The Role of Financial Development in Exchange Rate Regime Choices

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Abstract

We make the first attempt in the literature to empirically investigate the role of financial development in the choice of exchange rate regimes. Using a binary choice model, we first show that financially less developed countries are more likely to adopt a fixed exchange rate. To further examine the impact of financial development on the conditional probability of exiting from an existing pegged system to a flexible one, we then employ hazard-based duration analysis. We find strong evidence that countries with higher levels of financial development are more likely to exit a pegged system, and, interestingly, financial development only matters to orderly exits but not disorderly exits. Our results are robust to controlling for endogeneity and sample selection.

Keywords: exchange rate regimes; financial development; duration analysis; hazard; competing risks

JEL classification: F3, F4

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1. Introduction

Foreign exchange rate policies — whether to adopt a fixed or flexible exchange rate regime — have long been at the heart of policy debates among academic researchers and policymakers.[1] As the traditional Mundell-Fleming model (Fleming 1962; Mundell, 1963) suggests, a country's exchange rate regime choice should be based on the sources of shocks, the level of capital mobility and the preference for independent monetary policies.[2] According to the optimal currency area theory proposed by Mundell (1961), a country's exchange rate regime decision should also take into account its trade openness, country size and trading relationship with its pegging country, etc. Furthermore, the view (Bruno, 1991; Calvo and Végh, 1994; Mecagni, 1995) that pegging to a sound currency can provide an inflation anchor implies that a country should consider a fixed exchange rate when it intends to keep domestic inflation under control but lacks policy credibility.

While the above conventional theories of exchange rate regime determination have been quite successful in explaining many countries' exchange rate regime choices in practice, there are certainly some exceptions. Consider the case of China. Although, based on the conventional theories, many researchers suggest that a flexible exchange rate regime would fit China better, the country has been very reluctant to exit from its *de facto* fixed exchange rate regime to a more flexible one. More generally, an influential study by Calvo and Reinhart (2002) find that there is an epidemic case of "fear of floating" among emerging and developing countries. Why are those countries so afraid of allowing their exchange rates to fluctuate?

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[1] Bordo (2003) provides a comprehensive survey on exchange rate regime choices from a historical perspective.

[2] According to the Mundell-Fleming Model, in a world with perfect capital mobility, a fixed (flexible) exchange rate regime should be selected in countries experiencing nominal (real) shocks. Meanwhile, for a country that prefers independent monetary policies, a flexible exchange rate regime would be a better choice. The argument on monetary independence and exchange rate regimes dates back to Friedman (1953).

Two recent studies, Bordo (2003) and Bordo and Flandreau (2003), propose a novel rationale for the above puzzling real world exchange rate arrangements by exploring the role of financial development in exchange rate regime choices. Their idea is later formalized by Aghion, Bacchetta, Rancière, and Rogoff (2009) (ABRR thereafter).[3] In ABRR's study, the authors first employ a monetary growth model to show that real exchange rate volatility amplifies the negative investment effects of domestic credit market constraints. In their model, exchange rate volatility leads to large variations in firms' profits. With underdeveloped financial markets, the large profit volatility would greatly reduce firms' external financing capability, depress their investment, especially in R&D, and eventually curtail a country's productivity growth. They then provide some convincing empirical evidence that higher levels of flexibility in exchange rate are associated with lower productivity growth when financial development is limited. Taken together, they thus conclude that financial development plays a critical role in countries' choices of exchange rate regimes and that less flexible exchange rate regimes should be considered in countries with less developed financial markets.

Despite this theoretical prediction on the role of financial development in exchange rate regime choices, direct and formal empirical tests have yet to be done on this interesting and important issue. Does financial development really matter to a country's exchange rate regime choice in the real world? Is a country with lower financial development more likely to adopt a fixed exchange rate regime in reality? Does financial development play a role in a country's transition from a fixed exchange rate regime to a flexible one?

[3] An informal discussion is also spotted in a study by Husain et al. (2005), implying that it would be better for countries with immature financial markets to adopt fixed exchange rate regimes.

Our study makes the first attempt in the literature to address the above important questions by empirically investigating the role of financial development in the selection of exchange rate systems. We first use a conventional simple logit model to examine the effect of financial development on the unconditional probability of adopting fixed exchange rate regimes. A limitation of this approach, however, is that it considers the selection of exchange rate regimes as independent events without taking into account the existing exchange rate arrangement prior to the current choice. We then take another step forward to further examine how financial development affects the probability of switching from a fixed exchange rate regime to a flexible one, conditional on the length of time a country has been in a fixed exchange rate regime, by employing a hazard-based duration analysis. This novel approach not only allows us to explore the conditional likelihood of exiting from a fixed to a flexible exchange rate system but also sheds some light on the role of financial development in the durations of fixed exchange rate regimes.[4] In addition, we also make efforts to distinguish orderly exits from disorderly ones in our duration analysis by incorporating a competing risks framework.[5] In doing so, we are able to check whether financial development facilitates smooth exits from a fixed exchange rate regime or actually causes economic turmoil.

Based on a comprehensive sample of 102 economies over the post Bretton Woods era, our logit regressions show that financial development does have a significant influence on a country's choice of exchange rate regime. The less developed a country's financial market is, the more likely the country will adopt a fixed exchange rate regime. Our duration analyses further

[4] Klein and Marion (1997) used a logit model to examine the determinants of the duration of pegged exchange rate regimes in Latin American countries. Detragiache *et al*. (2005) employs a multinomial Logit model to examine how various factors affect the exits from fixed exchange rate regimes. However, neither of these two studies examines the role of financial development. In a study by Asici and Wyplosz (2003), a probit model is used to study the determinants of a peaceful exit from a peg as compared to a troubled exit. They included financial development in their specification but found no significant effects on peaceful exits.

[5] Orderly and disorderly exits are defined in Section 2.

reveal that a country is more likely to exit from a fixed exchange rate regime to a flexible one when its financial market is more developed. For example, had China's financial development in 2005 reached the concurrent level of that of the US, the hazard rate (i.e. the risk of exiting from a fixed exchange rate) that China faced would have increased by a factor of 3.06 (306%)! Interestingly, we notice that financial development only affects the conditional likelihood of orderly exits but not disorderly exits, suggesting that financial development would only facilitate smooth exits. We also show that our results are robust to controlling for endogeneity and sample selection. Overall, the evidence lends strong support to ABRR's theoretical prediction that exchange rate flexibility should be positively associated with the level of financial development.

The remainder of this paper is organized as follows. A brief introduction of our dataset is provided in Section 2. Section 3 discusses the methodological issues involved in our study. Our main empirical results are presented in Section 4. In Section 5, we address the potential endogeneity and sample selection issues. Section 6 offers our concluding remarks.

2. Data

The dataset used in this study consists of annual observations of 102 economies, both OECD and non-OECD, during the post Bretton Woods system period from 1974 to 2005. The primary source of our data is World Development Indicators (WDI) published by the World Bank. We provide detailed variable definitions and data sources and also a list of the sampled economies in Appendices. Summary statistics of variables are available in Table 1.

