

*On the determinants of fiscal stabilizations:  
Testing the war of attrition model*

by

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Abstract:

In this paper, we test the predictions of the war of attrition approach to delayed fiscal stabilizations. Specifically, we identify high deficit spells in the data and estimate duration models to test whether variables suggested by the war of attrition approach significantly affect the hazard function. In a variety of models, we consistently find strong support for what we consider to be the two major predictions of the war of attrition approach. First, we show that various measures of government fractionalization are significantly associated with longer delays in stabilizing high deficits. Second, we show that various measures of waiting costs are significantly associated with shorter delays in fiscal stabilization. We also find that fractionalization has a greater impact on delay in economies with slower GDP growth.

“You load 16 tons and what do you get? Another day older and deeper in debt.”

Merle Travis

A fundamental question in political economy is why socially beneficial policies are either not implemented or implemented only after a costly delay. Perhaps the dominant theoretical explanation for this phenomenon was given by Alesina and Drazen (1991), who argue that interest groups often fight a war of attrition over who will bear the costs of the reform or stabilization.

In this paper, we test the predictions of the war of attrition approach to delayed fiscal stabilizations in a large dataset with annual observations for 90 countries over the period 1975 to 2006. Understanding what determines the speed of fiscal stabilization is an especially relevant topic today, given the large number of countries currently facing high fiscal deficits.

Specifically, we identify high deficit spells in the data and estimate duration models to test whether variables suggested by the war of attrition approach significantly affect the hazard function. In a variety of models, we consistently find strong support for what we consider to be the two major predictions of the war of attrition approach. First, we show that various measures of government fractionalization are significantly associated with longer delays in stabilizing high deficits. Second, we show that various measures of waiting costs are significantly associated with shorter delays in fiscal stabilization. In sum, our work provides strong empirical support for the war of attrition approach.

We can also shed some light on how countries may differ in the length of time it takes to stabilize their deficits in the wake of the current crisis. For example, other factors held equal, the higher initial government debt (i.e. higher waiting costs) in Greece compared to the US implies that they are over 15% more likely to stabilize their deficit in 2010 than is the US. In a similar vein, the greater fractionalization of the Italian political system compared to the US system makes them, other relevant factors held constant, 12% less likely to stabilize the deficit in 2010 than is the US.

The rest of the paper is organized as follows. Section 2 is a review of the relevant theoretical and empirical literature. Section 3 describes our data, while section 4 explains the statistical methods we use in our analysis. Section 5 contains our main results and several robustness tests, and Section 6 summarizes our results and concludes.

## **2. Review of the Literature**

### ***2.1. The theoretical literature***

As noted above, despite the inefficiency and high costs associated with large unsustainable fiscal deficits, governments often delay socially beneficial and necessary fiscal stabilizations, which would have been adopted immediately by a social planner. In the new political economy literature, a reasonable theoretical explanation for this phenomenon is based on the public goods nature of a fiscal stabilization. While a fiscal reform can bring benefits to all interest groups, any individual group would prefer the other groups to bear the costs of reform. The conflicts between different interest groups over the distribution of the costs thus lead to socially undesirable delays.

The above idea was first formalized by Alesina and Drazen (1991). In this influential study, the authors argue that inefficient delays in socially beneficial fiscal reforms can be well modeled

as a war of attrition game. They consider an economy in which the government is running a positive budget deficit. Prior to a fiscal stabilization, government expenditures can only be financed by highly distortionary taxes (e.g., monetization) that are costly to both interest groups. A fiscal reform that brings the budget deficit to zero will benefit both groups by replacing highly distortionary taxes with non-distortionary ones. A key assumption of the model is that the increase in non-distortionary taxes is unequally distributed. Thus, while both groups agree on the need for a fiscal stabilization, they fight about the distribution of the tax burden. Under the assumption that a group does not know the relative bargaining strength of its opponent, the war of attrition between two interest groups will keep going till one party realizes that its rival has more at stake and concedes, resulting in delays in stabilizations, which, by assumption, can be implemented only under a political consensus.

The above model has two important predictions. First, it predicts that the more unequally distributed the relative burden of a fiscal stabilization, the longer the delay. The intuition behind this prediction is fairly straightforward as an unequal distribution of the relative tax burden increases the expected gain from holding out. Alesina and Drazen (1991) further suggest that the shares of the burden of a stabilization could be interpreted as reflecting the degree of political fractionalization in the society. According to the authors, countries with relatively equal distribution of the costs of reform can be viewed as politically more cohesive while countries with very unequal distribution of the burden are politically more fractionalized. The model thus implies that the delays in necessary fiscal stabilizations are longer in more politically fractionalized countries, which is one of the main hypotheses we test in this paper.

The idea that government characteristics play an important role in the delays of fiscal stabilizations is developed further by Spolaore (1993). Employing a similar war of attrition type

of model, Spolaore shows that a coalition government delays fiscal adjustment relative to a social planner when the economy is hit by a fiscal shock. Furthermore, he demonstrates that the length of the delay (thus the inefficiency associated with the delay) increases with the number of parties in the coalition.

The second important prediction of the Alesina and Drazen model, which we shall also examine in the empirical section of this study, is that an increase in the waiting costs associated with high deficits (e.g., an increase in the fraction of the prestabilization deficit financed by distortionary taxes or utility loss due to high inflation) to all parties will shorten the delays in stabilization. This idea is further elaborated by Drazen and Grilli (1993) and Hsieh (2000). Drazen and Grilli (1993) consider the role of economic crises, such as a sharp increase in inflation, in a similar war of attrition setup. They show that, by making holding out extremely costly to both parties in a war of attrition game, economic crises and emergencies hasten fiscal stabilizations and, thus, can be welfare-improving and socially desirable. Hsieh (2000) models the delay in stabilizations as the outcome of a bargaining game between two parties in which the distribution of the stabilization costs is endogenously determined. Hsieh further demonstrates that, in his bargaining game, a crisis that increases the costs from not stabilizing the economy will also facilitate stabilizations.

