The Duration of Intermediate Exchange Rate Regimes and Capital Controls*

Raul Razo-Garcia†
Department of Economics
Carleton University

October 2011

Abstract

We perform a survival analysis of the policy composed of an intermediate exchange rate regime and a closed financial account. The analysis is novel because we deal with the potential endogeneity between the two policies by analyzing the duration of the policy mix, estimate a multiple destinations model and control for unobserved heterogeneity. Financial development, inflation, per capita income, reserves, size, trade openness, election cycles, and the global acceptance of intermediate regimes and capital controls affect the duration of the policy mix. The evidence shows that a single destination model hides interesting factors affecting the duration of the regime.

KEY WORDS: Survival analysis; Multiple destinations; Semiparametric; Log-logistic; International monetary system; Financial account.

Journal of Economic Literature Classification Number: F33

*I thank Barry Eichengreen, Lynda Khalaf, Hashmat Khan, Huntley Schaller, Marcel Voia, and the participants of the seminar in international trade and finance at U.C. Berkeley for helpful comments and suggestions on previous versions of the paper. I also thank Hiro Ito, Menzie Chinn, and Carmen Reinhart for making their data available on their websites, and Nancy Brune for providing me her data. All errors, however, are my own.

†Address: 1125 Colonel By Drive Loeb Building C870, Ottawa, Ontario, Canada, K1S 5B6. Email address: raul_razo-garcia@carleton.ca.

1 INTRODUCTION

In July 1944 delegates from 44 nations gathered in Bretton Woods, New Hampshire, and signed the Bretton Woods agreement. This new monetary order, designed to promote price stability and full employment, was characterized by fixed-but-adjustable exchange rates (hereafter, ERs) and capital controls. Beyond providing monetary independence and currency stability, capital controls allowed countries to manage occasional adjustments of the currency pegs. The reconstruction of the world economy and the increasing sophistication in international financial markets, however, eroded the effectiveness of the capital restrictions. As a consequence, orderly adjustments of the pegs were more difficult to carry out and the shift to more flexible rates was inevitable. After almost thirty years from its establishment the Bretton Woods system collapsed and this, in turn, opened the way to an era of more flexible ERs and the resumption of a world with more liberal financial account (hereafter, FA) policies (See Obstfeld and Taylor, 2005).

Now the post-Bretton Woods system is nearing its 40^{th} anniversary and is possible to verify whether most of the countries have moved toward more flexible ERs and more open FAs. On the one hand, today's return to a world of globalized capital has been gradual and marked by great asymmetries across advanced and developing countries. While the former have moved virtually all the way to fully open FAs, for the latter, capital controls are still a pervasive policy. On the other hand, since the abandonment of the Bretton Woods System in 1973 far-reaching changes in the spectrum of exchange rate regimes (hereafter, ERRs) have been observed. During this period, Europe moved from the European Monetary System to the euro, Argentina's attempt to maintain a Currency Board failed, China adopted a dollar peg and then moved to a basket, band and crawl in July 2005. In addition, during the post-Bretton Woods era, emerging markets lived a series of crises that pushed some of them to implement arrangements of greater ER flexibility and others to rethink the pace of FA liberalization. The interpretation of these developments is not an easy task:

some economists conclude that recent trends in ERRs are confirmation of the “bipolar view” that intermediate ER arrangements are disappearing, while members of the “fear of floating thought”, initiated by Calvo and Reinhart (2002), conclude precisely the opposite.

Motivated by the wide array of ER and FA policies implemented during the post-Bretton Woods era, many economists have spent a great deal of time trying to shed light on the factors driving the choice of ERR and capital controls.[1] Although the empirical literatures on these two topics are vast, to date, one related issue remains for the most part unexplored; the duration of the different ERRs and capital controls. This paper tries to shed light on this issue by performing a duration analysis of the ER and FA policies. We claim that a better understanding of the duration of hard pegs, intermediate regimes, freely floating arrangements, and capital controls is important because it can help to explain why countries have historically switched their ERRs frequently but not their financial openness. It can also help to better understand the importance of the institutional framework to maintain certain types of ER arrangements, the developments of the international monetary system, the national choices of ERRs and capital controls, and recent economic phenomena such as the build up of international reserves by some emerging markets.

Our analysis also helps to answer some interesting policy questions: How macroeconomic performance (e.g. inflation) affects the stability of the ER arrangement and level of financial openness? Is there any interdependence between the institutional framework and the duration of the ERR and capital controls? Does the stock of international reserves help countries to maintain less flexible ER arrangements? Does trade openness is associated with long lasting soft and hard pegs? Relative to the rest of the world, do emerging market economies implement capital controls and ERRs for a longer period of time?

To better understand the duration of the different ERRs and capital controls and answer these

[1] Rogoff, Husain, Mody, Brooks, and Oomes (2004) provide a review of a reasonably broad collection of studies of the choice of ERR and Dooley (1995) a survey of the literature on capital controls.

questions, we focus on the policy mix composed of an intermediate ERR and capital controls (hereafter, IECC). This decision is based on the importance of this policy mix in the last 40 years. We use simple plots to show that the most common path toward a more open FA and more flexible rate has been characterized by a strong preference in dealing with greater ER flexibility, through the adoption of an intermediate regime, before starting or accelerating the removal of capital controls. As a byproduct, the IECC policy mix has been one of the most popular regimes among policymakers since the early 1970s.

There are two challenges in our endeavor. First, we need to deal properly with the potential interdependence (endogeneity) of ER and FA policies, implied by one of the central hypothesis in international finance; the so-called trilemma of monetary policy. This hypothesis states that policymakers in open economies may choose two out of three conflicting objectives: monetary independence, ER stability, and international capital mobility.[2]

Second, in our attempt to identify the determinants of the duration of the IECC policy we need to recognize the existence of another dimension in the analysis: the presence of multiple destinations. The importance of this neglected dimension in previous analyses may be understood through an example. From February 1973 to November 1977, Japan implemented a *de facto* crawling band (an intermediate ERR). For over ten years, June 1990 to December 2000, El Salvador adopted a *de facto* peg (another type of intermediate regime). These two countries, El Salvador and Japan, moved in opposite directions in terms of ER flexibility when they abandoned their intermediate regime. In January 1, 2001, El Salvador gave up its domestic currency, the Salvadoran colon, and the U.S. dollar became legal tender (a hard peg regime). In December 1977, Japan, for its part, allowed the Yen to freely float against the U.S. dollar. Then, to answer the question of what factors affected the duration of the intermediate regimes in El Salvador and Japan, we first need to ask if

[2] See Obstfeld, Shambaugh, and Taylor (2004, 2005) and Aizenman, Chinn, and Ito (2008) for empirical evidence of the constraints of the trilemma.

the factors leading El Salvador to switch to a hard peg were the same as the factors leading Japan to exit to a floating regime. Recognizing these two dimensions in our analysis – when to move and in what direction – implies that the naive, one destination model, commonly used in this area of research, might not serve to analyze the duration of the IECC arrangement.

We overcome these challenges in two ways. First, we deal with the endogeneity of ERR and capital controls by studying the duration of the policy mix composed of ER and FA policies. Second, we estimate a multiple destinations model.[3]

Our analysis is novel in four ways. First, rather than oversimplifying the currency spectrum in fixed versus floating regimes, a common practice in the literature, we allow for three arrangements: hard pegs, intermediate, and floating regimes. Second, we allow multiple destinations. Third, we investigate the role played by unobserved factors on the duration of the policy mix. Fourth, we study the duration of the policy mix consisting of the ERR and FA openness.

The rest of the paper is structured as follows. In Section 2 we briefly describe the evolution of ERRs and capital controls. Next, in Section 3 we describe the econometric model. In Section 4 we describe the data and present the results. Conclusions are contained in Section 5.

2 CLASSIFICATION AND EVOLUTION OF EXCHANGE RATE REGIMES AND CAPITAL CONTROLS

2.1 Classifications

A key issue in the analysis of ERRs is how to classify these arrangements. The two choices are *de jure* and *de facto* classifications. While the former is generated from regimes reported by countries (i.e. official regimes), the latter is constructed on the basis of the behavior of market ERs and

[3] A traditional multiple destinations model is the medical competing risks model. A patient could die of lot of things (hearth attack, cancer, etc.). Another example would be the duration of marriage, where one risk is death of one of the spouses and the other is divorce.

other macroeconomic variables (e.g. international reserves). Since our investigation deals with the duration of the implemented policies, we utilize *de facto* classifications.[4] We use Reinhart and Rogoff's classification under the following arguments. First, when multiple ERs coexist, Reinhart and Rogoff use data from informal markets to classify the ERR under the assertion that market-determined dual or parallel markets can be better barometers of the underlying monetary policy.[5] Second, this classification is available for a longer time period.

Reinhart and Roggoff's classification is collapsed into three regimes: hard pegs, intermediate and floating. Our definition of hard pegs includes regimes with no separate legal tender, pre-announced peg or currency board, and pre-announced horizontal band that is narrower than, or equal to, plus/minus 2%. *De facto* pegs are not classified as hard pegs because there is no commitment by the monetary authorities to keep the parity irrevocable. Floating regimes includes managed floating and freely floating arrangements. Intermediate regimes include all the other regimes in Reinhart and Rogoff "natural" classification not included in our definitions of hard pegs or floating regimes (e.g. *de facto* pegs, *de facto* crawling bands, pre-announced crawling bands, moving bands, pre-announced crawling peg, pre-announced crawling band, and *de facto* crawling peg.) Reinhart and Rogoff classified countries as 'freely falling" when the 12-month inflation rate is equal to or exceeds 40% per annum, or the six months following an ER crisis where the crisis marked a movement from a peg or an intermediate regime to a floating regime. The "freely falling" observations are reclassified into hard pegs, intermediate, or freely floating regimes using the information included in their detailed chronologies (See Reinhart and Rogoff, 2004).[6]

Given the lack of *de facto* classifications for the openness of the FA, we measure financial

[4]Three *de facto* ERR classifications have been constructed recently Bubula and Ötker-Robe (2002), Levy-Yeyati and Sturzenegger (2005), and Reinhart and Rogoff (2004).