[Insert Table 1 about here]

Our main variable of interest is the level of financial development. As is standard now in the literature, we use the share of domestic credit to private sectors in GDP as a measure of financial development. Our definition of foreign exchange rate regimes follows the *de facto* exchange rate classifications that are initially developed by Reinhart and Rogoff (2004) and recently updated by llzetzki, Reinhart and Rogoff (2009). Unlike the IMF's *de jure* exchange rate regime classification, the *de facto* classification has the advantage of reflecting countries' real practice rather than their official claims. According to this *de facto* classification, there are six broad categories of countries' exchange rate regimes: hard pegs, soft pegs, managed floating, freely floating, freely falling and dual market. In this study we define a fixed exchange rate regime as either a hard peg or a soft peg.

Over our sample period we notice that the average level of financial development is significantly different in a fixed exchange rate regime than in a flexible one. The average level of financial development under fixed regimes is about 45% of GDP while that under flexible regimes is close to 60% of GDP. Formal statistical test suggests that, on average, fixed exchange rate regimes are associated with significantly lower level of financial development than flexible exchange rate regimes.[6] In Table 2 we also provide a comparison of financial development at varying percentiles between the two types of regimes. In general, financial development levels are lower under fixed exchange rate regimes. This preliminary evidence seems quite consistent with the ABRR's prediction.

[Insert Table 2 about here]

Since our study is also interested in the role of financial development in a country's exit from a fixed exchange rate regime to a flexible one, we need first identify fixed exchange rate spells for each country. We consider a country entering a spell once it starts a fixed exchange

[6] The t-statistic is 6.34, and the p-value is smaller than 0.01.

rate system and exiting from a fixed exchange rate regime when it switches to managed floating, freely floating, freely falling or dual market.[7] A country can re-enter a fixed exchange rate regime spell after an exit as long as it meets the above entry criterion. Based on this identification strategy, we have a total of 54 exits in our sample. The median duration of a fixed exchange rate regime is about 14 years. Despite a few exits taking place after long-standing fixed exchange rate spells, the majority (over 70%) of exits occurred within 20 years of a country entering a fixed exchange rate regime.

Of these exits, we make a further distinction between orderly and disorderly exits. When a country exits to either a managed floating or freely floating regime, we consider it as an orderly exit. A disorderly exit is defined as one exits to freely falling for this regime, by the definition of Reinhart and Rogoff (2004), is associated with huge currency depreciation, high inflation and speculative attacks.[8] Within our sample, 31 spells exit orderly to either managed or freely floating regimes and 20 exits end disorderly with freely falling.

3. Methodology

Our study shall be conducted in two parts. First, we will examine whether a country's financial development plays an important role in its decision on whether to adopt a fixed or flexible exchange rate regime. We will then investigate, conditional on the time length that a country has been in a fixed exchange rate regime, how financial development affects its exit from the fixed exchange rate regime.

[7] We also did a robustness check dropping freely falling and dual market observations and found similar results.

[8] When we distinguish between orderly and disorderly exits, exits to dual market are excluded given the fact that no information is available to determine whether the exit is orderly or not. In our sample, there are only 3 exits to dual market: Guinea in 1983, Argentina in 2002, and Venezuela in 2003. Including these 3 exits as disorderly exits does not affect our results.

3.1 Estimate the effect on the unconditional probability of selecting pegged systems

The dependent variable in this analysis is a fixed exchange rate dummy, which takes on the value of 1 when a country has a fixed exchange rate regime in effect and 0 otherwise. To estimate the impact of financial development on the dependent variable, a natural choice is a logit model:

$$\Pr(FIX_{iy} \mid X_{iy}) = \frac{\exp(X_{iy}\beta)}{1+\exp(X_{iy}\beta)}, \tag{1}$$

where FIX_{iy} is an indicator for whether country i is under a fixed exchange rate regime in year y, X_{iy} include various explanatory variables, and β is a vector of coefficients associated with the explanatory variables. We are interested in the estimated coefficient on the variable of financial development, which captures the effect of financial development on the unconditional probability of choosing fixed exchange rate regimes. Here the probability is unconditional in the sense that a country's prior history of exchange rate regimes is ignored.

3.2 Estimate the effect on the conditional probability of exiting to flexible exchange rates

To investigate how a country's financial development affects the conditional probability of exiting from a fixed exchange rate regime, we employ hazard models that are typically used in duration analysis. The duration variable T measures the length of time (in years) that a country stays in a fixed exchange rate regime. Since many countries have multiple fixed exchange rate regime spells and exits during the sample period, we reset $T=0$ whenever a country re-enters a fixed exchange rate regime.

Let $F(t)$ denote the cumulative probability distribution function of T. The probability that a country stays in a fixed exchange rate regime longer than t is given by the survival function $S(t)$

$= 1\text{-}F(t) = Pr\ (T>t)$. The hazard function gives the conditional probability that an exit occurs at the interval of Δt given that a country maintains its fixed exchange rate regime until t. Following the notation of Kiefer (1988), the hazard function can be written as:

$$\lambda(t) = \lim_{\Delta \to 0} \frac{pr(t \le T < t + \Delta t \mid T \ge t)}{\Delta t}. \tag{2}$$

Thus, the survival function $S(t)$ becomes:

$$S(t) = \exp[-\Lambda(t)] = \exp[-\int_0^t \lambda(z)dz], \tag{3}$$

where $\Lambda(t) = \int_0^t \lambda(z)dz$ is the integrated hazard function.

To examine the influence of financial development on the probability of exits conditional on maintaining a fixed exchange rate system until t, we specify a proportional hazard function:

$$\lambda(t, X_{jy}, \beta, \lambda_0) = \exp(X_{jy}'\beta)\lambda_0(t), \tag{4}$$

where λ_0 denotes the baseline hazard corresponding to zero values of explanatory variables for the hazard, X_{jy} is a vector of explanatory variables for spell j in year y , and β is a vector of parameters to be estimated. While the baseline hazard is common to all spells, individual hazard functions vary proportionately according to the observed covariates X.

To avoid placing any restrictions on the shape of baseline hazard and thus allow for more flexibility in estimation, we utilize the partial likelihood Cox (1975) model. A great advantage of the Cox model is that it does not explicitly specify a functional form for the baseline hazard but only uses the order of spell lengths for coefficient estimation. Given the estimated coefficients (β), a one-unit increase in an individual variable (x_k) would cause the hazard (i.e. the risk of exiting from a fixed exchange rate regime) to change by $(exp(\beta_k)\text{-}1)$*100%.

Since the Cox model assumes a continuous distribution for time, we also estimate a discrete hazard model that is developed under a discrete time framework. Following Cooper, Haltiwanger and Powers (1999) and more recently Dunne and Mu (2010), we parameterize the discrete hazard as

$$\lambda(t, X_{jy}, \beta) = 1 - \exp(-\exp(\varphi + \sum_{t=2}^{L} \gamma_t D_{tjy} + X_{jy}'\beta)), \quad (5)$$

where φ is the intercept, D_{tjy} is a set of duration dummies, equal to 1 if year y is the t^{th} year since spell j starts, and γ and β are the coefficients to be estimated. Here L denotes the longest spell duration, and D_{1jy} is the omitted category. The marginal effect of an individual economic factor (x_k) on the hazard is measured by $exp(-exp(X'\beta)) \cdot exp(X'\beta)\beta_k$, and the sign on the estimated coefficient, β_k, gives the directional effect on the hazard function. A positive β_k means that the hazard increases in x_k.