## ***2.2. Related empirical studies***

Given its importance in the new political economy literature, it is surprising that the war of attrition approach to explaining delays in fiscal stabilizations has yet to be formally tested. There are, however, some related empirical studies that have examined the role of politics in

contributing to high levels of budget deficits (government debts) in the first place.<sup>1</sup> Roubini and Sachs (1989a) regress budget deficit as a share of GDP on an index of political cohesion in a sample of 15 OECD countries over the period 1960-1986. They find that, compared to a presidential or one-party-majority government, coalition and minority governments are associated with a significantly higher deficit to GDP ratio. The authors also include an interaction term between their political cohesion index and the lagged deficit to examine the impact of weak governments on the persistence of deficits, which can be viewed as an indirect test of the above war of attrition models, and find the estimated coefficient on the interaction term positive yet insignificant. Roubini and Sachs (1989b) further show that, in addition to number of parties in the government, government ideology also plays a crucial role as countries with a higher proportion of left-of-center governments have higher levels of governments spending.

Grilli, Masciandaro, and Tabellini (1991), compare the political systems and government debts of 18 OECD countries. They show that political instability and proportionality of the electoral systems have significant impacts on the accumulation of government debts. In fact they find that almost all high debt episodes are found in countries with short-lived governments or highly proportional electoral systems that favor small political parties. The work of Roubini and Sachs (1989a, b) and Grilli, Masciandaro, and Tabellini (1991) is expanded by subsequent studies including Alesina and Perotti (1995), Corsetti and Roubini (1993), Edin and Ohlsson (1991), De Haan and Sturm (1994), and De Haan, Sturm, and Beekhuis (1999), and their results are broadly confirmed by these later studies.

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<sup>1</sup> See, among others, Alesina and Tabellini (1990), Persson and Svensson (1989), Persson and Tabellini (1990), and Tabellini and Alesina (1990) for theoretical studies on politics and high levels of deficits (debts).

The paper closest in spirit to ours is Alesina, Ardagna, and Trebbi (2006). They use the war of attrition approach to motivate their empirical study. They create panels where the dependent variable is the change in the deficit over some future horizon, and the independent variables are a dummy for deficit crises and the average value over that future horizon of one of a number of political indicators like presidential systems, election years, unified governments, and left leaning governments. They find that deficit crises and strong governments cause deficit reductions over future horizons to be significantly faster. While they show that a crisis makes future deficits fall faster, we ask a different question. We study the factors which determine the duration of high deficit spells.

In sum, evidence that politics have significant impacts on fiscal deficits (government debts) seems to be quite strong and robust, while to date there is no existing formal evidence on our question of interest: do politics affect the duration of delays in fiscal stabilizations?

### **3. The Data**

Our empirical study is based on a large dataset with annual observations for 90 countries over the period 1975 to 2006. The primary sources of our dataset include Database of Political Institutions (DPI) 2006, International Financial Statistics (IFS) published by the International Monetary Fund, and World Development Indicators (WDI) published by the World Bank. We provide detailed variable definitions and data sources and a list of the sampled economies in the Appendix tables. Summary statistics for our variables are available in Table 1.

#### ***3.1 Duration of delays in fiscal stabilizations***

Throughout this study, the duration of a delay in fiscal stabilization is defined as the time elapsed between the onset of an unsustainable high fiscal deficit spell and the start of fiscal reform to stabilize budget deficits. Here we define unsustainable high deficit spells based on the size of fiscal deficits as a share of GDP. A country enters a high deficit spell when there is an increase in its fiscal deficit and the deficit exceeds 3% of GDP and exits from the spell when a fiscal stabilization is initiated. Following Alesina and Perotti (1997), we define the start of a fiscal stabilization as the year in which fiscal deficits start falling by more than 1.5 percent of GDP; or the year in which the deficits start to fall, by at least 1.25 percent a year, for two consecutive years; or the year in which the deficits start to fall, by an average of around 0.5 percent a year, for five consecutive years. A country can re-enter a deficit spell after an exit event as long as it meets the above “entry” criterion. However, we exclude the stabilization events that occur within two years of a previous one. By doing so, we identify a total of 254 fiscal stabilization events within our sample.<sup>2,3</sup>

To gain some insights into the nature of the duration of fiscal stabilization delays, we graph the age distribution of the identified stabilization initiations in Figure 1 and the estimated Kaplan-Meier survival curve in Figure 2. Here age is defined as the number of years that a country stayed in a high deficit spell preceding a fiscal stabilization. For example, if a country enters a high deficit spell in year  $t$  and exits with a stabilization in year  $t+2$ , then the age of the stabilization initiation is 2 years. Each bar in Figure 1 represents the percentage of stabilizations started at a certain age. The survival rate depicted in Figure 2 is the probability of maintaining

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<sup>2</sup> In defining entry to a high deficit spell, we also used 2.5% and 3.5% as alternative threshold values. In doing so, we identified 261 and 226 fiscal stabilization events within our sample, respectively.

<sup>3</sup> Among the 254 identified events, 232 events meet the 1.5% reduction in fiscal deficit in one year exit criterion, 89 events meet the 1.25% reduction in two consecutive years criterion, and 77 events meet both criteria. There are 10 events that meet only the 0.5 reduction in five consecutive years criterion. We also tried to test our hypotheses using the 232 stabilization events identified by the dominant exit criterion. Our results hold strongly.



high fiscal deficits past certain time  $t$  or, equivalently, the probability of starting a fiscal stabilization in a country conditional on the country having maintained its high deficits until time  $t$ .

These graphs reveal some salient features about the duration of fiscal stabilization delays. First, the age distribution of fiscal stabilization initiation is highly peaked and skewed with a fat and long tail extending to the right.<sup>4</sup> Second, the survival rate drops dramatically within the first 5 years into a high deficit spell and then declines gradually thereafter. Third, the majority (75%) of the stabilization events occur within the first 4 years of a country entering a high deficit spell. The median and mean of the duration of delays are about 2 and 3.8 years, respectively.