[5]Under official peg arrangements, for example, dual or parallel rates have been used as a form of back door floating.

[6]To check the robustness of the results to the ERR classification we initially used the scheme proposed by Levy-Yeyati and Sturzenegger (2005), however, we faced a problem with the durations of the regimes derived from it. About 40% of the spells obtained with this classification have a duration of 1 year. This contrast with the 10% of the spells with duration equal to 1 year using Reinhart and Rogoff classification. Since these short durations may underestimate the probability of survival we did not estimate the model using Levy-Yeyati-Sturzeneger scheme.

openness with the Chinn and Ito (2008) *de jure* index, which is constructed from data reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions on the existence of multiple exchange rates, restrictions on the current and financial accounts and requirements to surrender export proceeds. The Chinn-Ito index is the first principal component of these indicators and ranges between $[-1.795, 2.540]$. An increase in the index signals a move toward more openness in the FA. For simplicity, two FA regimes are assumed: namely, closed and open. Countries with a Chinn-Ito index greater than zero are classified as relatively open FA regimes. A value of zero corresponds to the 66^{th} percentile of the Chinn-Ito index.[7] Hence, while countries with many restrictions of capital are classified as closed (Chinn-Ito lower than 0), economies with relatively open FAs and fully open FAs are labeled as open.[8]

We use data from advanced, emerging and developing countries in the analysis. Countries included in the Emerging Market Bond Index Plus (EMBI+), the Morgan Stanley Capital International Index (MSCI), Singapore, Sri Lanka and Hong Kong SAR are defined as emerging markets.

2.2 Evolution of Exchange Rate Regimes and Financial Openness

Under the Bretton Woods system orderly adjustments of the currency pegs were approved by the IMF for economies experiencing a fundamental disequilibrium. The innovations in the international financial markets, however, worn out the effectiveness of capital controls and this, in turn, made more difficult to carry out the ER adjustments. As a consequence, in 1973 the Bretton Woods system came to an end. This breakthrough in the international financial system had serious consequences for the currency spectrum and capital controls. Now we describe some of these changes.

Figure 1 combines data on ER and FA policies. Important insights can be obtained when we

[7] Shaw and Eidelman (2011) also consider a country with a positive Chinn-Ito index to have a relatively open FA.

[8] We check the sensitivity of our results by replacing the Chinn-Ito index by Nancy Brune's *de jure* financial openness index (BFOI). The range of this index is [0,11] because it aggregates eleven components related to capital flow restrictions. Brune's index is the sum of eleven binary variables related to the capital flow. Higher numbers indicate more open FAs. For the purposes of this paper, we have updated Brune's index for 2005 and 2006. Countries with a BFOI greater than 3 are classified as open FA regimes. Results are available from the authors upon request.

perform the analysis separately for advanced countries, emerging markets and developing economies. First, there has been a tendency to lift capital restrictions. According to the Chinn-Ito index, the pace of FA liberalization has not been the same across countries, however. Starting in the late 1970s, a widespread removal of capital controls was observed among developed economies. By 1994, controls on international financial transactions were virtually absent among industrialized countries but still a common practice in the rest of the world. Second, according to Reinhart and Rogoff classification, there has been a trend toward greater ER flexibility. After the collapse of the Bretton Woods hard pegs gave way to intermediate regimes in advanced and emerging market countries but not in developing economies. In fact, it was not until the 1990s, when intermediate regimes became more accepted among developing countries. In 1999, as a consequence of the adoption of the euro by some European countries, the number of advanced countries with intermediate regimes fell sharply.

One thing that comes through clearly in Figure 1 is a discrepancy in the starting dates of the movement toward greater ER flexibility and the rise of capital mobility. After the Bretton Woods system came to an end, the IECC policy mix became the most popular arrangement among advanced and emerging countries. Contrary to this, developing countries preferred to maintain a hard peg with closed FAs. In fact, it was not until the mid 1980s when the IECC mix became more accepted among those economies. At the end of the 1980s a dominant movement toward an intermediate ERR and open FA in advanced economies took place. By the late 1990s advanced countries made significant strides to fully open FAs, and in doing so, abandoned the intermediate ERR in favor of either hard pegs or floating rates. Intermediate regimes and capital controls, however, are still prevalent among emerging markets and developing countries. The trends just described are consistent with the rejection of the "bipolar view" and with the idea that intermediate regimes are still a viable option for non-industrialized countries (e.g. Williamson, 2000).

In summary, historically countries have used their ER and FA policies to cope with domestic and international shocks. In spite of the discretionary use of these two policies, we can identify a common sequence during the post-Bretton Woods era. The first stage of this process initiated in the early 1970s, when a significant share of countries transited from hard pegs and closed FAs to intermediate regimes (Figure 1, panel A). During this initial stage there was no clear intention to lift capital controls. As a result, the IECC policy mix became one of the most popular arrangements implemented globally. The next stage is characterized by a removal of capital restrictions

3 DURATION MODEL WITH MULTIPLE DESTINATIONS

Klein and Marion (1997) provided a key early contribution on the duration of fixed ERRs by analyzing the duration of pegs in 16 Latin American countries plus Jamaica. Motivated by a belief that there exists a trade-off between the cost associated with the defense of the peg (e.g. overvaluation or undervaluation of the ER) and the costs associated with the abandonment of the parity (e.g. political cost) they estimate a logit model to study the factors affecting the likelihood of leaving a fixed ER. Including the duration of a peg as an explanatory variable, they find evidence of duration dependence, with the probability of devaluation first rising and then falling for pegs that have lasted at least 12 months. Duttagupta and Ötker (2003) extended Klein and Marion's analysis by distinguishing orderly from disorderly exits where exits could involve shifts within pegged regimes (e.g. crawling peg to a crawling band). In line with Klein and Marion, Duttagupta and Ötker's results suggest that the likelihood of exiting within pegged regimes falls with the duration of the peg.

Blomberg, Frieden, and Stein (2005) analyze the choice of ERR constrained by politics. Collapsing the spectrum of ERRs in two possible arrangements, fixed and flexible, Blomberg, Frieden, and Stein find that countries with larger manufacturing sectors experience shorter spells and provide statistical support for negative duration dependence (i.e. the longer a country has been on a currency peg the less likely it is to abandon it). In the same spirit, Setzer (2004) studies the role played by political, institutional and economic factors in the duration of fixed ERRs. He shows that political and institutional factors – such as the political color of the government in power and the degree of central bank independence – have an impact on the duration of pegs. Also, he shows that fixed ERs have a lower exit risk than floating or intermediate regimes. Finally, Wälti (2005) estimates a semiparametric proportional hazard model to identify the determinants of the probability of an exit from fixed ERs. Controlling for macroeconomic, financial and institutional variables, Wälti concludes that the exit risk depends on the elapsed duration of the peg in a non-monotonic way.

We identify three potential areas of improvement in the empirical literature on this area. First, there is, in general, an oversimplification of the currency spectrum ERRs in fixed versus floating arrangements, when data show that intermediate regimes are still a valid option in non-industrialized economies. Second, the common concern in the application of duration models to ER arrangements has been with the exit of countries from one ERR to any another arrangement – a single destination model pooling all the possible ER destinations in one state. Third, from the 'bipolar view' argument and the macroeconomic policy trilemma, we know that there exists a connection between the degree of capital mobility and the ERR. Thus, to analyze the duration of the ER arrangements, the interaction between the FA openness and the ERR must be acknowledged (Obstfeld, Shambaugh, and Taylor, 2005; Von Hagen and Zhou, 2006; Razo-Garcia, 2010, analyze this issue empirically).

To deal with these issues we use a multiple destinations model to analyze the duration of the ER and FA policies. Special emphasis is placed on the role played by macroeconomic conditions prevailing before the abandonment of the regime. To verify the robustness of the results, the model is augmented to incorporate unobserved heterogeneity. To compare the impact of the distributional assumptions imposed on the unobservable factors, we estimate the model using parametric and semiparametric methods.

3.1 The Multiple Destinations Model

The empirical model we use is a multiple destinations model. The medical competing risks model in which a patient could die of a hearth attack, cancer, or other factors is the canonical example of these models. While the implementation of this type of model is not new in the economics literature, it has become increasingly more familiar in the past few years. Bodies of research on the duration dependence of unemployment, retirement, length of hospital stay and brand loyalty, among other subjects, have made use of such models. Regarding the survival of the ER arrangements or capital controls, we are not aware of any study utilizing a multiple destinations model.

Han and Hausman (1990), Foley (1997), Addison and Portugal (2001) study unemployment duration allowing multiple destinations. While Han and Hausman allow two risks – new jobs and recalls, Foley and Addison and Portugal assume inactivity (out of the labor) and employment as the two possible destination states. In a similar spirit Butler, Anderson, and Burkhauser (1989) analyze the duration of retirement assuming two potential risks – return to work and death. In health economics, Picone, Wilson, and Chou (2003) resort to a competing risks model to identify factors influencing hospital lengths of stay and post-hospital destinations of Medicare patients.