In addition, we also consider allowing for potential unobserved heterogeneity in the Cox model. To control for unobserved heterogeneity in the Cox model, we introduce a multiplicative error term (frailty) v into the hazard function:

$$\lambda(t, X_{jy}, \beta, \lambda_0) = \exp(X_{jy}'\beta)\lambda_0(t)v, \quad (6)$$

The frailty (v) is assumed to have a gamma distribution with mean one and variance θ. Whether the unobserved heterogeneity is significant can be tested using a likelihood ratio test with the null hypothesis of θ being zero. We allow the frailty to be shared within the same country.

Up to now we have simply focused on the overall risk of exiting to flexible exchange rate regimes. To further distinguish orderly exits from disorderly exits, we re-estimate the Cox proportional hazard model by incorporating competing risks. In doing so, the effects of explanatory variables and baseline hazard are allowed to be unique to each exit type. Assuming independence of competing risks, the aggregate log-likelihood of exits can be partitioned into two component contributions, one from orderly exits and the other from disorderly exits, and each of the two contribution terms is a function of the parameters of single cause-specific hazards.[9] Given the additive separability property, we can simply treat exits from the alternative exit type as a censored observation and fit hazard models separately for the two exit types. For instance, to estimate the hazard to disorderly exits, spells that end with orderly exits are treated as right censored in the data.

4. Main empirical results

This section reports our main estimation results from the logit models and also the hazard models outlined in Section 3. We consider a variety of control variables commonly used in the literature. The first set of variables measures a country's domestic macro economy, among which are real GDP per capita growth rate (*rgdppcg*), CPI inflation rate (*infcpi*), foreign reserves to imports ratio as a measure of reserve adequacy (*resimp*), government expenditure as a share of GDP (*govgdp*), and also country size measured as a country's share of real GDP in the world (*csize*).[10] The second set of explanatory variables control for a country's integration into the world economy, including the sum of exports and imports to GDP ratio as a measure of openness to trade (*trade*) and the share of current account balance in GDP (*ca*). Given the potential heterogeneity between OECD and non-OECD countries, we also introduce a dummy variable (*oecd*) for advanced OECD countries. To alleviate the problem of endogeneity, we let all explanatory variables enter the benchmark specification with one-year's lag except the OECD dummy.

[9] See, for example, Narendranathan and Stewart (1991, 1993) and Lunn and McNeil (1995), for discussions on competing risks models.

[10] To avoid our results being affected by extreme values of inflation, the actual variable we use is inflation/(100+inflation).

4.1 Empirical results from logit models

4.1.1 Benchmark model

The two columns in Table 3 present the estimated coefficients and marginal effects of all explanatory variables in the logit regression, respectively.[11] Our focus here is the effect of financial development on a country's choice between fixed and flexible exchange rate regimes. We find that financial development has statistically significant, at the 1% level, and negative impact on the probability of choosing a fixed exchange rate regime. That is, countries with lower levels of financial development are more likely to adopt fixed exchange rate regimes. Moreover, this impact of financial development is also quantitatively large. Holding all other variables at their respective means, a one percentage point decrease in financial development tends to increase the probability of adopting a fixed exchange rate by 0.2%. Take Argentina for an instance. Had its financial development reached the concurrent level in the UK, the predicted probability of Argentina choosing a peg in 2005 would have dropped dramatically from 62% to less than 35%. This finding is consistent with ABRR's hypothesis that financial development plays a very important role in the choice of exchange rate regimes and that countries with lower levels of financial development have higher chances of adopting a fixed exchange rate regime.

[Insert Table 3 about here]

With regard to other control variables in the benchmark specification, real GDP per capita growth (*rgdppcg*), CPI inflation (*infcpi*), reserves to imports ratio (*resimp*), country's relative size (*csize*), openness to trade (*trade*) and the OECD dummy (*oecd*) are all found to have statistically significant impacts on the probability of adopting fixed exchange rate regimes.

[11] Marginal effects are evaluated at the sample means of all covariates.

Chances of adopting fixed exchange rate regimes are higher in countries with smaller country sizes, more rapid economic growth, lower inflation rates, lower reserve to import ratios or higher degrees of openness to international trade. The estimated coefficients on government expenditure and current account are found to be insignificant.

4.1.2 Robustness checks on logit models

To check whether our results are sensitive to different model specifications and samples, we conduct a series of robustness checks in this subsection and report the results in Table 4.

[Insert Table 4 about here]

First, we include year dummies in the logit regression to control for a potential common time trend. The results are reported in Column (1) of Table 4. Adding year dummies to the logit does not alter our results. We still find that financial development has negative and statistically significant effect on the probability of adopting a fixed exchange rate regime.

Our second robustness check is to see whether our results would change if the observations classified as either freely falling or dual market are excluded from our sample. Our results hold strongly in this restricted sample. In Column (2) of Table 4, the estimated coefficient on financial development is again found to be negative and statistically significant at the 1% level, indicating that countries with higher levels of financial development are less likely to adopt a fixed exchange rate regime.

In the next three columns of Table 4, we check the robustness of our results by adding additional controls to our benchmark logit model. An important rationale for adopting a fixed exchange rate regime is that it allows countries with weak monetary institutions to import foreign monetary policy and thus foreign monetary institutions. Furthermore, it is often the case that countries with weak monetary institutions also tend to have less developed financial markets. Therefore, it is crucial to check whether our previous results are potentially driven by quality of domestic monetary institutions. To address this concern, we add a five-year central bank governor turnover rate (*5ytor*) as an inverse proxy of central bank independence to our benchmark logit model and present the estimation results in the third column of Table 4. Controlling for central bank independence does not affect our results either as the estimated coefficient on financial development is still negative and significant at the 1% level. In Columns (4) and (5) of Table 4, we include the Chinn and Ito (2007) financial openness index (*finopen*) and terms of trade growth (*totg*) as an additional control to the benchmark logit model, respectively.[12] In neither case our main results is affected. Financial development significantly lowers the probability of adopting a fixed exchange rate regime in both regressions. We also note that financial openness has significant and positive effect on the probability of choosing a fixed exchange rate regime while terms of trade growth does not have statistically significant impact on a country's exchange rate regime choice.