### ***3.2 Measures of political fractionalization***

Another key variable in our study is the measure of political fractionalization. We use the fractionalization index (*frac*) obtained from the DPI2006 database as our primary measure of political fractionalization. This index is defined as the probability that two deputies chosen at random from the entire legislature belong to different parties. By construction, this index ranges from 0 to 1 with higher values indicate more parties (thus a higher degree of fractionalization) in the legislature.<sup>5</sup> For example, an index value of 0.5 indicates a perfectly balanced two-party system. To check the robustness of our estimation results, we also consider three alternative measures of political fractionalization in this study. The first one is the political constraint index (*polcon*) constructed by Henisz (2002), which measures the extent to which an executive or a legislature is constrained in his or her choice of future policies. Henisz identifies the number of independent branches of government with veto power in each country and derives a quantitative

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<sup>4</sup> Skewness and kurtosis tests strongly reject normality.

<sup>5</sup> In DPI2006, *frac* takes the value of one if the legislature is made up of all independents with no party affiliations. Simply dropping those observations does not affect our results.

measure of political constraints using a spatial model of political interaction. This measure is then modified to take into account the extent of alignment across branches of government and also the extent of within-branch preference heterogeneity. The final index ranges from zero to one, with a larger value reflecting a higher level of political constraints on an executive or legislature.<sup>6</sup> The second alternative measure is the political cohesion index (*cohesion*) proposed by Roubini and Sachs (1989a). Following their definition, we expand the index based on the information extracted from the DPI2006 database. This cohesion index runs from 0 to 3, and a higher value is associated with a larger size of governing coalition (thus a weaker government). The last alternative (inverse) measure of political fractionalization is a Herfindahl index of legislative concentration (*herftot*) obtained from the DPI2006 database. This variable is calculated as the sum of the squared seat shares of all parties in the entire legislature and its value varies from 0 to 1 with a higher value indicating a less divided government.

#### **4. Estimation Methodologies**

Our empirical analyses of the influence of government fractionalization on the duration of fiscal stabilization delay follows two steps. As a starting point, we first obtain some preliminary evidence by examining the effect of government fractionalization on the unconditional probability of initiating fiscal stabilizations using simple logit models. We then formally estimate the impact of political fractionalization on the length of delays in fiscal stabilizations (the probability of exiting a high deficit spell with a fiscal stabilization, conditional on being in the high deficit status until time  $t$ ) by using hazard-based duration models.

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<sup>6</sup> See Henisz (2002) for details on the construction of the political constraint index. The index is subsequently updated by the author to 2004.

#### ***4.1 Estimating the unconditional probability of fiscal stabilization***

If political fractionalization indeed causes delays in fiscal stabilizations, it would be natural to expect a negative association between the probability of fiscal stabilizations and fractionalization. Here we use a logit regression to model the relationship between political fractionalization and the likelihood of implementing a fiscal stabilization:

$$\Pr(FS_{iy} | X_{iy}) = \frac{\exp(X_{iy}\beta)}{1 + \exp(X_{iy}\beta)} \quad (1)$$

where  $FS_{iy}$  is an indicator that takes on the value of 1 when country  $i$  initiates a fiscal stabilization in year  $y$  and 0 otherwise,  $X_{iy}$  includes various explanatory variables, and  $\beta$  is a vector of coefficients associated with the explanatory variables. We are interested in the estimated coefficient on the variable of political fractionalization, which captures the effect of fractionalization on the probability of starting a fiscal stabilization. Note that, however, the probability studied here in the logit model is unconditional in the sense that the length of time a country has been in a high deficit spell is not taken into consideration.

#### ***4.2 Estimating the duration of delays in fiscal stabilizations***

Prior to the formal estimation of the duration of time delay to a fiscal stabilization, we first fit ordinary least-squares (OLS) linear regressions using the time delay ( $t$ ) and its log-transformed form ( $\ln(t)$ ) as dependent variables, respectively. Given the fact that OLS regressions cannot deal appropriately with right censoring issues common to duration studies and that the normality assumptions in OLS regressions are generally inappropriate for the distribution of duration, our OLS regressions here simply serve as preliminary analyses on the association between time delay and political fractionalization.

To directly investigate how the degree of government fractionalization and waiting costs affect the length of time delay to a fiscal stabilization, 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 high fiscal deficit spell. Since some countries have multiple high deficits spells during the sample period, we reset  $T=0$  whenever a country re-enters a high deficit spell.

Let  $F(t)$  denote the cumulative probability distribution function of  $T$ . The probability that a country stays in a high deficit spell longer than  $t$  is given by the survival function  $S(t) = 1 - F(t) = Pr(T > t)$ . The hazard function describes the conditional probability that a fiscal stabilization occurs at the interval of  $\Delta t$  given that a country remains in a high deficit spell until  $t$ . Following the notation of Kiefer (1988), the hazard function can be written as:

$$\lambda(t) = \lim_{\Delta t \rightarrow 0} \frac{Pr(t \leq T < t + \Delta t | T \geq t)}{\Delta t} \quad (2)$$

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

$$S(t) = \exp[-\Lambda(t)] = \exp[-\int_0^t \lambda(j) dj] \quad (3)$$

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

To examine the influence of government fractionalization on the duration of delays in fiscal stabilizations, we specify a proportional hazard (PH) function to model the probability of initiating a fiscal stabilization conditional on maintaining high deficits until period  $t$ :

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

where  $t$  is the number of years from the entry into a high deficit spell, and  $\lambda_0$  denotes the baseline hazard corresponding to zero values of explanatory variables for the hazard.  $X_{iy}$  is a vector of explanatory variables for country  $i$  in year  $y$ , and  $\beta$  is a vector of parameters to be estimated. While the baseline hazard is common to all observations, individual hazard functions vary proportionately according to the observed covariates ( $X_{iy}$ ).

To avoid placing any restrictions on the shape of the baseline hazard (and thus to allow for more flexibility in the 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 ( $\beta$ ), the partial effect of an individual variable ( $x_k$ ) on the hazard (i.e. the likelihood of starting fiscal stabilization) is thus measured by  $\exp(\beta_k) - 1$ . If the hypothesis proposed by Alesina and Drazen (1991) and Spolaore (1993) is correct, we would expect the estimated coefficient on our political fractionalization measure to be negative and significant, and the coefficients on the waiting costs variables to be positive and significant.