3.2 The Empirical Model

This Section relies heavily on Lancaster (1990). Suppose that there are K possible destination states and define each of them as k, $k = 1, 2, ..., K$. These destinations must be mutually exclusive and they have to exhaust the possible destinations. For example, a country with a IECC policy mix can continue with its peg but lift capital controls, move to hard peg with or without international capital flow restrictions, or switch to a floating regime with open or closed FAs.

Let us think of time to exit as a continuous random variable, T, and consider a large number of countries entering state k at a time we shall identify as $T = 0$. In fact, for country i^{th} we must define k different continuous duration random variables T_i^k (one for each destination). Only the smallest of all these durations $T_i = \min\{T_i^k\}_{k=1}^K$ and the corresponding destination are observed. All the other durations are censored given that risk k is materialized. Estimating erroneously a single destination model under the presence of multiple risks is equivalent to assume that the random variables T_i^k are independent. Nevertheless, since the $T_i^k s$ are affected by the policymakers' behavior and unobservable characteristics this assumption looks very unrealistic and might led to incorrect inference (Van den Berg, 2005).

Define the instantaneous rate of exiting for state k per unit time period at t, known as the transition intensity for state k, as

$$\theta_k(t;\mathbf{X}) = \lim_{\Delta_t \to 0} \frac{Pr(t \leq T \leq t + \Delta_t, \mathbf{D_k}; T \geq t, \mathbf{X})}{\Delta_t} \qquad k = 1, 2, \ldots, K \tag{1}$$

where $Pr(t \leq T \leq t + \Delta_t, \mathbf{D_k}; T \geq t, \mathbf{X})$ is the conditional probability that a country with explanatory variables $\mathbf{X}$ transits from the current arrangement to state k in the short interval $(t, t + \Delta_t)$ given that the state is still occupied at t, and $\mathbf{D_k}$ is a vector containing K binary variables d_k assuming the value of one if state k is entered and zero otherwise. So $\mathbf{D}_k$ is a vector of zeros except for the k^{th} row which is equal to one. In this framework, the probability of exit from the current regime in the short interval of time of length Δt after t, conditional on the regime still being implemented at t, the hazard function, is the sum of the transition intensities over the destination states

$$\theta(t;\mathbf{X}) = \lim_{d_t \to 0} \frac{Pr(t \leq T \leq t + \Delta_t; T \geq t, \mathbf{X})}{dt} = \frac{f(t)}{1 - F(t)} = \sum_{k=1}^{K} \theta_k(t;\mathbf{X}) \tag{2}$$

where $f(\cdot)$ and $F(\cdot)$ are the probability density function and the cumulative density function of the random variable T, respectively. The last equality in (2) indicates that the total of the survivors at t who exit on the following period is the sum over k of those who leave for destination k. In other words, since the potential risks (destinations) are mutually exclusive events their densities (transition intensities) are added to obtain the conditional probability of exiting the current regime. These competing risks, however, may be correlated due to the unobserved heterogeneity present in each transition intensity.

Let $\overline{S}(t;\mathbf{X})$ denote the probability of survival to t, $Pr(T \geq t) = 1 - F(t)$. From a well known relationship between the hazard and the survivor functions we obtain that

$$\overline{S}(t;\mathbf{X}) = \exp\Big\{ -\int_0^t \theta(s;\mathbf{X})ds \Big\} = \exp\Big\{ -\Lambda(t;\mathbf{X}) \Big\} \tag{3}$$

where $\Lambda(t;\mathbf{X})$ is the integrated hazard function.

Two types of spells contribute to the likelihood function; completed and (right) censored. Right-censoring occurs when the implementation date of the regime is known but the exit date is unknown. A country observed to exit for regime k at time t_i contributes the probability of exiting for state k at time t, $Pr(t < T_i < t + \Delta_t, \mathbf{D}_{k,i}; \mathbf{X}_i)$. From equations (2) and (3) we obtain the contribution of non-censored spells to the *likelihood* function

$$Pr(t < T_i < t + \Delta_t, \mathbf{D}_{k,i}; \mathbf{X_i}) = \quad \exp\left\{ -\int_0^t \sum_{k=1}^K \theta_k(u;\mathbf{X_i})du \right\}\theta_k(t;\mathbf{X_i})dt \tag{4}$$

A spell censored at time t_i contributes the probability of being "alive" at that time (i.e. the survival function). Thus, the likelihood function is

$$L(\Gamma) = \prod_i^n \left[\prod_{k=1}^K Pr(t < T_i < t + \Delta_t, \mathbf{D}_{k,i}; \mathbf{X_i})^{d_{k,i}} \right] \exp\Big\{ -\Lambda_i(t;\mathbf{X_i}) \Big\}^{1-\sum_{k=1}^K d_{k,i}} \tag{5}$$

where Γ is a vector of parameters and $d_{k,i}$ is a binary variable equal to one when transition is for state k and equal to zero otherwise.

3.3 Baseline Function

The baseline function determines the time dependence of the conditional probability of transiting to a new regime. Anticipating a possible non-monotonic behavior of the transition intensities we use an accelerated failure time *log-logistic* model to control for the effects of covariates on the survival function and transition intensities.[9] Formally,

$$\theta_k(t;x) = \frac{\alpha_k \exp\{-\alpha_k \mathbf{x'}_k \beta_k\} t^{\alpha_k - 1}}{1 + \exp\{-\alpha_k \mathbf{x'}_k \beta_k\} t^{\alpha_k}} \tag{6}$$

where t represents the duration of the regime, $\mathbf{x}$ is a vector of explanatory variables that shift the transition intensities, β is a vector of coefficients associated with these variables, and α is a scale parameter. If $\exp\{-\mathbf{x'}_k \beta_k\}$ is greater (lower) than one, time is accelerated (decelerated). Hence, this parameterization implies a deceleration of time with the increase of a covariate –an increase in the expected waiting time for failure. We adjust the model for unobserved heterogeneity.[10] A discussion of the approaches followed to deal with unobservable factors is included in Appendix A.

4 VARIABLES AND RESULTS

4.1 Variables

The variables we use to control for observed heterogeneity are based on the literature on currency crises, optimal currency area (hereafter, OCA), and capital controls. Inflation, per capita income, trade openness, stock of international reserves (normalized by M2), financial development

[9] Relative to the proportional hazard model, the accelerated failure time model changes the time scale by a factor of $\exp\{-\mathbf{x'}_k \beta_k\}$.

[10] Heterogeneity arises when different countries have potentially different duration distributions. Not controlling for these unobserved factors implies that countries with the same level of covariates are identical. If this is not the case, the model would be misspecified.

(M2/GDP), relative size (in terms of GDP), election cycles, and the degree of acceptance of intermediate regimes and capital controls are the variables used in the analysis. We also include an emerging market dummy variable to determine whether these countries exhibit different durations, relative to the rest of the world. A list of sources of the variables is included in Appendix .1.

Let $SPILLER_t$ be the proportion of countries in period t implementing an intermediate ERR and $SPILLFA_t$ the fraction of countries with a closed FA. These two variables are included to control for network externalities that characterize international monetary arrangements. In his widely-cited study on the history of the international monetary system, Eichengreen (1996) describes this network effect as follows:

> "When most of your friends and colleagues use computers with Windows as their operating system, you may choose to do likewise to obtain technical advice and ease the exchange of data files, even if a technologically incompatible alternative exists (think Linux or Leopard) that is more reliable and easier to learn when used in isolation. These synergistic effects influence the costs and benefits of the individual's choice of technology. Similarly, the international monetary arrangement that a country prefers will be influenced by arrangements in other countries. Insofar as the decision of a country at a point in time depends on decisions made by other countries in preceding periods, the former will be influenced by history. The international monetary system will display path dependence. Thus, a chance event like Britain's "accidental" adoption of the gold standard in the eighteenth century could place the system on a trajectory where virtually the entire world had adopted that same standard within a century and a half." (Eichengreen, 1996, page 4)

Under a similar argument, Frieden, Ghezzi, and Stein (2000) and Broz (2002) control for the feasibility of the ER arrangement. Their idea, similar to Eichengreen's network externality effect, is to capture the"climate of ideas" regarding the appropriate ERR. That is, the survival and choice of an ER arrangement may be related to the degree of acceptance of that regime in the world. This being true, if most of the countries are implementing an intermediate arrangement, it would be more feasible to maintain that regime. Therefore, we expect a positive association between *SPILLER* and the duration of intermediate regimes. In our empirical model, we can observe a longer duration of intermediate regimes if there is no change from the IECC policy mix or there is a transition to a policy mix with an intermediate regime but open FA. The same logic applies to *SPILLFA*.

To the extent that a high level of reserves is seen as prerequisite for defending less flexible regimes, a negative association between the ER flexibility and the stock of international reserves is expected. The build-up in the foreign exchange reserves of emerging markets has been a significant economic development of the last 20 years. While total reserves (minus gold) of the advanced economies tripled over the years 1990 to 2009 from $1.25 trillion to $3.65 trillion, the holdings of the emerging markets rose eleventh-fold from $195 billion to $2.26 trillion. This impressive hoarding of reserves in emerging countries may have affected more their ER and FA policies, and therefore the duration of the IEEC policy mix, relative to rest of the world. To test this hypothesis, we add an interaction between the emerging market dummy variable and international reserves.

We use per capita income as a proxy of the quality of the institutional framework because, on average, a positive correlation is expected between per capita income and the development of general legal systems and institutions (See Acemoglu, Johnson, and Robinson, 2001). While institutional development is difficult to measure, there is a presumption that it is most advanced in high-income countries (Eichengreen, 2002). Acemoglu, Johnson, and Robinson (2001) and Klein (2005) found empirical evidence supporting this presumption. Regarding the ERR and its expected correlation with institutions, Hausmann, Panizza, and Stein (2001) claim that the ability to adopt a freely floating regime is closely related to the level of development. So, countries with better institutional framework are more inclined to adopt flexible arrangements. In order to move further in the FA liberalization process, countries need to develop the general legal systems and institutions. Hence, a better institutional framework increases the chances of transiting to a flexible ER or to a more open FA.