Finally, given that there is substantial heterogeneity between OECD countries and non-OECD countries, we further investigate whether financial development has different impacts on exchange rate regime choices in these two country groups. We do so by replacing the financial development variable (*fd*) with two interaction terms, *fd*oecd* and *fd*(1-oecd)*. This specification allows us to estimate the effects of financial development in different country groups without splitting the sample. Column (6) of Table 4 shows that the estimated coefficients

[12] To construct the financial openness index, Chinn and Ito first take the first principal component of four categories of restricts on international financial transactions reported in the IMF's Annual Report on Exchange Arrangement and Exchange Restrictions (*AREAER*). They then switch the sign so that a larger value of the index indicates a higher level of financial openness. See Chinn and Ito (2007) for detailed discussion on the construction of this index.

on the two interaction terms are both negative and statistically significant, indicating that higher levels of financial development lower the probabilities of adopting a fixed exchange rate regime in both country groups. A formal Wald test then further suggests that we are not able to reject the null hypothesis that that financial development has the same effect in the two country groups. The Wald statistic is 0.12 with a p-value of 0.73.

In sum, our robustness checks tell a very consistent story: the lower a country's financial development is, the more likely the country will adopt a fixed exchange rate regime.

4.2 Empirical results from duration analysis

So far we have been solely focusing on the effect of financial development on the unconditional probability of adopting a fixed exchange rate regime, which does not take into consideration the exchange rate policy a country had before. Now we shall dig deeper by asking a more interesting question: how does financial development affect a country's probability of exiting from a fixed exchange rate regime, given the fact that the country has maintained its fixed exchange rate regime till the current period? Duration models presented in Section 3 are employed here to address this issue.

4.2.1 The benchmark Cox model

Table 5 shows the results from our benchmark Cox proportional hazard model. The two columns report the estimated coefficients and hazard ratios, respectively.[13] Here a country's financial development is found to have statistically significant, at the 1% level, and positive impact on the country's conditional probability of exiting from a fixed exchange rate regime.

[13] The impact of one unit change in a covariate on the conditional probability of exits from fixed exchange rate regimes is measured by (hazard ratio – 1)100%. Because of limited data availability for some covariates, 111 spells were used in the estimation, of which 42 exit to flexible exchange rate regimes.

The higher a country's level of financial development is, the more likely it will exit from its fixed exchange rate regime, and hence the shorter the duration of its fixed exchange rate regime. Also, the magnitude of this impact is fairly large. A one percentage point increase in a country's financial development would increase the hazard rate by 2%. That is, if China had achieved the same level of financial development as that of the US, ceteris paribus, its hazard rate of exiting the fixed exchange rate regime in 2005 would have increased by a factor of 3.06 (that is, 306%). This finding thus lends another piece of supportive evidence to ABRR's hypothesis on the connection between financial development and exchange rate flexibility.

[Insert Table 5 about here]

As far as other control variables are concerned, we find that real GDP per capita growth (*rgdppcg*), CPI inflation (*infcpi*), openness to trade (*trade*), and OECD dummy (*oecd*) have systematic effects on the risk of exiting a fixed exchange rate regime. Countries with higher economic growth, lower inflation, or higher levels of trade openness have lower risks of exiting a fixed exchange rate regime, and thus a prolonged duration of a fixed exchange rate regime. Also, it turns out that OECD economies are more likely to successfully maintain their fixed exchange rate regimes.

4.2.2 Robustness checks on hazard models

In Table 6 we conduct various robustness checks on our duration models. In Column (1), we re-estimate the benchmark regression using the specification demonstrated in Equation (6) that allows for potential unobserved heterogeneity in the Cox model. Controlling for unobserved heterogeneity does not affect our main results as the estimated coefficient on financial development is still positive and significant at the 1% level, indicating that higher levels of financial development are associated with significantly higher conditional probability of exiting a fixed exchange rate regime. Moreover, the likelihood ratio test of unobserved heterogeneity has a test statistic of 0.3 with a p-value of 0.293, suggesting that we are not able to reject the null of no unobserved heterogeneity in the benchmark Cox regression and that all the explanatory variables have already captured the heterogeneity in the data.

[Insert Table 6 about here]

We then check whether our results from the hazard model still hold if we drop observations classified as freely falling or dual markets. Our results remain unaffected even after dropping those observations. In Column (2) of Table 6, the estimated coefficient on financial development stays positive and highly significant, suggesting that financial development significantly increases the risk of exiting from a fixed exchange rate regime, and thus reduces the duration of a fixed exchange rate regime.

Next, we include a five-year central bank governor turnover rate (*5ytor*), financial openness (*finopen*), and terms of trade growth (*totg*) as additional covariates to the benchmark Cox regression in Columns (3)-(5) of Table 6, respectively. The results obtained in these robustness checks are quite similar to those of the benchmark Cox regression. In all three columns, the estimated coefficients on financial development remain positive and statistically significant.

In Column (6) of Table 6, we investigate whether financial development has different effects in OECD and non-OECD countries by replacing the financial development variable with the interaction terms, *fd*oecd* and *fd*(1-oecd)*. The estimated coefficients on the two interaction terms suggest that financial development significantly shortens the duration of fixed exchange rate regimes in both country groups. In addition, a formal Wald test yields a χ^2 statistic of 0.09 and a p-value of 0.765, indicating that we are not able to reject the null that financial development has the same effect in these two country groups.

Finally, in the last column of Table 6, we assume discrete distribution for time and estimate a discrete hazard model described in Equation (5) with the benchmark specification. The estimation results are fairly consistent with those obtained from the continuous time Cox model. Again, financial development significantly increases the conditional probability of exiting a fixed exchange rate regime.

4.2.3 Results from competing risk models

We have now presented strong evidence that countries with higher levels of financial development are more likely to exit a fixed exchange rate regime and have shorter durations of a fixed exchange rate regime, but we would also like to examine whether financial development facilitates smooth exits from a fixed exchange rate regime or actually leads to disorderly exits.

To address this interesting question, we estimate a competing risks model which distinguishes orderly exits from disorderly exits and report the results in Table 7.[14] In the first panel of Table 7, we compare the effects of financial development on different exit outcomes in all countries. An examination on the estimated coefficients reveals a clear distinction in the effects of financial development on different exit outcomes. It turns out that the level of financial

[14] After fitting the competing risks model, we also test for proportionality of risks, that is, to verify whether the two exit types behave distinctly or simply incidental. The test statistic is constructed as: $LR = 2[\ln L^C - \ln L^S - N*\ln(N_o/N) - N_d*\ln(N_d/N)]$, where $\ln L^C$ is the sum of log-likelihoods from the two competing risks models, $\ln L^S$ is the long-likelihood from the overall risk model, N_o is the number of orderly exits, N_d is the number of disorderly exits, and $N = N_o + N_d$. The test statistic has a chi-square distribution with degree of freedom equal to the number of explanatory variables. In our case, since the computed test statistics have p-values less than 0.01, we can reject the null hypothesis of proportionality of risks at the 1% significance level. Details on the proportionality test can be found in Narendranathan and Stewart (1991, 1993).

development matters a lot to orderly exits but not to disorderly exits. With respect to the likelihood of orderly exiting to flexible exchange rate regimes, financial development is statistically significant at the 1% level and carries a positive sign. That is to say, the higher the level of financial development, the more likely a country will experience an orderly exit from its existing pegged system to a flexible exchange rate regime. On the other hand, financial development is found to have no statistically significant impact on the risk of disorderly exits.