Since the Cox model assumes a continuous distribution for time, we also estimate a discrete proportional hazard model, developed under a discrete time framework, as a robustness check:

$$\lambda(t, x, \beta) = 1 - \exp(-\exp(\varphi + \sum_{t=2}^S \gamma_t D_{it} + x_{iy}' \beta)) \quad (5)$$

where  $\varphi$  is the intercept,  $D_{it}$  is a set of duration dummies, equal to 1 if year  $y$  is the  $t^{\text{th}}$  year since country  $i$  enters a high deficit spell, and  $\gamma$  and  $\beta$  are the coefficients to be estimated.<sup>7</sup> Here  $S$

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<sup>7</sup> See Cooper, Haltiwanger and Power (1999) and more recently Dunne and Mu (2008) for details.

denotes the longest spell duration, and  $D_{liy}$  is the omitted category. The marginal effect of an explanatory variable on the hazard is measured by  $\exp(-\exp(x'\beta)) \cdot \exp(x'\beta)\beta$ , and the sign on the estimated coefficient,  $\beta$ , gives the directional effect on the hazard function. A positive  $\beta$  means that the hazard increases in  $x$ .

In addition, we allow for potential unobserved heterogeneity in the Cox model. To control for unobserved heterogeneity in the Cox model, we introduce a multiplicative error term (frailty)  $\nu$  into the hazard function:

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

The frailty ( $\nu$ ) is assumed to be gamma distributed with mean one and variance  $\theta$ . Whether the unobserved heterogeneity is significant can be tested by the null hypothesis of  $\theta$  being zero. We allow the frailty to be shared within the same country.

## 5. Results

This section reports the estimation results from the logit model and also the duration models outlined in Section 4. We consider a variety of control variables. The first three control variables, initial government debt as a share of GDP at entry ( $debt0$ ), the change in inflation ( $dlinf$ ), and government expenditure to GDP ratio ( $govgdp$ ) as a measure of government size, are included to measure the waiting costs associated with delays in necessary fiscal stabilizations. A sharp increase in inflation due to monetization of high deficits leads to welfare loss in the society, and large budget deficits are particularly costly when the existing government debt is already at a high level. Furthermore, prior to a fiscal stabilization, higher government spending implies higher costly distortionary taxes. According to the war of attrition models of Alesina and

Drazen (1991), Drazen and Grilli (1993), and Hsieh (2000), higher waiting costs will shorten the length of delays in fiscal stabilizations. Therefore, positive and significant estimated coefficients on these variables can be viewed as strong empirical evidence supporting the above models. In addition, we also control for real GDP per capita growth rate (*rgdppg*) and trade to GDP ratio as a measure of trade openness (*trade*) in the logit and duration models.<sup>8</sup>

### ***5.1 Empirical Results from Logit Models***

In Table 2 we present the estimation results from logit models.<sup>9</sup> Our primary measure of political fractionalization, *frac*, is used in column (a) and three alternative measures are employed in columns (b) through (d). In general, we find that political fractionalization has statistically significant impact on the unconditional probability of a fiscal stabilization and that a higher level of political fractionalization is associated with a lower probability of stabilizing high fiscal deficits. In the four reported logit regressions, the measures of political fractionalization all have the expected signs and are statistically significant. This preliminary evidence from the logit regressions is thus consistent with the predictions of Alesina and Drazen (1991) and Spolaore (1993).

As for control variables, we find that the estimated coefficients on government debt as percent of GDP (*debt*) and government size are positive and significant at the 1% level in all regressions, indicating that, other relevant factors held constant, a fiscal stabilization is more likely to take place in the face of a higher level of government debt or a higher level of

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<sup>8</sup> All control variables, except initial debt, enter the regressions with one year lag.

<sup>9</sup> We use debt to GDP, instead of initial debt to GDP ratio at entry, in the logit models because the concept of entry into a high deficit spell is not well defined in a logit model that exams the unconditional probability of a stabilization.

government spending. This finding is also in line with the theoretical prediction that higher waiting costs shorten the delays in fiscal stabilization.

## ***5.2 Empirical Results from Duration Models***

Prior to the formal estimation of the hazard-based duration models, we report in Table 3 some preliminary results from OLS linear regression models using the length of duration ( $t$ ) and its log transformation ( $\ln(t)$ ) as dependent variables.<sup>10</sup> Note that in both cases the estimated coefficients on political fractionalization are positive and significant at the 1% level, indicating that a highly fractionalized government tends to delay fiscal stabilizations and thus leads to a longer duration of high deficit spell. We shall now turn to the formal investigation of the effect of political fractionalization on time delay to fiscal stabilization by using duration models.

### ***5.2.1 Results from the Cox models***

Table 4 presents the estimation results from the Cox proportional hazard model using different measures of political fractionalization. In Column (a), we use our primary measure of political fractionalization (*frac*) and control for initial debt at entry (*debt0*), increase in inflation (*dlnf*), government size (*govgdp*), real GDP per capita growth (*rgdppcg*), and trade openness (*trade*).<sup>11</sup> The evidence strongly supports the hypothesis that higher levels of political fractionalization lead to significantly longer delays in fiscal stabilizations. We find that the estimated coefficient on our primary measure of political fractionalization is negative and significant at the 5% level, meaning that a more fractionalized government is associated with a

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<sup>10</sup> Following Roubini and Sachs (1989a), we also examined the effect of political fractionalization on the persistence of fiscal deficits by including an interaction term of fractionalization and lagged deficits to a linear regression of fiscal deficits. Our results show that political fractionalization increases the persistence of fiscal deficits significantly and thus reduces the speed of adjustment of fiscal deficits.