Previous findings suggest that countries may benefit by having increasingly flexible ERRs as they become more financially developed (Husain, Mody, and Rogoff, 2004). Hence, a negative association between the development of the financial system and the duration of intermediate regimes is predicted. Since financial development and innovation reduce the effectiveness of capital controls, countries with more developed financial systems should exhibit less durable capital controls. Hence, a negative effect of financial development on the duration of the IECC policy mix is expected.

OCA theory holds that high openness to trade is associated more frequently with less flexible regimes. The argument is that a higher volume of trade increases the benefits from hard and soft pegs, reducing transaction costs. Trade openness may be associated with FA liberalization in two ways. On the one hand, trade openness is commonly seen as a prerequisite to open the FA (McKinnon, 1993). On the other hand, a high level of trade openness can erode the effectiveness of capital controls (e.g. over-invoicing of imports or under-invoicing of exports). Hence, higher trade openness should be associated with a higher propensity to lift capital controls. Since high openness to trade is associated with longer durations of intermediate regimes but shorter duration of capital controls, an ambiguous relationship between trade openness and the duration of the IECC policy is predicted.

Continuing with OCA theory, smaller economies have a higher propensity to trade internationally, leading to a higher likelihood of pegging. Small countries might also benefit from risk sharing and therefore of an open FA. The gains from risk sharing may be larger for small countries because they contribute less to global output relative to large countries, making it less likely that their domestic output would be correlated with world output. Hence, more of their idiosyncratic risk can be eliminated by trading assets with residents in other parts of the world. In terms of the duration of the IECC policy mix this implies that smaller countries are expected to open their financial markets. Hence, a shorter duration is expected for those countries transiting from the IECC regime to an intermediate regime with an open FA policy.

Inflation can play two different roles regarding the ERR. On the one hand, countries can choose a less flexible regime as a commitment mechanism to assist them in maintaining credibility for low-inflation monetary policy objectives. On the other hand, defending an intermediate or a fixed ERR in high inflation countries might be a difficult and costly task. Regarding the FA, previous research suggests that governments compelled to resort to the inflation tax are more likely to utilize capital controls to broaden the tax base. Hence, a negative correlation between inflation and the openness of the FA is expected. The overall effect of inflation on the duration dependence of the IECC policy mix is, therefore, ambiguous.

Finally, election cycles may define the level of the ER (to stabilize high inflation) and this in turn is likely to affect the duration of the ER arrangement. We control for this political factor including a dummy variable, *ELECTION*, assuming the value of one in year t if an election took place in that year and zero otherwise.

With the exception of the dummy variables, *SPILLER*, and *SPILLFA*, all the other covariates are lagged by one period to mitigate potential simultaneity problems. Lagging the explanatory variables may not fully eliminate endogeneity but may be superior than leaving in the variables without modification. Another approach, which is very complicated, would be to jointly model the duration of the IECC policy mix and the covariates.

4.2 Descriptive Statistics

Our sample consists of 147 spells with an average duration of 9.3 years and standard deviation of 8.58 (see Table 1). The longest spell lasted 36 years (Colombia), while the shortest only 1 year (15 spells). A country adopting an IECC regime can move to 5 different regimes: 1) hard peg and closed FA; 2) hard peg and open FA; 3) intermediate ERR and open FA; 4) floating regime and closed FA; and 5) floating regime with open FA. The fourth choice, floating ERR and closed FA, might not make sense because countries implementing these policies are choosing only one leg of the trilemma of monetary policy (i.e. monetary independence). However, countries have switched to this policy mix in the past (e.g. Argentina in 1980, Brazil in 1998, Chile in 1999, Philippines in 1997).

Only one country moved to a floating ER and open FA (Japan in 1971). This spell was discarded. No country transited from the IECC regime to a hard peg and open FA. This implies that during the post-Bretton Woods system countries implementing the policy mixes composed of a hard-peg and open FA or a floating regime and open FA transited to those regimes from a state different from the IECC policy mix. For example, the European countries that in 1999 adopted the euro (e.g. implemented a hard peg with open FA) moved from a regime composed of an open FA and a flexible ER.

These facts leave us with three potential destinations: 1) Hard Pegs and Closed FA (hereafter, HPC), 2) Intermediate Regime and Open FA (hereafter, IO) and 3) Floating ER and Closed FA (hereafter, FC). Fifty one spells are censored to the right. Overall and destination-specific descriptive statistics for all the covariates are shown in Table 1. From these table we can verify that a single destination model may mask differences in means and standard deviations across destinations.[11]

[11]For example, countries transiting at the end of the regime to a hard peg and closed FA have, on average, the lowest level of financial development across the three destinations.

4.3 Results

Table 2 presents the coefficients and standard errors for the single and multiple destination models – assuming a log-logistic baseline function and Gamma or semiparametric unobserved heterogeneity.

Single Destination Model.

In model [1] we estimate the traditional one destination model assuming Gamma unobserved heterogeneity. In this model, factors such as high trade openness, underdeveloped financial markets, high inflation, larger economic size, and a widespread acceptance of capital controls (*SPILLFA*) are associated with shorter durations of the IECC regime (a negative coefficient increases the hazard, see equation 6). Based on this model, the emerging market dummy variable and its interaction with international reserves do not affect the duration of the IECC policy mix. Interestingly, the risk of leaving the IECC policy mix depends on the elapsed duration; first rising and then falling monotonically (see upper panel in Figure 3). Wälti (2005) finds a similar result for the duration of pegs and argues that the exit risk may fall as credibility is gradually achieved. Hence, if the decision to choose an intermediate ERR with capital controls is indeed affected by its viability (i.e. the risk of exiting) then, policymakers should implement the IEEC policy mix only if they know the country has the preconditions for the regime to survive in the first years after its implementation.

Results slightly change when a semiparametric method is used to control for unobserved heterogeneity; model [2]. Relative to model [1], the ratio of reserves to M2 becomes a significant determinant of the duration of IECC regime in model [2]. In this case, countries with a relatively high level of international reserves present shorter durations.

Multiple Destinations Model.

In model [3] we estimate the multiple destinations model controlling for unobservable variables using parametric methods. Contrasting models [1] and [3] –single and multiple destination models with Gamma heterogeneity- we found important differences in the estimated coefficients across destinations. Thus, many interesting relationships, impossible to identify with the single destination model, can be unmasked with the multiple destination model. In model [4] we reestimate model [3] to check the robustness of the results to the Gamma and independence assumptions imposed in model [3] using semiparametric techniques. Comparing models [3] and [4] we found almost no differences in the signs on the coefficients; further, in most cases, the significance levels are the same. For that reason, the rest of this Section focuses on comparing models [2] and [4].

The first striking difference between the single and multiple destination models is in the estimates of the hazard and survival functions. Comparing the hazard obtained with both models, upper panel Figure 3, we see that the single destination model overestimates (underestimates), relative to the multiple destinations model, the probability of survival (hazard) of the IEEC policy mix. For some horizons the difference is so large that the hazard obtained with the multiple destinations model is twice as big as the hazard obtained via the single destination model. Therefore, policy analysis is severely affected when a single destination model is used: policymakers using a single destination model can conclude that the IECC policy mix is more viable than it actually is.

There are several relationships between the explanatory variables and the duration of the IECC policy mix hidden in the single destination model. We emphasize three of them. First, the explanatory variables affect differently the probability of an exit to each destination. For countries liberalizing their FA (IO) all the variables, with the exception of election and relative size, affect the exit risk from the IECC regime. Things look different for countries moving to a hard peg (HPC). In this equation, inflation and financial development become insignificant, relative to the IO destination, and economic size and election turn out to be significant. While the acceptance of capital controls, trade openness, and the emerging market dummy variable and its interaction with reserves do not significantly affect the probability of exiting for the economies transiting to a flexible ER (FC), election and relative size are now significant relative to the IO destination. Second, there are five variables that present striking differences in model [4] relative to model [2]: per capita income, *SPILLER*, election, the emerging market dummy variable and its interaction with reserves. While neither of these variables are significant in the single destination model [2], they are significant in at least two destinations of model [4]. Moreover, some of these variables do not exhibit the same sign across destinations. Third, four factors that are significant in model [2], size, trade openness, reserves, and the degree of acceptance of capital controls (*SPILLFA*) change their sign and level of significance across destinations in model [4]. Next we discuss these results in more detail.

From model [4] we can draw two important conclusions related to the emerging market dummy variable and the acceptance of soft pegs (*SPILLER*). First, the general acceptance of intermediate regimes significantly affect the duration of the IECC policy mix. As expected, when the general acceptance of soft pegs rises, countries transiting to a policy mix composed of an intermediate ERR and open FA (IO) exhibit shorter durations relative to the countries moving to either a hard peg (HPC) or a flexible rate (FC). Then, intermediate regimes can be maintained for longer when *SPILLER* is high than when there is weak acceptance of soft pegs. This result may suggest that a good time to lift capital controls is when intermediate regimes are widely accepted. The reason being that when soft pegs are popular it might be easier to maintain them and therefore countries can start to liberalize their FAs. The coefficient associated with *SPILLER* is positive and significant in destinations HPC and FC. Intuitively, among the countries moving to the corners of the currency spectrum, higher acceptance of soft pegs discourage the abandonment of an intermediate regime. Second, emerging markets are different relative to the rest of the world when we talk about the duration of the IECC arrangement. On the one hand, emerging markets that shift to a hard peg and keep capital controls (HPC) or open their financial markets but keep a soft peg (IO) are less likely to abandon the intermediate regime. This is consistent with the view that intermediate regimes are still an attractive option for emerging markets. On the other hand, the interaction of the emerging market dummy variable and $Reserves/M2$ is statistically significant at the 5% level for the IO and HPC destinations. Thus, a higher stock of reserves significantly increases the exit risk in emerging countries lifting capital controls but keeping a soft peg (i.e. transition to IO) or transiting to a hard peg but retaining capital controls (HPC). This evidence implies that foreign reserves have helped emerging markets to maintain or defend less flexible regimes for a longer period of time. Hence, the removal of capital restrictions in emerging markets may be easier to carry out if they have hoarded enough reserves. Finally, this result is consistent with the findings in Aizenman, Chinn, and Ito (2008) that higher levels of foreign reserves can relax the trilemma of monetary policy.