[Insert Table 7 about here]

In Panel 2 of Table 7, we further distinguish the effects of financial development on different exit outcomes in two different country groups, OECD and non-OECD countries. We find that, in both country groups, financial development significantly increases the risk of orderly exits but has no significant effect on that of disorderly exits as the estimated coefficients on the two interaction terms, *fd*oecd* and *fd*(1-oecd)*, are positive and significant in the first column of Panel 2 but insignificant in the second column of Panel 2. Moreover, a Wald test further indicates that we are not able to reject the null that financial development has the same effect on the conditional probability of orderly exits in both country groups.[15]

As for control variables, we also observe some differences in terms of their influence on the risks of the two different exit types. First, interestingly, while reserve adequacy has no significant effect on orderly exits, it significantly lowers the probability of exiting disorderly from a fixed exchange rate regime in both panels of Table 7. Second, we find that country size has a positive and statistically significant effect on orderly exit but negative and insignificant effect on disorderly exits. Third, openness to trade is found to have a negative and significant

[15] For orderly exits, the Wald statistic is 0.55 with a p-value of 0.458. For disorderly exits, the Wald statistic is 0.53 with a p-value of 0.467.

effect on the likelihood of orderly exits but insignificant effect on the risk of disorderly exits. Finally, we also find that economic growth has strong negative effect on disorderly exits. The faster the domestic economy grows, the less likely a country will exit disorderly, and hence the longer it can sustain its fixed exchange rate regime. There is also some rather weak evidence that growth lowers the risk of orderly exits as well. Nevertheless, the estimated coefficient on growth is only marginally significant in the first column of Panel 1 and insignificant in the first column of Panel 2 despite a negative sign.

5. Dealing with potential endogeneity and sample selection issues

In this section, we further examine whether our results are sensitive to endogeneity and sample selection issues.

5.1 Endogeneity

One potential complication in studying the role of financial development in exchange rate regime choices is that financial development may be endogenous. Just as financial development may impact exchange rate regime choices, so might exchange rate regime choices cause financial development to change. As a matter of fact, Bordo and Flandreau (2003) show that the levels of financial development are higher in countries with flexible exchange rate regimes during the post-Bretton-woods period.[16] While we have used lagged financial development to alleviate the endogeneity problem in our previous analyses, here we employ an instrumental variable (IV) regression approach to formally address the endogeneity issue.

[16] The authors also find that countries that adhered to the gold standard during the classical gold standard period, 1880-1939, had higher levels of financial development.

So far we have used a binary choice model to examine the effect of financial development on the unconditional probability of adopting a fixed exchange rate regime and hazard models to study the impact of financial development on the hazard rate (i.e. conditional probability) of exiting to a flexible exchange rate regime. While correcting for endogeneity in the binary choice model can be easily done by estimating an IV probit model, dealing with endogeneity in the duration models, especially in the semi-parametric Cox model, remains a challenge for econometricians (e.g., Gowrisankaran and Town, 1999).[17] Here we follow Klein and Marion (1997) and parameterize the hazard model as a binary choice (probit) model. The dependent variable is a dummy that equals to 1 when exiting to a flexible exchange rate regime and 0 otherwise, and the length of time (in natural logarithm) a country has been in a fixed exchange rate regime ($ln(t)$) is used as an additional control variable. In doing so, we are still able to examine the probability of exiting to a flexible exchange rate regime conditional on the length of time a country has already been in a fixed exchange rate regime. Furthermore, this specification also allows us to address the endogeneity issue using an IV probit regression. In addition to the IV probit approach, we also linearize both the binary choice model and the hazard model and apply the 2SLS method to obtain some additional evidence.

The IV approach requires us to find good instrumental variables that are closely correlated with financial development but not correlated with exchange rate regime choices. Our choice of instruments is motivated by recent development in the law and finance literature that emphasizes the role of legal institutions in financial development determination. Specifically, we use a legal creditor rights index (*cr*) and a French legal origin dummy (*fren*) obtained from

[17] Gowrisankaran and Town (1999) linearize their hazard model and apply the 2SLS method to correct for endogeneity. They state that "the reason that we use a linear probability model instead of a more common specification for the hazard models is that it is extremely difficult to use nonlinear models such as these with endogenous variables."

Djankov, McLiesh, and Shleifer (2007) as instruments. The legal credit rights index covers the period 1978-2003 and ranges from zero to four with higher values indicating stronger creditor rights. On the one hand, studies in the law and finance literature have well documented that improvement in legal creditor rights significantly facilitates financial development while a French legal origin is associated with significantly lower levels of financial development.[18] On the other hand, legal origin is clearly exogenous, and there is no reason to expect that legal creditor rights have any direct effect on exchange rate regime choices (beyond its indirect impact via financial development) either.

Results from our IV estimations are presented in Table 8. Panels 1 and 2 report the effects of financial development on the unconditional probability of pegging and conditional probability of exiting from a fixed exchange rate regime, respectively. Controlling for the endogeneity of financial development does not alter our main results. No matter which model specification is used, IV probit or 2SLS, the estimated coefficient on financial development in the second-stage is always negative and significant in the unconditional probability regressions yet positive and significant in the conditional probability regressions. That is, countries with higher level of financial development are less likely to select fixed exchange rate regimes and, conditional on having been in a fixed exchange rate regime, they are more likely to exit. We also report the estimated coefficients on the two instrumental variables in the first-stage regressions. Both variables enter the first-stage regressions significantly at the 1% level with expected signs.[19] In particular, better creditor rights and non-French legal origins are associated with

[18] See, for example, La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997, 1998), Djankov , Glaeser, La Porta, Lopez-de-Silanes, and Shleifer (2003) and Djankov, McLiesh and Shleifer (2007).
[19] We also performed Sargan's over-identification tests and failed to reject the null hypothesis that the two instrumental variables are uncorrelated with the residuals. That is, our instruments are valid.

significantly higher levels of financial development, which is consistent with previous findings in the law and finance literature.

[Insert Table 8 about here]

Finally, we also test for the endogeneity of financial development and report the results in the last row of Table 8. It turns out that we are able to reject the null hypothesis of financial development being exogenous in the unconditional probability model at the 1% level but not in the conditional probability model. That is to say, financial development is indeed endogenous to a country's decision to adopt a fixed exchange rate regime while it is exogenous to a country's decision to exit to a flexible one once the country has already been in a fixed exchange rate regime.