<sup>11</sup> Because of the limited data availability for some covariates, 157 spells are used in the estimation of the baseline model. The shrinkage in sample size is largely caused by including initial debt as an explanatory variable. If we drop initial debt, we can estimate using 234 spells and our main results still hold.



lower (conditional) likelihood of initiating a fiscal stabilization and hence prolonged duration of delay. In particular, given an additional 0.1 increase in *frac*, the conditional probability of starting fiscal stabilization is expected to drop by over 6.55%.<sup>12</sup>

With respect to other covariates included in this benchmark model, initial debt at entry and increase in inflation are both found to have statistically significant and positive influences on the conditional probability of starting a fiscal stabilization. That is, higher debt levels at entry to a high fiscal deficit spell and sharper increases in inflation significantly raise the likelihood of implementing a fiscal stabilization and, as a result, shorten the delay. This finding thus lends strong support to another important prediction of the theory that higher waiting costs facilitate fiscal stabilizations. Other covariates are statistically insignificant at the conventional levels.

In Columns (b) through (d) of Table 4, we use three alternative measures of political fractionalization to check the robustness of our results. The estimation results from all three Cox models are very similar to those from the benchmark Cox model in Column (a) of Table 4. The more fractionalized a government is, the longer the delay. All three alternative fractionalization measures are statistically significant and carry the expected signs. The findings on the effects on time delay in stabilizations of initial debt and change in inflation also remain robust.

Furthermore, the estimated coefficient on government size is positive in all four regressions and is significant at the 5% level in Column (c), where the cohesion index is used as a measure of political fractionalization.

### 5.2.2 Additional Robustness checks

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<sup>12</sup> Here the marginal impact of an increase of 0.1 in *frac* on the conditional probability of starting fiscal stabilization is measured by  $[\exp(-0.6775*0.1) - 1]*100\%$ .

To further examine the robustness of our results, here we conduct a variety of additional sensitivity analyses by adding additional covariates, year dummies, using different criteria to define entry into a high deficit spell, and assuming discrete time distribution.

In Columns (a) and (b) of Table 5, we add two additional measures of waiting costs associated with failing to stabilize a high deficit, debt burden (*drb*) and change in real effective exchange rate (*reerg*), to the baseline Cox model, respectively.<sup>13</sup> Including these covariates comes at a cost of shrinking our usable sample, but does not change our main results. There is still strong evidence that political fractionalization leads to delays in fiscal stabilizations. These regressions also confirm the findings that high initial debt and fast acceleration of inflation significantly hasten fiscal stabilization. Government size is also positive in both regressions and is significant in Column (a). In addition, we find that, interestingly, while *reerg* is statistically insignificant, debt burden (*drb*) turns out to be positive and significant at the 10% level, suggesting that heavier debt burden raises governments' waiting costs and thus tends to bring the starting date of fiscal stabilization forward.

Next we add, in Column (c) of Table 5, checks and balances (*checks*) and also the percent of veto players who drop from the government in any given year (*stabs*) to control for the effect of the number of veto players on delays in stabilizations, and include an additional political variable (*state*) to control for whether state/province level governments are locally elected in Column (d) of Table 5.<sup>14</sup> Adding these additional political variables does not alter our results either. We still find supportive evidence for the hypotheses that political fractionalization significantly delays fiscal stabilizations and high waiting costs significantly hasten stabilizations.

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<sup>13</sup> Debt burden is measured as the previous year's debt (% of GDP) multiplied by the change in the difference between real interest rate and real GDP per capita growth rate.

<sup>14</sup> See Table A2 for detailed definition of *state*.

In addition, we also notice that *stabs* is positive and statistically significant while *state* is negative and significant. We consider these findings consistent with the conventional wisdom in the political economy literature that a status quo is more likely to be changed (namely, to end a high deficit spell with a fiscal stabilization in our case) when more veto players drop from a government or when state/province level governments are not directly locally elected.

To further control for the potential time trend common to all countries included in our sample, we add year dummies to the benchmark Cox model and show the estimation results in Column (e) of Table 5. Controlling for year dummies does not affect our main result as we still find significantly longer delays in countries with more fractionalized governments.

In the next two columns of Table 5, we re-estimate the benchmark Cox model with high deficit spells identified by alternative entry criteria. Now an entry is identified when there is an increase in fiscal deficit and the deficit exceeds 2.5% and 3.5% of GDP in Columns (f) and (g), respectively. The results are quite similar to those from the benchmark model in Column (a) of Table 4: fiscal stabilizations are more likely to be delayed in countries with more fractionalized governments or lower waiting costs.

Finally, in the last column of Table 5, we assume a discrete distribution for time and estimate a discrete hazard model with the benchmark specification. The estimation results are quite consistent with those obtained from the continuous Cox model. Again, political fractionalization is found to have statistically significant and negative effect on the conditional probability of starting a fiscal stabilization. That is to say, a country is more likely to delay its stabilization when its government is more fractionalized. As for other covariates, initial debt and

change in inflation remain positive and statistically significant while other variables stay insignificant as before.

All in all, the empirical results present above deliver a very consistent message that strongly supports the predictions of the theoretical models. That is, political fractionalization significantly delays necessary fiscal stabilizations while increases in waiting costs associated with high deficits significantly facilitate fiscal reforms.

### 5.2.3. Exploring potential interaction effects

Can the effect of political fractionalization on delays in fiscal stabilizations be contingent upon domestic economic conditions? To explore this potential interaction effect of fractionalization, we add an interaction term of political fractionalization and real GDP per capita growth to the baseline Cox model and report the results in Table 6. We find that, interestingly, while the estimated coefficient on the fractionalization variable (*frac*) per se still remains negative and significant at the 1% level, the estimated coefficient on the interaction term (*frac\*rgdppcg*) is positive and significant at the 5% level. This result suggests that the delay problem caused by political fractionalization is even worse in a recession (when real GDP per capita growth rate is negative) when government spending cuts and tax increases are particularly unpopular political actions. Our finding here is also consistent with that of previous studies (e.g. Roubini and Sachs, 1989a).<sup>15</sup>

### 5.2.4. Controlling for potential unobserved heterogeneity

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<sup>15</sup> Roubini and Sachs (1989a) include an interaction of political cohesion index and a recession dummy in their panel data linear regression of deficits and show that “coalition governments are prone to larger deficits in circumstances of highly adverse macroeconomic shocks.”