Interestingly, our multiple destinations model indicates that international reserves can help policymakers to maintain an intermediate regime. In two of the three destinations, HPC and FC, the coefficient associated with reserves is positive and significant. Hence, a higher stock of international reserves is associated with longer durations among countries eventually adopting a hard peg or a floating rate.

The feasibility of capital controls has a significant effect in two of the three risks. In particular, when the general acceptance of capital controls is high (i.e. high *SPILLFA*), countries lifting capital controls (IO) or implement a hard peg (HPC) are at higher risk of exiting the IECC policy mix. At first glance, this result may seem counterintuitive but it is not. When the global acceptance of capital controls is high it is more likely to observe an exit among the countries keeping capital restrictions rather than opening its financial markets (IO). The latter result is derived by adding up the hazard rates of an exit to a regime with capital controls, HPC and FC, to obtain the risk of abandoning the soft peg but keeping capital controls.

While per capita income and the duration of the IECC regime exhibit no relationship in the single destination model, the magnitude, sign and significance of the coefficients associated with this variable vary across destinations in model [4]. The general legal systems and institutions, proxied by per capita income, do appear to motivate policymakers to maintain the IECC policy mix in countries transiting to a hard peg (HPC) or a floating regime (FC), significantly increasing the time they spend implementing a soft peg with capital controls. For the IO destination, a significant negative coefficient is estimated in model [4]. This negative estimate suggests that among the countries lifting capital controls (IO) the ones with better general legal systems and institutions are more likely to abandon the IECC regime. What are the policy implications of these results regarding per capita income? First, the development of general legal systems and institutions might be a precondition to liberalize the FA. Second, other things equal, economies with a preference toward intermediate regimes must develop a strong institutional framework in order to maintain them.

Models [2] and [4] show that economies with developed financial systems have longer durations relative to the countries with thinner financial systems. This implies that both a developed financial market and capital controls can help policymakers to maintain an intermediate regime for a longer period of time. Analyzing the duration across destinations we find noticeable differences. Financial development decreases more the risk of transiting either to a hard peg (HPC) or to a floating regime with a closed FA (FC) relative to the countries keeping an intermediate regime and opening their financial markets (IO). Hence, a developed financial system rises more the chances of supporting a soft peg with closed FA among the countries eventually moving to any of the two corners of the currency spectrum than among those eventually lifting up capital controls.

Although in models [1] and [4] larger economies are found to experience significantly shorter durations, the picture looks different for each destination. First, relative size does not have any significant effect on the duration of the IECC policy mix for countries liberalizing their FAs (IO). This is inconsistent with the risk sharing argument discussed in Section 4.1. Second, for countries moving to a flexible rate or to a hard peg an increase in its size (relative to the U.S.) raises their exit risk. These two results support the "bipolar view" for industrialized countries. Also, in the FC equation, the negative coefficient associated with relative size supports the claim that the ability to adopt a flexible rate is related to the level of development (Hausmann, Panizza, and Stein, 2001).

Trade openness motivates policymakers to switch to a different policy mix. This variable is negatively associated with the duration of the IECC policy mix among the economies eventually removing capital controls but keeping a soft pegs (IO) or countries adopting a hard peg (HPC). This evidence is in line with the prescriptions of the OCA theory; hard and soft pegs are associated with higher levels of trade openness.

Inflation increases the risk of eventually opening the financial markets (IO regime) or adopting a floating regime (FC). The last result may reflect the difficulties faced by countries with high inflation to maintain an intermediate regime (i.e. a switch to a floating rate) or the policies imposed as conditions to obtain international funding in times of macroeconomic stress (i.e. the liberalization of the FA).

While the exit risk associated to the HPC destination rises when elections take place, the risk of implementing a floating rate (FC destination) falls. This indicates that in electoral periods countries are more prone to implement less flexible ER arrangements (hard peg) than allowing the ER to float (FC) or removing capital restrictions (IO). This result is consistent with previous studies finding a lower probability of exiting from pegs in the run-up to elections (e.g., Frieden, Ghezzi, and Stein 2000 and Blomberg, Frieden, and Stein 2005).

In all the models reported in Table 2, the parameter α is statistically greater than one at conventional significance levels implying that the probability of an exit from the IECC regime depend on the elapsed duration (see Figure 2). This probability rises during the first five years of the spell and then decreases monotonically. Hence, the chances of abandoning an intermediate ERR and a closed FA are higher at the beginning of the regime. As mentioned above, one reason may be that the exit risk may decrease as credibility is gradually achieved. In the upper panel of Figure 2) we see that the countries at higher risk of moving to a new regime are, on average, the countries that end up with a hard peg (HPC), followed by the economies eventually removing capital restrictions (IO) and countries allowing the ER to freely float (FC).

Finally, from model [4] we can verify that the unobservable factors of the three risk are correlated (in model [3] these unobservable factors are assumed to be independent). While the correlation between the unobservable factors in risks one and two is positive, corr(ν_1,ν_2)=0.47, the two correlations associated with ν_3 are negative.

5 FINAL REMARKS

We analyze the duration of the most popular mix of ER and FA policies among policymakers in the last 40 years – a policy composed of an intermediate ERR and a closed FA. A multiple destinations model, augmented to incorporate unobserved heterogeneity, is estimated to analyze the duration of 147 spells in advanced, emerging and developing countries. Financial development, per capita income, inflation, relative size, trade openness, reserves, election cycles, general acceptance of capital controls, feasibility of intermediate ERRs, and an emerging market dummy variable are the variables with the highest explanatory power. Regarding the probability of moving to a new policy mix, the evidence shows that it depends on the elapsed duration.

The results favor the multiple destination model over the single destination version. Specifically, we find that the latter masks interesting factors affecting the duration of the policy mix and overestimates the probability of survival. Therefore, policymakers using a single destination model can erroneously conclude that soft pegs with capital controls are more viable than they really are.

The results support the argument that a high level of international reserves is seen as a prerequisite for maintaining less flexible ERRs. The effect of reserves on the duration of the IECC policy mix differs across countries. The accumulation of reserves have helped emerging markets to maintain intermediate regimes for longer time. Specifically, relative to advanced and developing countries, emerging markets with a high stock of reserves exhibit a higher risk of exiting to a hard peg with a closed FA and a higher risk of keeping an intermediate regime but removing international capital restrictions. Hence, our analysis explains part of the the significant accumulation of international reserves by emerging markets.

Some policy implications can be derived from our analysis. First, large economies currently implementing a soft peg and capital controls are at higher risk of transiting to any of the corners of the currency spectrum rather than moving to a more open FA. In 2007 China, India, and Russia were still implementing an intermediate regime and restricting capital flows (i.e. were implementing the IECC policy mix), so our results predict that as these countries catch up larger economies it will be more likely to see them adopting a more flexible ER or moving toward a hard peg than lifting capital restrictions.

Second, developing countries implementing hard pegs and willing to adopt a more flexible regime (e.g. an intermediate) with capital controls need to develop their financial markets and strength their general legal systems and institutions (e.g. prudential supervision and regulation) in order to have a more durable intermediate regime. Third, intermediate regimes and capital controls are more durable when they are widely accepted in the world. Therefore, as long as emerging markets and developing countries find attractive the intermediate regimes (i.e. keeping its popularity high) these will not tend, as predicted by the 'bipolar view', to give way to regimes at either corner of the currency spectrum.

References

Acemoglu, D., S. Johnson, and J. A. Robinson (2001): "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review*, 91(5), 1369–1401.

Addison, J. T., and P. Portugal (2001): "Unemployment Duration: Competing and Defective Risks," IZA Discussion Papers no. 350 350, Institute for the Study of Labor (IZA).

Aizenman, J., M. D. Chinn, and H. Ito (2008): "Assessing the Emerging Global Financial Architecture: Measuring the Trilemma's Configurations over Time," *National Bureau of Economic Research Working Paper Series*, No. 14533.

Blomberg, B., J. Frieden, and E. Stein (2005): "Sustaining Fixed Rates: The Political Economy of Currency Pegs in Latin America," *Journal of Applied Economics*, VIII(2), 203–225.

Broz, L. (2002): "Political Economy Transparency and Monetary Commitment Regimes," *International Organization*, 56(4), 861–887.

Bubula, A., and I. Ötker-Robe (2002): "The Evolution of Exchange Rate Regimes since 1990: Evidence from De Facto Policies," *IMF Working Paper No. 02/155.*

Butler, J. S., K. H. Anderson, and R. V. Burkhauser (1989): "Work and Health after Retirement: A Competing Risks Model with Semiparametric Unobserved Heterogeneity," *The Review of Economics and Statistics*, 71(1), 46–53.

Calvo, G., and C. Reinhart (2002): "Fear of Floating," *Quarterly Journal of Economics*, 47(2), 379–408.

