	0.16	1	0.6924
newfinance	-0.02355	0.03	1	0.8743
newtmacsim~g	0.1006	0.4	1	0.5257
global test		9.75	19	0.9589

8. Test of proportional-hazard assumption for Model 4 (quarterly-type)

Time: Rank(t)

	rho	chi2	df	Prob>chi2
0b.lfinop	.	.	1	.
1.lfinop	0.00828	0	1	0.9495
UnempgStdt~e	-0.12568	0.61	1	0.4346
tgdpg	0.07189	0.53	1	0.4685
PCris	0.04561	0.15	1	0.701
econsize	0.13618	1.22	1	0.2697
newldGDPg	0.16044	2.56	1	0.1094
newldreer	-0.05449	0.37	1	0.5438
newldUnempR	-0.09925	1.25	1	0.2638
newldCPI1	0.13574	0.96	1	0.3282
newldcShareP	-0.12434	1.46	1	0.2269
newldMQMg	0.08314	0.3	1	0.5853
newldRDMCRg	0.01289	0.02	1	0.8927
newldOPs	-0.06854	0.65	1	0.421
newldCAGDP	-0.01401	0.02	1	0.8824
newldCPGDP	-0.02698	0.12	1	0.7275
newFAGDP	-0.01647	0.05	1	0.8299
newldBDGDP	0.16969	1.3	1	0.2537
newcompeti~n	0.08466	0.58	1	0.446
newfinance	-0.04696	0.24	1	0.6236
newtmacsim~1	-0.07016	0.34	1	0.5582
global test		15.57	20	0.743