In this subsection, we re-estimate the four regressions in Table 4 using the specification demonstrated in Equation (6) to allow for potential unobserved heterogeneity in the Cox model. The results are reported in Table 7. Our two main findings still hold strongly. First, the estimated coefficients on our four political fractionalization measures are all found to be statistically significant with correct signs, indicating that higher levels of political fractionalization are associated with significantly longer delays in fiscal stabilizations. Furthermore, the estimated coefficients on initial debt, change in inflation, and government size are all positive and mostly significant, implying that higher waiting costs significantly shorten the delays in fiscal stabilizations. Finally, note that none of the likelihood ratio test statistics for the frailty tests reported in the third last row of Table 7 is significant, indicate that we are actually not able to reject null of no heterogeneity in the baseline Cox regressions, and all the explanatory variables have already captured the heterogeneity in the data.

## **6. Conclusion**

This paper tests the hypothesis that a more fractionalized government tends to delay a necessary and socially beneficial fiscal stabilization. By using hazard-based duration models that are typically utilized in clinical trials, we are able to directly examine the effect of political fractionalization on the length of time delay to a fiscal stabilization.

Based on a comprehensive dataset of 90 countries over the period 1975 to 2006, we first show that political fractionalization has statistically significant and negative impact on the unconditional probability of implementing fiscal stabilization. Our duration analyses then reveal that political fractionalization is indeed associated with prolonged delays in fiscal stabilizations. This finding is robust to alternative measures of political fractionalization, different model

specifications, and distributional assumptions about time. Our study thus lends strong support to the hypothesis initially proposed by Alesina and Drazen(1991).

Furthermore, we also find that the delay effect would be dampened when domestic economy is growing. In addition, we also show that fiscal stabilization is more rapid when the cost of delay is higher. That is, high initial debt stock at entry, acceleration of inflation and large government size all significantly reduce the length of time needed to exit a high deficit situation.

Thus, when considering the prospects for fiscal stabilization in wake of the recent global crisis, political fractionalized countries with lower growth, smaller government sectors and lower initial debt would be predicted to be the slowest to achieve stabilization. For the case of the US, being relatively non-fractionalized and having returned to growth indicate faster stabilization but its relatively small government size and initial debt level predict slower deficit reduction.

## Appendices

**Table A1. Countries Included in the Sample**

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Algeria	Finland	Namibia
Argentina	France	Nepal
Australia	Germany	Netherlands
Austria	Greece	New Zealand
Bahamas,	Guatemala	Nicaragua
Bahrain	Guyana	Oman
Barbados	Haiti	Panama
Belgium	Honduras	Papua New Guinea
Belize	Hungary	Paraguay
Bhutan	Iceland	Peru
Bolivia	India	Poland
Botswana	Indonesia	Portugal
Brazil	Iran	Rwanda
Bulgaria	Ireland	Seychelles
Burkina Faso	Israel	Sierra Leone
Burundi	Italy	Singapore
Canada	Japan	South Africa
Chad	Jordan	Spain
China, P.R.	Kenya	Sri Lanka
Colombia	Korea	Swaziland
Costa Rica	Kuwait	Sweden
Croatia	Latvia	Switzerland
Cyprus	Lesotho	Tanzania
Czech Republic	Malawi	Thailand
Dominican Republic	Malaysia	Togo
Ecuador	Maldives	Tunisia
Egypt	Mali	United Kingdom
El Salvador	Mauritius	United States
Ethiopia	Mexico	Venezuela
Fiji	Moldova	Zambia

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**Table A2. Variable Definitions and Data Sources**

Variable	Definition	Source
<i>frac</i>	The fractionalization of the government, measured as the probability that two deputies picked at random from the legislature will be of different parties.	DPI 2006 database
<i>polcon</i>	An index ranging from zero to one with a larger value reflecting a higher level of political constraints on an executive or legislature.	Henisz's POLCON 2005 dataset
<i>cohesion</i>	A measure of the degree of political cohesion of a national government: 0 if one-party majority parliamentary government or presidential government with the same party in the majority in the executive and legislative branch; 1 if coalition parliamentary government with 2 coalition partners or presidential government with different parties in control of the executive and legislative branch; 2 if coalition parliamentary government with 3 or more coalition partners; 3 if minority parliamentary government.	Authors' own calculation based on Roubini and Sachs' (1989) definition, and DPI 206 database
<i>herftot</i>	Herfindahl Index, calculated as the sum of the squared seat shares of all parties in the legislature	DPI 2006 database
<i>debt0</i>	Outstanding debt at the entry to an unsustainable fiscal deficit spell, % of GDP.	IFS
<i>debt</i>	Outstanding debt, % of GDP.	IFS
<i>dlinf</i>	The change in log-transformed GDP deflator inflation.	Authors' own calculation based on WDI
<i>rgdppcg</i>	Annual growth of real GDP per capita, PPP prices, Laspeyres index.	Penn World Table 6.3
<i>trade</i>	Sum of imports and exports, % of GDP	WDI
<i>govgdp</i>	Government expenditure, % of GDP	WDI



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<i><b>drb</b></i>	Debt burden, measured as the previous year's debt (% of GDP) multiplied by the change in the difference between real interest rate and real GDP per capita growth rate.	IFS, Penn World Table 6.3, and WDI
<i><b>reerg</b></i>	The percentage change in real effective exchange rate (CPI based, 2000=100).	IFS
<i><b>checks</b></i>	The number of veto players in the legislature.	DPI 2006 database
<i><b>stabs</b></i>	The percent of veto players who drop from the government in a year. A higher percent indicates a higher extent of turnover of a government's key decision makers.	DPI 2006 database
<i><b>state</b></i>	A measure of whether state/provincial governments are locally elected: 0 if neither state/provincial executive nor legislature is locally elected; 1 if the executive is appointed, but the legislature elected; 2 if they are both locally elected.	DPI 2006 database