5.2 Sample selection

Another econometric issue is that our previous duration analyses can potentially suffer from a classic sample selection problem as they only employ within-spell observations. To address this concern, here we again parameterize the hazard model as a probit model (with *ln(t)* included as an additional control) and apply Heckman's probit with sample selection method. Specifically, we consider the following statistical model:

$$EXIT_{iy} = \alpha' X_{iy} + U_{1iy}, \tag{7}$$

$$SPELL_{iy} = \beta' Z_{iy} + U_{2iy}, \tag{8}$$

where $U_1 \sim N(0,1)$, $U_2 \sim N(0,1)$, and $corr(U_1, U_2) = \rho$. Equation (7) is the outcome equation, and Equation (8) is the equation of selecting into a spell. Heckman (1979) shows that a direct estimation of equation (7) would produce biased estimates if ρ is nonzero. Since both equations have binary dependent variables, one can estimate them jointly by applying the full information maximum likelihood method to the full sample. The log-likelihood function can be written as:

$$L = \sum_{SPELL=0} \ln[1-\Phi(\beta' Z_{iy})] + \sum_{SPELL=1}^{EXIT=1} \ln[\Phi_2(\alpha' X_{iy}, \beta' Z_{iy}, \rho)] + \sum_{SPELL=1}^{EXIT=0} \ln[\Phi_2(-\alpha' X_{iy}, \beta' Z_{iy}, \rho)], \qquad (9)$$

where $\Phi_2(\bullet)$ is the cumulative bivariate normal distribution function with zero mean and $\Phi(\bullet)$ is the standard cumulative normal distribution function. The first term in the log-likelihood function is the probability of not being in a spell, and the last two terms are the probabilities of exiting and not exiting from a spell conditional on being in a spell, respectively.

Estimating Equation (9) requires that the selection equation should contain at least one variable not included in the outcome equation. We add a lagged floating exchange rate regime dummy (*lagfloat*) to the selection equation as an additional control for countries with a lagged floating exchange rate regime are more likely to maintain a floating exchange rate regime (thus less likely to enter a spell). The estimation results are provided in Table 9. Columns 1 and 2 show the results of the outcome equation and the selection equation, respectively. Our main results hold strongly even after correcting for sample selection. We find that the coefficient on financial development is negative and significant in the selection equation but positive and significant in the outcome equation, indicating that financially more developed countries are less likely to enter a fixed exchange rate spell in the first place and are more likely to exit from a fixed exchange rate regime to a floating one. Furthermore, as shown in the last row of Table 9, the χ^2 statistic, used to test for the presence of sample selection, is insignificant, suggesting no evidence for the existence of a sample selection problem in our previous duration analyses.

[Insert Table 9 about here]

6. Conclusions

This paper empirically examines the impact of financial development on a country's foreign exchange rate policy. As a first step, we employ logit models to study the influence of financial development on the unconditional probability of choosing fixed exchange rate regimes. We find strong evidence that a country's financial development is significantly and negatively associated with its choice of a fixed exchange rate regime. When the level of financial development is lower in a country, it is more likely to adopt a pegged exchange rate system.

In the second stage, we further explore the impact of financial development on the conditional probability of exiting from a fixed exchange rate regime by using hazard models. Our studies show that financial development indeed has statistically significant impact on the probability of exiting from a pegged system to a flexible one, conditional on the length of time a country has been in a pegged regime. In particular, the lower the level of financial development, the more likely a country will stay in its fixed exchange rate regime. Furthermore, using a competing risks model, our investigation finds that financial development has different effects on the risk of orderly exits from that of exiting disorderly exits. While higher financial development significantly raises the hazard of orderly exits, it does not have any significant impact on the hazard of disorderly exits at all. We also show that our results hold strongly even after controlling for endogeneity and sample selection.

All in all, we have presented strong and supportive evidence for ABRR's hypothesis that financial development plays a vitally important role in a country's choice of exchange rate regime and that a country with lower financial development should choose a fixed exchange rate regime. Our empirical evidence also yields two important policy implications for the selection of exchange rate regimes. One is that a country should take into consideration of its own financial development when making a decision about its exchange rate regime. The other is that countries can consider exiting from fixed exchange rate regimes when their financial markets are more developed.

Finally, our findings are also of interest to the history of exchange rate regimes literature. Two influential studies, Bordo (2003) and Bordo and Flandreau (2003) find that core advanced countries tended to adopt fixed exchange rate regimes during the Pre-WWI classical gold standard period but floating exchange rate regimes a century later. Also, in both eras, peripheral developing countries attempted to emulate the core countries. What caused the change? In their studies, the authors suggest that financial development is the driving force of the evolution of the international monetary system. In both eras, the exchange rate regimes adopted by the core countries require financial maturity. Moreover, developing countries today can successfully adopt a floating exchange rate regime only if they have reached a sufficiently high level of financial development. Therefore, given their findings, it would be interesting to put our results into historical perspective to study the linkage between exchange rate regimes and financial development under different historical backgrounds and economic environments, and to examine the role of financial development in the evolution of the international monetary system. While a thorough investigation is beyond the scope of this study, it certainly remains a fruitful area for future research.

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Appendices

I. Variable definitions and data sources

Variable	Definition	Data Source
ca	Current account balance, % of GDP	WDI
trade	Sum of imports and exports, % of GDP	WDI
resimp	Reserves to imports ratio, in percent	WDI
rgdppcg	Growth rate of real GDP per capita	WDI
infcpi	CPI inflation/(100+CPI inflation)	WDI
oecd	1 if OECD economy; 0 otherwise	WDI
totg	Growth rate of terms of trade, in percent	WDI
fd	Domestic credit to private sector, % of GDP	WDI
csize	Real GDP, % of U.S. real GDP	WDI
govgdp	Government expenditure , % of GDP	WDI
finopen	Index of financial openness	Chinn and Ito (2007)
5ytor	5-year central bank governor turnover rate	Dreher et al. (2008)
cr	Legal creditor rights index	Djankov et al. (2007)
fren	1 if French legal origin; 0 otherwise	La Porta et al. (1997, 1998)
fix	Fixed exchange rate regime dummy	Llzetzki et al. (2009)
exit	Dummy for exiting a spell	Llzetzki et al. (2009)
lagfloat	Lagged floating dummy	Llzetzki et al. (2009)

II. A list of countries included in the sample.

Albania	Ghana	Mauritania
Algeria	Greece	Mauritius
Argentina	Guatemala	Mexico
Armenia	Guinea	Moldova
Austria	Guinea-Bissau	Namibia
Azerbaijan	Guyana	Nepal
Barbados	Honduras	Netherlands
Belarus	Hong Kong	Nicaragua
Belgium	Hungary	Pakistan
Bolivia	Iceland	Paraguay
Brazil	Indonesia	Peru
Bulgaria	Iran	Philippines
Burundi	Israel	Poland
Cambodia	Italy	Portugal
Cameroon	Jamaica	Russia
Canada	Japan	Slovenia
Chile	Jordan	Spain
China	Kazakhstan	Sri Lanka
Colombia	Kenya	Suriname
Congo, Rep.	Korea	Sweden
Costa Rica	Kuwait	Switzerland
Cote D'Ivoire	Kyrgyz Rep	Syria
Croatia	Lao	Tajikistan
Czech Rep	Latvia	Tanzania
Denmark	Lebanon	Thailand
Dominican Rep	Liberia	Tunisia
Ecuador	Libya	Turkey
Egypt	Lithuania	Uganda
El Salvador	Macedonia	UK
Estonia	Madagascar	Ukraine
Finland	Malawi	Uruguay
France	Malaysia	US
Gambia	Mali	Venezuela
Germany	Malta	Zimbabwe