Chinn, M., and H. Ito (2008): "A New Measure of Financial Openness," *Journal of Comparative Policy Analysis*, 10(3), 309–322.

Dooley, M. P. (1995): "A Survey of Academic Literature on Controls over International Capital Transactions," IMF Working Papers 95/127, International Monetary Fund.

Duttagupta, R., and I. Ötker (2003): "Exits From Pegged Regimes: An Empirical Analysis," IMF Working Papers 03/147, International Monetary Fund.

Eichengreen, B. (1996): *Globalizing Capital: A History of the International Monetary System.* Princeton: Princeton University Press.

——— (2002): "Capital Account Liberalization: What Do the Cross Country Studies Show Us?," *World Bank Economic Review*, 15, 341–366.

Foley, M. C. (1997): "Determinants of Unemployment Duration in Russia," Working papers no. 779, Economic Growth Center, Yale University.

Frieden, J., P. Ghezzi, and E. Stein (2000): "Politics and Exchange Rates: A Cross-Country Approach to Latin America," *Research Network Working Paper No. R421.*

Han, A., and J. A. Hausman (1990): "Flexible Parametric Estimation of Duration and Competing Risk Models," *Journal of Applied Econometrics*, 5(1), 1–28.

Hausmann, R., U. Panizza, and E. Stein (2001): "Why Do Countries Float The Way They Float?," *Journal of Development Economics*, 66(2), 387–414.

Heckman, J., and B. Singer (1984): "A Method for Minimizing the Impact of Distributional Assumptions in Econometric Models for Duration Data," *Econometrica*, 52(2), 271–320.

Husain, A. M., A. Mody, and K. S. Rogoff (2004): "Exchange Rate Regime Durability and Performance in Developing Countries Versus Advanced Economies," NBER Working Papers 10673, National Bureau of Economic Research, Inc.

Klein, M. (2005): "Capital Account Liberalization, Institutional Quality and Economic Growth: Theory and Evidence," *NBER Working Paper No. 11112*, p. 37.

Klein, M. W., and N. P. Marion (1997): "Explaining the duration of exchange-rate pegs," *Journal of Development Economics*, 54(2), 387–404.

Lancaster, T. (1990): *The Econometric Analysis of Transition Data*. Cambridge, Cambridge University Press.

Levy-Yeyati, E., and F. Sturzenegger (2005): "Classifying Exchange Rate Regimes: Deeds vs. Words," *European Economic Review*, 49(6), 1603–1635.

McKinnon, R. (1993): *The Order of Economic Liberalization*. Baltimore: The John Hopkins University Press.

Obstfeld, M., J. Shambaugh, and A. Taylor (2004): "Monetary Sovereignty, Exchange Rates, and Capital Controls: The Trilemma in the Interwar period," *NBER, Working Paper No. 10393*.

——— (2005): "The Trilemma in History: Tradeoffs Among Exchange Rates, Monetary Policies, and Capital Mobility," *Review of Economics and Statistics*, 87(3), 423–438.

Obstfeld, M., and A. M. Taylor (2005): *Global Capital Markets: Integration, Crisis, and Growth*. Cambridge University Press.

Picone, G., R. M. Wilson, and S.-Y. Chou (2003): "Analysis of hospital length of stay and discharge destination using hazard functions with unmeasured heterogeneity," *Health Economics*, 12(12), 1021–1034.

Razo-Garcia, R. (2010): "Estimating the Effect of Exchange Rate Flexibility on Financial Account Openness," in *Advances in Econometrics: Maximum Simulated Likelihood Methods and Applications, vol. 26*, ed. by W. H. Greene. forthcoming, Emerald Group Publishing Limited.

Reinhart, C., and K. Rogoff (2004): "The Modern History of Exchange Rate Arrangements: A Reinterpretation," *Quarterly Journal of Economics*, 119(1), 1–48.

Rogoff, K., A. Husain, A. Mody, R. Brooks, and N. Oomes (2004): "Evolution and Performance of Exchange Rate Regimes," *IMF Ocassional Paper 229*.

Setzer, R. (2004): "The Political Economy of Exchange Rate Regime Duration: A Survival Analysis," Manuscript, University of Hohenheim.

Shaw, W., and V. Eidelman (2011): "Why Are Capital Controls So Popular?," International economic bulletin, Carnegie Middle East Center. June 9.

Van den Berg, G. (2005): "Competing Risk Models," Working Papers no. 2005:25, Department of Economics, Free University Amsterdam.

Von Hagen, J., and J. Zhou (2006): "The Interaction Between Capital Controls and Exchange Rate Regimes: Evidence from Developing Countries," *C.E.P.R. Discussion Paper No. 5537*.

Wälti, S. (2005): "The Duration of Fixed Exchange Rate Regimes," *Manuscript. Trinity College*.

Williamson, J. (2000): "Exchange Rate Regimes for Emerging Markets: Reviving the Intermediate Option," *Policy Analyses in International Economics 60, Institute of International Economics, Washington, D.C.*

Figure 1: Exchange Rate Regime and Financial Account Openness Distribution (percentage of members in each category)

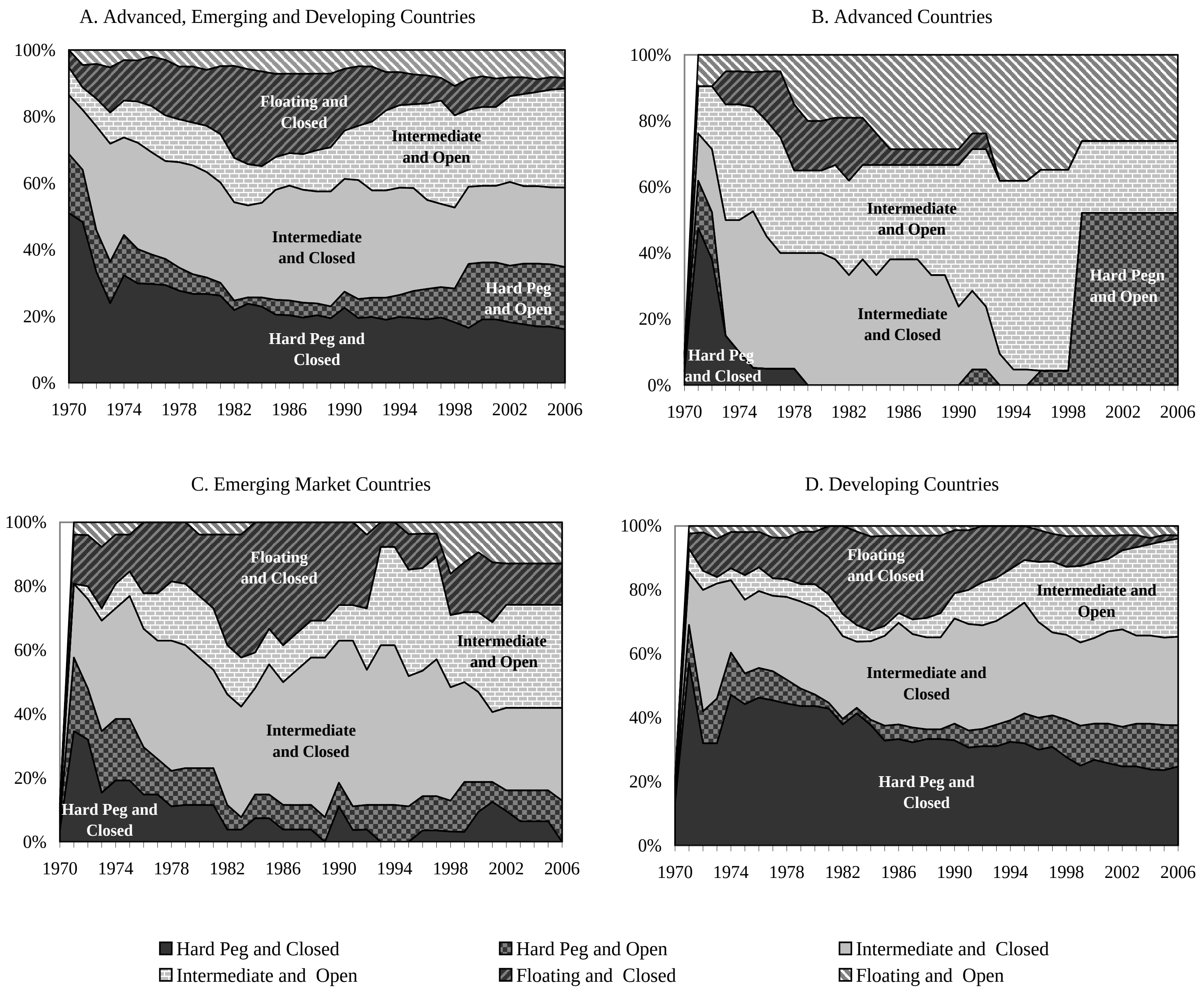


Figure 2: Estimated Hazard, Survival and Transition Intensities: Multiple Destinations Model