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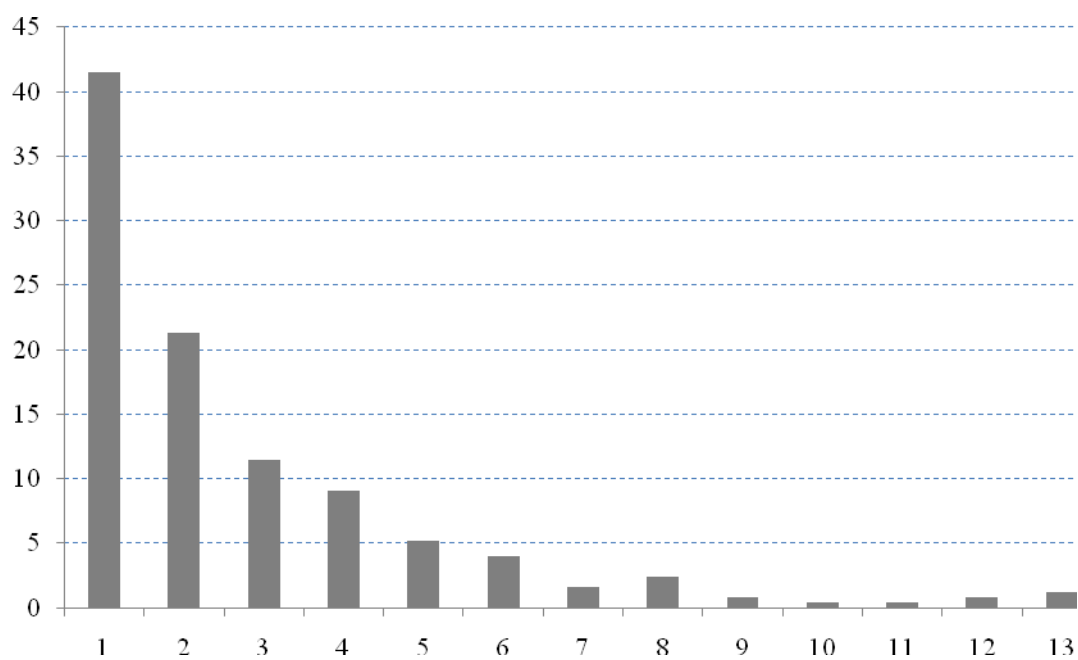
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**Figure 1. Age Distribution of Fiscal Stabilization Initiations**

Note: The horizontal axis indicates the age, in years, of a fiscal stabilization initiation (i.e. the length of time delayed to starting a fiscal stabilization). The vertical axis indicates the percentage of fiscal stabilization initiations that occur at each age. Only completed spells are plotted.

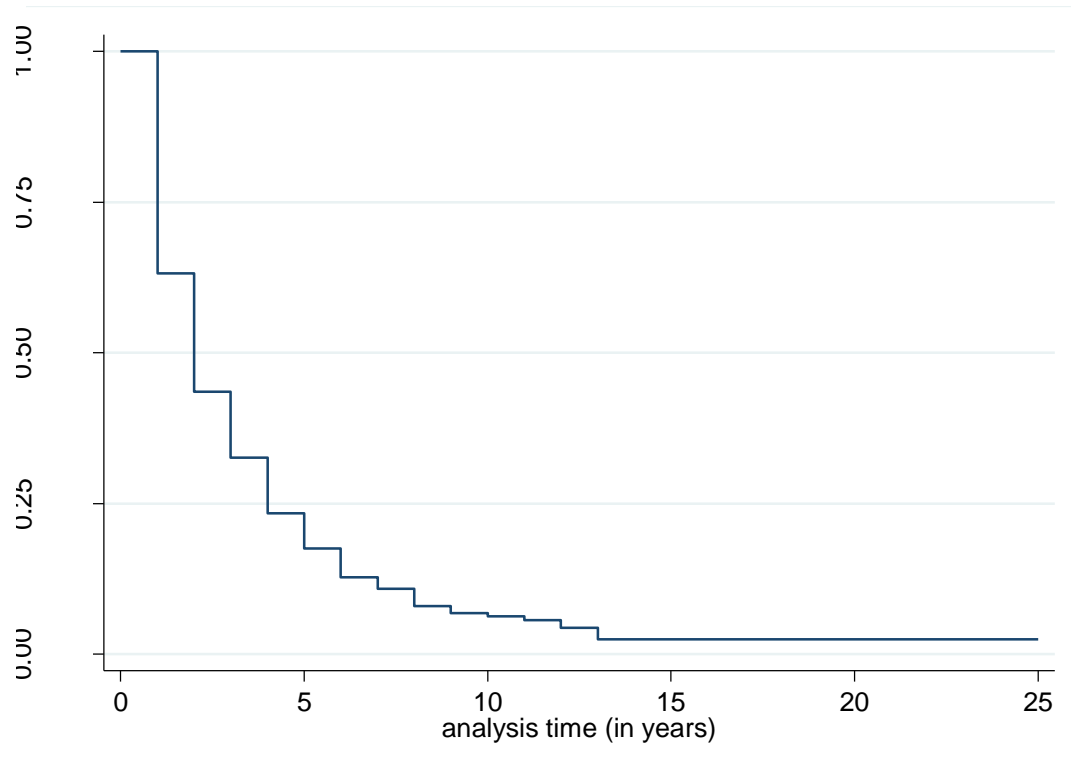
**Figure 2. Estimated Kaplan-Meier Survival Functions**

Table 1. Descriptive Statistics of Variables

<b>Variable</b>	<b>Obs</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min.</b>	<b>Max.</b>
<i>frac</i>	2454	0.53	0.28	0.00	1.00
<i>polcon</i>	2463	0.28	0.22	0.00	0.71
<i>cohesion</i>	2421	0.71	0.89	0.00	3.00
<i>herftot</i>	2454	0.47	0.28	0.00	1.00
<i>debt0</i>	1193	57.02	67.84	0.80	585.30
<i>debt</i>	1624	55.44	61.53	0.00	615.17
<i>dlinf</i>	2628	0.00	0.23	-3.63	3.09
<i>rgdppcg</i>	2806	1.87	5.86	-42.90	69.33
<i>trade</i>	2684	74.79	44.27	9.01	444.32
<i>govgdp</i>	2656	16.25	6.28	2.9	76.22
<i>drb</i>	1261	19.60	2175.47	-35415.00	42254.64
<i>reerg</i>	1423	-1.15	34.38	-1166.50	218.86
<i>checks</i>	2680	2.78	1.76	1.00	18.00
<i>stabs</i>	2606	0.13	0.28	0.00	1.00
<i>state</i>	2141	0.88	0.84	0.00	2.00