Table 1. Summary statistics of explanatory variables

Variable	No. of Obs.	Mean	Std. Dev.	Min.	Max.
fd	2053	47.145	39.882	0.963	232.203
ca	1895	-2.499	9.186	-240.496	56.698
trade	2082	68.556	39.148	8.248	371.536
resimp	2013	28.739	24.074	0.043	226.415
rgdppcg	2012	1.852	4.822	-54.113	31.845
infcpi	1974	0.113	0.142	-0.277	0.992
oecd	2186	0.306	0.461	0	1
csize	2085	4.598	13.947	0.002	100
govgdp	2061	15.392	6.337	2.900	76.222
5ytor	1761	0.244	0.247	0	1.6
totg	1276	-0.380	9.847	-74.144	52.030
finopen	2047	0.284	1.570	-1.798	2.540
cr	1647	1.786	1.189	0	4
fren	2184	0.577	0.494	0	1
fix	2186	0.675	0.468	0	1
exit	2186	0.025	0.155	0	1
lagfloat	2131	0.328	0.470	0	1

Table 2. Financial development by exchange rate regimes

Percentiles	Flexible	Fixed
1%	4.001	3.183
10%	9.306	10.902
25%	19.168	20.203
50%	34.560	33.977
75%	91.261	64.857
90%	137.762	92.224
99%	206.191	160.815
Mean	58.917	45.524
Std. Dev.	52.049	35.156

Notes: Freely falling and dual market are not included in calculation.

Table 3. Estimation results from a logit model: Benchmark specification

Explanatory Variable	Coefficient	Marginal Effect
Financial development (*fd*)	-0.008***	-0.002***
	(0.003)	(0.001)
Real GDP per capita growth (*rgdppcg*)	0.044***	0.009***
	(0.014)	(0.003)
CPI inflation rate (*infcpi*)	-7.285***	-1.523***
	(1.104)	(0.240)
Reserves to imports ratio (*resimp*)	-0.010***	-0.002***
	(0.004)	(0.001)
Government expenditure (*govgdp*)	-0.010	-0.002
	(0.013)	(0.003)
Country's relative size (*csize*)	-0.036***	-0.008***
	(0.009)	(0.002)
Openness to trade (*trade*)	0.014***	0.003***
	(0.002)	(0.0005)
Current account balance (*ca*)	-0.003	-0.001
	(0.008)	(0.002)
OECD economy dummy (*oecd*)	0.406**	0.083**
	(0.175)	(0.035)
No. of Obs.	1671	
Log Likelihood	-844.2402	
Wald Statistic	162.46***	
Pseudo R^2	0.1895	

Notes: Constants are included but not reported. Marginal effects are evaluated at the mean of covariates. Robust standard errors are reported in parentheses below. *, ** and *** indicate the significance levels of 10%, 5% and 1%, respectively.

Table 4. Estimated coefficients from logit regressions: Robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)
fd	-0.007***	-0.008***	-0.007***	-0.012***	-0.007**	
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	
fd*oecd						-0.009***
						(0.003)
fd*(1 - oecd)						-0.007**
						(0.003)
rgdppcg	0.043***	0.043***	0.048***	0.055***	0.041**	0.043***
	(0.015)	(0.015)	(0.016)	(0.014)	(0.019)	(0.014)
infcpi	-7.856***	-3.498***	-6.750	-6.420***	-7.759***	-7.315***
	(1.232)	(1.204)	(1.156)	(1.051)	(1.471)	(1.117)
resimp	-0.010**	-0.012***	-0.008**	-0.010***	-0.010***	-0.010***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
govgdp	-0.009	-0.003	-0.006	-0.011	-0.003	-0.011
	(0.013)	(0.015)	(0.013)	(0.013)	(0.017)	(0.013)
csize	-0.038***	-0.037***	-0.037***	-0.039***	-0.050***	-0.036***
	(0.009)	(0.009)	(0.001)	(0.009)	(0.008)	(0.009)
trade	0.014***	0.014***	0.013***	0.011***	0.009***	0.014***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ca	-0.003	-0.006	-0.002	-0.011	-0.02	-0.004
	(0.009)	(0.008)	(0.009)	(0.009)	(0.014)	(0.008)
oecd	0.357**	0.354*	0.533***	0.279	0.266	0.478*
	(0.179)	(0.203)	(0.183)	(0.179)	(0.207)	(0.274)
5ytor			0.291			
			(0.312)			
finopen				0.318***		
				(0.049)		
totg					0.008	
					(0.008)	
No. of Obs.	1671	1546	1488	1617	1149	1671
Log Likelihood	-832.6036	-763.3573	-787.6984	-799.4813	-614.3704	-844.1725
Wald Statistic	191.16***	151.34***	147.59***	207.52***	143.30***	161.71***
Pseudo R^2	0.2006	0.1384	0.1748	0.2104	0.1862	0.1895

Notes: Constants are included but not reported. Robust standard errors are reported in parentheses below. *, ** and *** indicate the significance levels of 10%, 5% and 1%, respectively.

Table 5. Cox proportional hazard model: Benchmark specification

	Coefficient	Hazard Ratio
fd	0.020***	1.020***
	(0.005)	(0.005)
rgdppcg	-0.129***	0.879***
	(0.042)	(0.037)
infcpi	2.394*	10.954*
	(1.335)	(14.621)
resimp	-0.007	0.993
	(0.008)	(0.008)
govgdp	-0.001	0.999
	(0.040)	(0.040)
csize	0.011	1.011
	(0.007)	(0.007)
trade	-0.020***	0.981***
	(0.007)	(0.007)
ca	-0.036	0.965
	(0.024)	(0.024)
oecd	-1.347**	0.260**
	(0.534)	(0.139)
No. of Obs.	1149	
No. of Spells	111	
No. of Exits	42	
Log Likelihood	-122.4663	
Wald Statistic	56.18***	

Notes: Robust standard errors are reported in parentheses below. *, ** and *** indicate the significance levels of 10%, 5% and 1%, respectively.