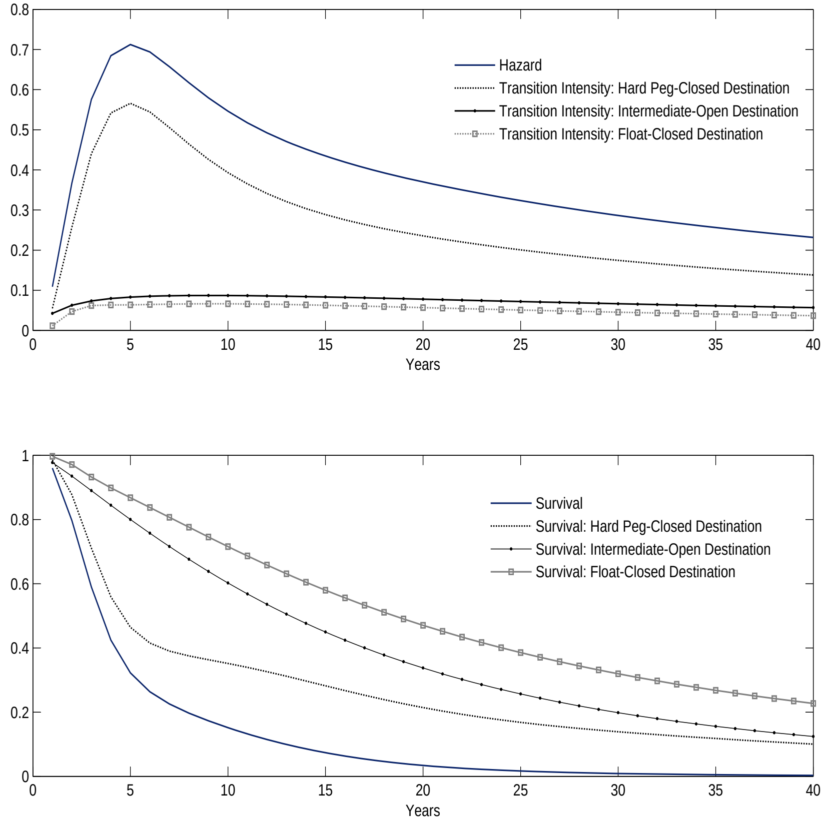
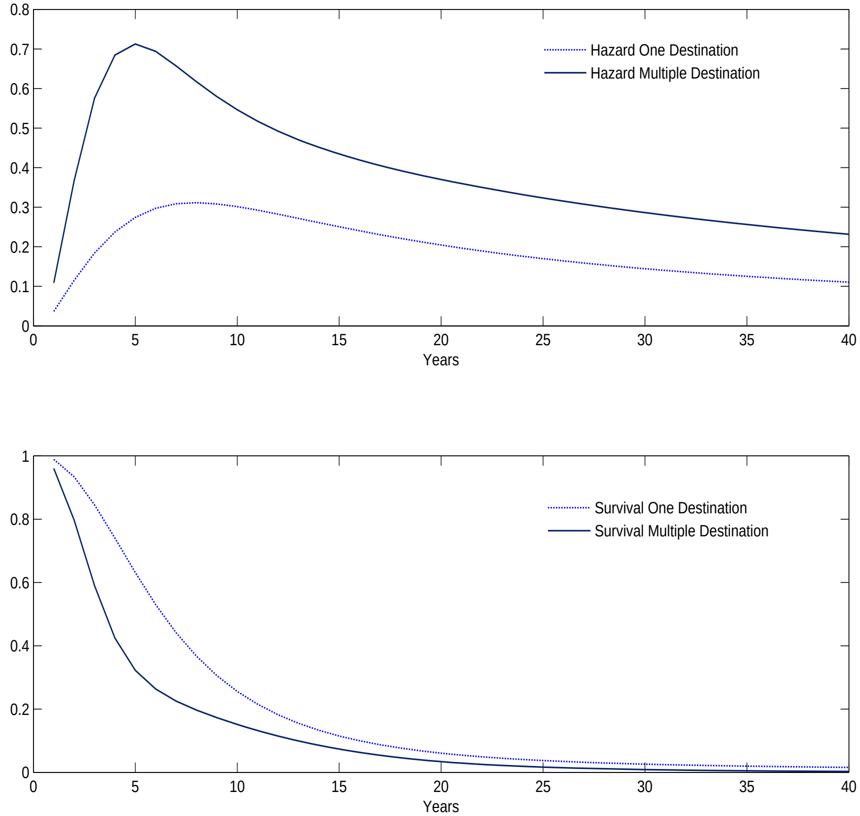


Figure 3: Single Destination versus Multiple Destinations: Hazard and Survival Functions



The upper-left panel presents the hazard function ($\theta(t;\mathbf{X})$) and the transition intensities for the 3 destinations. The hazard function, which is the sum of the 3 transition intensities, indicates the proportion of countries that have implemented the IEEC policy mix for t years moving to another regime. In the upper-left panel $\theta(5;\mathbf{X}) \approx 0.7$ (the solid black line), so about 70% of the countries implementing the IEEC policy mix for 5 years exit the regime before the sixth year. The lower-left panel present the overall survival function and the survival function associated with each of the three destinations. The survival function, $\overline{S}(t;\mathbf{X})$, denotes the probability of survival to t, $Pr(T \geq t)$. The right panel compares the hazard and survival functions obtained from the single and multiple destinations models. For example, the upper-right panel shows that the hazard function estimated with a single destination model is lower than the hazard obtained using the multiple destinations.

Table 1: Descriptive Statistics Using Reinhart and Rogoff Classification and Chinn-Ito Index.

	All Destinations				**Destination 1: Hard Peg and Closed FA**			
VARIABLE	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Duration	9.333	8.580	1	36	5.952	7.025	1	29
Inflation	0.130	0.147	-0.030	0.847	0.117	0.150	-0.030	0.705
Financial Development	0.387	0.289	0.062	1.699	0.221	0.140	0.067	0.625
Per Capita Income	0.340	0.476	0.010	2.489	0.156	0.245	0.014	1.127
Relative Size	0.013	0.030	0.000	0.172	0.010	0.033	0.000	0.153
Trade Openness	0.739	0.472	0.026	2.626	0.658	0.473	0.074	1.810
SpillER	0.470	0.059	0.203	0.558	0.409	0.063	0.239	0.513
SpillK	0.615	0.125	0.466	0.780	0.732	0.053	0.528	0.769
Reserves/M2	0.396	0.517	0.005	5.239	0.347	0.307	0.005	1.129
Reserves/M2 x EM	0.083	0.166	0.000	0.903	0.036	0.100	0.000	0.435
Emerging Market	0.265	0.443	0.000	1.000	0.190	0.402	0.000	1.000
Election	0.204	0.404	0.000	1.000	0.238	0.436	0.000	1.000
SPELLS	147				21			

	Destination 2: Intermediate ERR and Open FA				**Destination 3: Floating ERR and Closed FA**			
VARIABLE	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Duration	9.125	8.371	1	34	11.185	9.344	1	36
Inflation	0.134	0.145	-0.019	0.734	0.174	0.163	0.003	0.682
Financial Development	0.438	0.320	0.062	1.699	0.338	0.194	0.082	0.812
Per Capita Income	0.578	0.641	0.020	2.489	0.416	0.463	0.018	1.741
Relative Size	0.012	0.030	0.000	0.153	0.024	0.033	0.000	0.142
Trade Openness	0.850	0.482	0.326	2.626	0.419	0.188	0.087	0.848
SpillER	0.488	0.043	0.388	0.558	0.433	0.048	0.364	0.558
SpillK	0.631	0.097	0.469	0.780	0.703	0.101	0.528	0.780
Reserves/M2	0.526	0.820	0.040	5.239	0.233	0.186	0.024	0.767
Reserves/M2 x EM	0.088	0.193	0.000	0.903	0.108	0.153	0.000	0.455
Emerging Market	0.229	0.425	0.000	1.000	0.407	0.501	0.000	1.000
Election	0.229	0.425	0.000	1.000	0.296	0.465	0.000	1.000
SPELLS	48				27			

Note: The descriptive statistics for all destinations include censored spells.

Table 2: Results of the Single and Multiple Destination Models: Log-logistic Model

	Single Destination		Multiple Destionations			Multiple Destionations		
	Heterogeneity		Gamma Frailty[d]			Semiparametric[c]		
			Destinations			Destinations		
	Gamma	Semipara-metric[c]	HPC	IO	FC	HPC	IO	FC
	[1]	[2]	[3]	[3]	[3]	[4]	[4]	[4]
α	1.88***	3.25***	8.55***	1.66***	2.10***	3.76***	1.80***	3.76***
	(0.16)	(0.24)	(2.70)	(0.20)	(0.31)	(0.96)	(0.20)	(0.66)
SPILLER	1.49	-0.16	6.92***	-12.80***	3.83	7.50***	-8.33***	7.52**
	(2.05)	(0.76)	(1.88)	(4.06)	(2.99)	(1.97)	(3.26)	(3.76)
SPILLFA	-3.18***	-3.19***	-5.10***	-4.49***	-0.68	-7.14***	-3.64***	0.50
	(1.12)	(0.47)	(1.65)	(1.72)	(1.75)	(2.35)	(1.47)	(1.58)
EMERGING	0.45	0.31	2.51***	0.63	0.91*	2.39***	0.67*	-0.15
	(0.40)	(0.36)	(0.30)	(0.57)	(0.55)	(0.28)	(0.35)	(0.81)
RESERVES/M2	-0.15	-0.18***	0.18	-0.16	1.35	0.33*	-0.17***	1.15**
	(0.14)	(0.04)	(0.18)	(0.18)	(0.86)	(0.19)	(0.06)	(0.59)
EMERGING*RESERVES/M2	-0.99	-1.03	-4.50***	-1.33	-2.76	-2.69**	-1.47**	-2.50
	(1.04)	(1.18)	(0.88)	(1.28)	(1.76)	(1.20)	(0.66)	((2.79)
PER CAPITA INCOME	0.11	0.02	1.89***	-0.44*	0.48	1.89***	-0.40***	0.51***
	(0.20)	(0.10)	(0.38)	(0.25)	(0.32)	(0.37)	(0.16)	(0.10)
FINANCIAL DEVELOPMENT	1.40***	1.19***	1.85***	0.93*	1.17	3.57	0.91**	1.38***
	(0.42)	(0.16)	(0.54)	(0.52)	(0.79)	(2.24)	(0.44)	(0.51)
RELATIVE SIZE	-6.33*	-3.05***	-14.02***	-0.65	-10.81**	-17.15***	0.89	-11.21***
	(3.53)	(0.39)	(4.04)	(5.06)	(4.74)	(4.06)	(2.61)	(1.50)
TRADE OPENNESS	-0.62***	-0.41**	-0.64***	-1.04***	0.90	-0.92***	-0.80***	0.51
	(0.25)	(0.20)	(0.22)	(0.31)	(0.73)	(0.21)	(0.28)	(0.62)
INFLATION	-1.53***	-1.55***	-0.07	-2.95***	-2.48***	-0.18	-3.03***	-1.45***
	(0.61)	(0.23)	(0.31)	(0.86)	(0.93)	(0.37)	(0.58)	(0.36)
ELECTION	-0.16	0.08	-0.07	0.07	-0.23	-0.26*	0.07	0.41***
	(0.22)	(0.14)	(0.17)	(0.29)	(0.30)	(0.14)	(0.27)	(0.16)
σ^2	< 0.001	2.839	4.545	< 0.001	< 0.001	5.173	1.142	4.191
Corr(ν_1, ν_2)							0.470	
Corr(ν_1, ν_3)							-0.908	
Corr(ν_2, ν_3)							-0.092	
Spells	147	147	21	48	27	21	48	27
$t(\alpha)^b$	5.57	9.54	2.79	3.35	3.56	2.89	4.09	4.20