Table 6. Proportional hazard models: Robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
fd	0.021***	0.023***	0.019***	0.028***	0.024***		0.024***
	(0.007)	(0.005)	(0.005)	(0.006)	(0.005)		(0.006)
fd*oecd						0.022***	
						(0.007)	
fd*(1 - oecd)						0.019**	
						(0.008)	
rgdppcg	-0.133***	-0.114*	-0.135***	-0.150***	-0.182***	-0.129***	-0.134***
	(0.037)	(0.060)	(0.048)	(0.045)	(0.043)	(0.043)	(0.033)
infcpi	2.646*	2.230	2.047	1.906	1.133	2.394*	2.518*
	(1.547)	(2.314)	(1.372)	(1.397)	(1.445)	(1.340)	(1.451)
resimp	-0.007	-0.001	-0.009	-0.008	-0.011	-0.007	-0.008
	(0.009)	(0.010)	(0.009)	(0.008)	(0.009)	(0.008)	(0.008)
govgdp	0.006	-0.005	-0.003	-0.016	0.047	0.001	-0.009
	(0.041)	(0.063)	(0.044)	(0.045)	(0.036)	(0.044)	(0.039)
csize	0.011	0.018**	0.012	0.008	0.042	0.011	0.009
	(0.014)	(0.009)	(0.008)	(0.009)	(0.050)	(0.007)	(0.012)
trade	-0.020***	-0.019**	-0.023***	-0.021***	-0.022***	-0.019***	-0.021***
	(0.008)	(0.002)	(0.008)	(0.006)	(0.008)	(0.007)	(0.007)
ca	-0.038	-0.043	-0.033	-0.034	0.012	-0.035	-0.035*
	(0.031)	(0.029)	(0.026)	(0.025)	(0.031)	(0.025)	(0.020)
oecd	-1.466**	-1.309**	-1.434***	-0.992*	-1.174**	-1.592	-1.503***
	(0.626)	(0.616)	(0.544)	(0.539)	(0.545)	(1.079)	(0.571)
5ytor			0.360				
			(0.617)				
finopen				-0.293**			
				(0.137)			
totg					0.025		
					(0.021)		
No. of Obs.	1149	1133	985	1106	732	1149	1149
No. of Spells	111	109	96	110	78	111	111
No. of Exits	42	26	40	41	31	42	42
Log Likelihood	-122.3177	-70.3225	-111.6365	-111.7534	-74.8266	-122.4227	-143.7928
Wald Statistic	37.61***	61.36***	59.18***	58.10**	63.37***	60.22***	--

Notes: Robust standard errors are reported in parentheses. *, ** and *** indicate the significance levels of 10%, 5% and 1%, respectively. For discrete hazard model in column (7), constant and duration dummies are included but not reported.

Table 7. Estimation results from the Cox competing risks model

	(1)		(2)	
	Orderly Exits	Disorderly Exits	Orderly Exits	Disorderly Exits
fd	0.023*** (0.005)	0.011 (0.012)	--	--
fd*oecd			0.028*** (0.008)	-0.007 (0.015)
fd*(1 - oecd)			0.018** (0.008)	0.020 (0.014)
rgdppcg	-0.104* (0.061)	-0.095** (0.042)	-0.100 (0.063)	-0.090** (0.038)
infcpi	-1.452 (1.595)	1.344 (1.408)	-1.371 (1.589)	1.047 (1.503)
resimp	-0.002 (0.011)	-0.036* (0.019)	-0.001 (0.011)	-0.039** (0.019)
govgdp	-0.005 (0.061)	-0.002 (0.050)	0.003 (0.064)	-0.006 (0.049)
csize	0.020** (0.009)	-0.023 (0.020)	0.022** (0.009)	-0.012 (0.019)
trade	-0.018** (0.008)	-0.015 (0.013)	-0.017** (0.008)	-0.018 (0.011)
ca	-0.044 (0.031)	-0.026 (0.030)	-0.043 (0.031)	-0.015 (0.011)
oecd	-1.229** (0.682)	-1.106 (1.007)	-1.998 (1.405)	0.238 (1.179)
No. of Exits	26	14	26	14
Log Likelihood	-74.4013	-47.3479	-74.1434	-46.7798
Wald Statistic	52.28***	20.72**	55.86***	25.04***
LR Statistic (χ^2)	42.7977***		44.4387***	

Notes: LR statistics are associated with the test for proportionality of risks. Robust standard errors are reported in parentheses. *, ** and *** indicate the significance levels of 10%, 5% and 1%, respectively.

Table 8. Estimation results from instrumental variable (IV) approach

	(1)		(2)	
	Unconditional probability of pegging		Conditional probability of exiting	
	IV Probit	2SLS	IV Probit	2SLS
Second-stage:				
fd	-0.019***	-0.007***	0.026**	0.003*
	(0.005)	(0.002)	(0.013)	(0.002)
rgdppcg	0.028***	0.009***	-0.074***	-0.008***
	(0.009)	(0.003)	(0.024)	(0.002)
infcpi	-3.723***	-1.308***	1.404	0.190
	(0.533)	(0.153)	(1.005)	(0.153)
resimp	0.003	0.001	-0.007	-0.001
	(0.003)	(0.001)	(0.006)	(0.001)
govgdp	0.014	0.004	-0.014	-0.001
	(0.009)	(0.003)	(0.022)	(0.002)
csize	-0.013	-0.001	-0.002	0.002
	(0.010)	(0.002)	(0.031)	(0.003)
trade	0.012***	0.004***	-0.013***	-0.0009**
	(0.002)	(0.001)	(0.004)	(0.0005)
ca	0.009	0.002	-0.029***	-0.002*
	(0.007)	(0.002)	(0.009)	(0.001)
oecd	0.748***	0.236***	-1.105***	-0.113**
	(0.163)	(0.070)	(0.427)	(0.057)
***ln*(*t*)**			-0.228***	-0.022**
			(0.075)	(0.009)
First-stage:				
cr	4.135***	4.145***	2.725***	2.742***
	(0.735)	(0.768)	(0.906)	(0.924)
fren	-5.943***	-5.913***	-6.207***	-6.170***
	(1.796)	(1.923)	(2.239)	(2.307)
No. of Obs.	1339	1339	898	898
Wald statistic	283.50***	589.48***	73.00***	24.36***
Test of exogeneity (χ^2)	9.68***	1.154***	0.940	1.891

Notes: Constants are included but not reported. Robust standard errors are reported in parentheses. In the first-stage regression, legal creditor rights (***cr***) and French legal origin dummy (***fren***) are used as instruments for financial development (***fd***), and other control variables are included but not reported. Here ***t*** denotes the length of time a country has been in a fixed exchange rate regime. *, ** and *** indicate the significance levels of 10%, 5% and 1%, respectively.

Table 9. Estimation results from a probit model with sample selection

	Outcome equation	Selection equation
fd	0.011***	-0.003*
	(0.003)	(0.002)
rgdppcg	-0.064***	0.052***
	(0.020)	(0.015)
infcpi	2.012*	-1.109
	(1.030)	(0.823)
resimp	-0.003	0.0002
	(0.003)	(0.003)
govgdp	-0.006	-0.003
	(0.020)	(0.009)
csize	0.007	-0.009*
	(0.008)	(0.005)
trade	-0.009***	0.005**
	(0.003)	(0.002)
ca	-0.011	-0.002
	(0.010)	(0.008)
oecd	-0.703***	0.123
	(0.262)	(0.137)
***ln*(*t*)**	-0.134*	
	(0.078)	
lagfloat		-3.184***
		(0.133)
No. of Obs.	1671	
Log pseudolikelihood	-444.654	
Wald statistic	36.67***	
Test of independent equations (χ^2)	0.44	

Notes: The dependent variable in the selection equation is a dummy variable that equals to 1 if an observation is in a spell and 0 otherwise. The dependent variable in the outcome equation is a dummy variable that equals to 1 if a country exits from a fixed exchange rate regime to a flexible one and 0 otherwise. Constants are included but not reported. Robust standard errors are reported in parentheses. *, ** and *** indicate the significance levels of 10%, 5% and 1%, respectively.