Notes: ***, **, * denote coefficients statistically different from zero at 1%, 5% and 10% significance levels, respectively. "HPC" stands for hard peg ERR and closed FA, "IO" for intermediate ERR and open FA, and "FC" stands for floating ERR and closed FA. The constant is omitted to save space.

[a] p-value for the Likelihood-ratio test of $H_0 : \sigma^2 = 0$.

[b] The t-statistic is testing if alpha is different from one.

[c] Semiparametric estimation.

[d] In this model the random terms controlling for unobservable factors are independent gamma distributed random variables. See A for a detailed discussion of the estimation of unobserved heterogeneity.

.1 Data Sources

Variable	Source	Definition or Transformation	Units
CPI[a]	IFS Line 64	Consumer Price Index	Index (2000=100)
INFLATION[b]	CPI	Annual Inflation	Δ% over previous year
M2[c]	IFS Line 35	Money + Quasi Money	National Currency
RESERVES	IFS Line 1L	Total Reserves - Gold	U.S. Dollars
EXPORTS	IFS Line 90C	Exports of Goods and Services	National Currency
IMPORTS	IFS Line 98C	Imports of Goods and Services	National Currency
GDP	IFS Line 99	Gross Domestic Product	National Currency
FINANCIAL DEVELOPMENT	WDI and IFS	M2/GDP	%
TRADE OPENNESS	WDI and IFS	Exports plus Imports over GDP	%
RESERVES/M2	WDI and IFS	Reserves/M2	%
GDP per capita	WDI	GDP per capita	2000 U.S.$
ELECTION	Institutions & Elections Project Data	Equal to 1 if an election takes place	Binary Variable
RELATIVE SIZE	WDI	Size relative to the U.S. (GDP)	%
ERR	Reinhart and Rogoff (2004)	*De facto* "Natural" Exchange Rate	
		Regime Classification	15 categories
		Reinhart and Rogoff	Dummy Variable
Chinn-Ito Index	Chinn and Ito (2008)	Financial Openness Index	Index [-1.795,2.540]
BFOI[‡]	Nancy Brune	Financial Openness Index (excluding Exchange Rate Regime)	Index [0,11]

Notes: IFS stands for International Financial Statistics.

[a] For missing observations we use CPI from Global Financial Data

[b] BFOI is the sum of eleven binary variables related to the capital flows: I) controls on inflows of invisible transactions proceeds from invisible transactions, repatriation requirement and surrender requirements; II) controls on outflows of invisible transactions; III) controls on inflows of invisible transactions from exports; IV) controls on inflows pertaining to capital and money market securities; V) controls on outflows pertaining to capital and money market securities; VI) controls on inflows pertaining to credit operations; VII) controls on outflows pertaining to credit operations; VIII) controls on inward direct investment; IX) controls on outward direct investment; X) controls on real estate transactions; and XI) provisions specific to commercial banks.

[c] For Eurozone members we use data from the Yearbook of International Financial Statistics.

A Unobserved Heterogeneity.

Given the potential misspecification of the random process for unobserved heterogeneity and its consequences on the estimated parameters we estimate the competing risks model using parametric and semiparametric methods. Common in the literature is to assume multiplicative heterogeneity

$$\theta_k(t;\mathbf{X},\nu_k) = \alpha_k \exp\{-\alpha_k \mathbf{x'}_k\beta_k\}t^{\alpha_k-1}/(1+\exp\{-\alpha_k\mathbf{x'}_k\beta_k\}t^{\alpha_k})h(\nu_k) \tag{7}$$

where $h(\nu_k)$ is an increasing function of a time-invariant residual to be regarded as a realization of a random variable V_k. The realization of this random term, ν_k, is both unknown and varies over the population of interest. Equation (7) is the modified transition intensities of the *log-logistic* model. Let $\nu = (\nu_1,\ldots,\nu_K)$ be the vector of unobserved multiplicative heterogeneity assumed to have a joint distribution denoted by $G(\nu;\mathbf{X})$. Let $\overline{S}(t;\mathbf{X}_i,\nu_k)$ =exp$\{-\int_0^t \theta(u;\mathbf{X}_i,\nu_k)du\}$. Then, we can rewrite equations (3) and (4) conditioned on $\nu_{\mathbf{k}}$

$$Pr(t \leq T_i < t+\Delta_t,\mathbf{D}_{k,i};\mathbf{X}_i,\nu) = \theta_k(t;\mathbf{X}_i,\nu_k)\overline{S}(t;\mathbf{X}_i,\nu_k) \tag{8}$$

$$Pr(T_i \geq t;\mathbf{X}_i,\nu) = \overline{S}(t;\mathbf{X}_i,\nu_k) \tag{9}$$

To construct the *likelihood* function, however, we need to integrate out the random term ν.

A.0.1 Parametric Estimation

A general specification of unobserved heterogeneity allows for risk-specific random components. Let $h(\nu) = \nu$ and $G(\nu;\mathbf{X}_i)$ be the joint cumulative distribution function of the random vector ν conditional on $\mathbf{X}_i$. In models [1] and [3] we assume that the K elements of ν are independent

Gamma distributed random variables. Hence, following Lancaster (1990)

$$\overline{S}_k^m(t;\mathbf{X}_i) = \int_{-\infty}^{\infty} \cdots \int_{-\infty}^{\infty} \exp\Big(-\int_0^t \theta_k(t;\mathbf{X}_i,\nu)\Big)\mathbf{g}(\nu;\mathbf{X}_i)\mathbf{d}\nu = 1/[1+\sigma_k^2\Lambda_k^m(t;\mathbf{X}_i)]^{\frac{1}{\sigma_k^2}} \tag{10}$$

where the superscript "m" refers to the corresponding functions for the mixture distribution and $\Lambda_k^m(t) = \int_0^t \theta_k^m(s;\mathbf{X}_i)ds$ is the integrated transition intensity for state k. Similarly, the mixture transition intensities are $\theta_k^m(t;x) = \theta_k(t;x)/1+\sigma_k^2\Lambda_m^k(t;\mathbf{X}_i)$.

A.0.2 Semiparametric Method

In models [2] and [4], the unmeasured heterogeneity is controlled for in a manner similar to Butler, Anderson, and Burkhauser (1989) strategy. Contrary to Heckman and Singer (1984), who assume that the distribution of the unobservable heterogeneity term is explicitly discrete, Butler, Anderson, and Burkhauser consider that the discrete distribution is a numerical approximation of the true distribution. This semiparametric estimation technique allows correlated competing risks without imposing any distributional assumption on $G(\nu;\mathbf{X})$. Let $h(\nu) = \exp(\nu)$. To derive the *likelihood* function we need the unconditional counterparts of the equations (8) and (9). Hence,

$$\begin{aligned} Pr(t \le T < t+\Delta_t, \mathbf{D}_k; \mathbf{X}) &= \int_{-\infty}^{\infty} \cdots \int_{-\infty}^{\infty} Pr(t \le T < t+\Delta_t, \mathbf{D}_k; \mathbf{X}, \nu) g(\nu;\mathbf{X})\mathbf{d}\nu \\ &\approx \sum_{l_1=1}^{L_1} \cdots \sum_{l_K=1}^{L_K} \tau_{l_1,\ldots,l_k} Pr(t \le T < t+\Delta_t, \mathbf{D}_k; \mathbf{X}, \nu = \mathbf{q}) \end{aligned} \tag{11}$$

where $g(\nu;\mathbf{X})$ is the prior distribution of the residuals, $\nu = \Big\{\nu_{1,l_1},\ldots,\nu_{K,l_K}\Big\}'$, $\mathbf{q} = \Big\{q_{1,l_1},\ldots,q_{K,l_K}\Big\}'$ is a vector of integration points, L_k is the number of integration points related to the random effect of destination K and $\tau_{l_1,\ldots,l_k} = w_{1,l_1}\cdots w_{K,l_K} g(q_{1,l_1},\ldots,q_{K,l_K}) \exp\Bigg\{q_{1,l_1}^2/2+\cdots+q_{K,l_K}^2/2\Bigg\}$. The approximation is obtained by Gauss-Hermite numerical integration using $w's$ as the integration weights.