**Table 2. Logit Estimation of the Unconditional Probability of Fiscal Stabilizations**

	(a)	(b)	(c)	(d)
<i>frac</i>	-0.9242** (0.3673)			
<i>polcon</i>		-1.2585*** (0.4462)		
<i>cohesion</i>			-0.1747* (0.1024)	
<i>herftot</i>				0.9487*** (0.3703)
<i>debt</i>	0.0046*** (0.0013)	0.0042*** (0.0013)	0.0046*** (0.0013)	0.0046*** (0.0013)
<i>dlinf</i>	1.4494 (0.9578)	1.6335* (0.9154)	1.0665 (0.9500)	1.4468 (0.9574)
<i>govgdp</i>	0.0572*** (0.0170)	0.0543*** (0.0166)	0.0564*** (0.0175)	0.0571*** (0.0171)
<i>rgdppcg</i>	0.0080 (0.0164)	-0.0041 (0.0133)	0.0066 (0.0212)	0.0080 (0.0164)
<i>trade</i>	-0.0018 (0.0022)	-0.0022 (0.0022)	-0.0014 (0.0022)	-0.0019 (0.0022)
<i>No. of Obs.</i>	1205	1201	1157	1205
<i>Log pseudo-likelihood</i>	-384.1346	-385.6533	-374.1477	-384.0416

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

Table 3. Pooled OLS Estimation of the Length of Delay of Fiscal Stabilization

	Dependent Variable	
	(a) $t$	(b) $\ln(t)$
<i>frac</i>	1.9002*** (0.4516)	0.4772*** (0.1284)
<i>debt0</i>	-0.0045*** (0.0015)	-0.0017*** (0.0005)
<i>dlinf</i>	-0.6414 (0.8870)	0.0098 (0.2688)
<i>govgdp</i>	-0.0221 (0.0215)	-0.0076 (0.0066)
<i>rgdppcg</i>	0.0275 (0.0285)	0.0080 (0.0087)
<i>trade</i>	-0.0060* (0.0033)	-0.0015 (0.0009)
<b>No. of Obs.</b>	462	462
<b><math>R^2</math></b>	0.2055	0.1981
<b><math>F</math> statistic</b>	3.79***	4.44***

Notes: Here  $t$  denotes the length of delay (in years). Constant and year dummies are included but not reported. Robust standard errors are reported in parentheses. \*\*\*, \*\* and \* indicate the significance levels of 1%, 5% and 10%, respectively.



**Table 4. Estimation Results from the Cox Proportional Hazard (PH) Models**

	(a)	(b)	(c)	(d)
<i>frac</i>	-0.6775** (0.2985)			
<i>polcon</i>		-0.8919** (0.3990)		
<i>cohesion</i>			-0.2417** (0.1013)	
<i>herftot</i>				0.6840** (0.3012)
<i>debt0</i>	0.0028*** (0.0007)	0.0022*** (0.0008)	0.0024*** (0.0008)	0.0028*** (0.0007)
<i>dlinf</i>	1.1928*** (0.2734)	1.2101*** (0.2852)	0.9372*** (0.2535)	1.1905*** (0.2736)
<i>govgdp</i>	0.0262 (0.0163)	0.0244 (0.0165)	0.0332** (0.0167)	0.0261 (0.0163)
<i>rgdppcg</i>	0.0019 (0.0170)	0.0029 (0.0163)	-0.0070 (0.0160)	0.0018 (0.0170)
<i>trade</i>	0.0021 (0.0021)	0.0029 (0.0020)	0.0030 (0.0021)	0.0021 (0.0021)
<b>No. of Obs.</b>	462	446	445	462
<b>No. of Spells</b>	157	157	153	157
<b>No. of Exits</b>	140	141	136	140
<b>Log pseudo-likelihood</b>	-551.7521	-554.8372	-533.2019	-551.7550
<b>Wald <math>\chi^2</math></b>	64.97***	54.75***	70.29***	64.97***

Notes: Estimated coefficients are reported and robust standard errors are reported in the parentheses below. \*\*\*, \*\* and \* indicate the significance levels of 1%, 5% and 10%, respectively. The Efron approximation (Efron, 1977) is applied to handle tied failures in the Cox model.

**Table 5. Robustness Checks on the Proportional Hazard Model**

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
<i>frac</i>	-0.8167** (0.3263)	-1.2068*** (0.4744)	-0.7099** (0.3555)	-0.7724** (0.3248)	-0.6634** (0.3242)	-0.7904** (0.3099)	-6073** (0.3003)	-0.6674** (0.3246)
<i>debt0</i>	0.0032*** (0.0008)	0.0022** (0.0009)	0.0027*** (0.0008)	0.0028*** (0.0008)	0.0030*** (0.0009)	0.0030*** (0.0007)	0.0026*** (0.0008)	0.0037*** (0.0012)
<i>dlinf</i>	4.1747*** (1.3475)	3.3055*** (1.1900)	1.2759*** (0.2747)	1.2979*** (0.2826)	1.4321*** (0.4469)	2.2550** (0.9408)	1.1141*** (0.2533)	2.8979** (1.1951)
<i>govgdp</i>	0.0319* (0.0175)	0.0048 (0.0209)	0.0269 (0.0167)	0.0328* (0.0196)	0.0175 (0.0187)	0.0268* (0.0156)	0.0181 (0.0173)	0.0257 (0.0161)
<i>rgdppcg</i>	0.0242 (0.0249)	-0.0010 (0.0247)	0.0043 (0.0170)	0.0131 (0.0187)	0.0160 (0.0205)	-0.0068 (0.0185)	0.0026 (0.0176)	0.0054 (0.0196)
<i>trade</i>	0.0023 (0.0023)	0.0024 (0.0022)	0.0021 (0.0020)	0.0015 (0.0021)	0.0023 (0.0023)	0.0016 (0.0021)	0.0017 (0.0023)	0.0030 (0.0022)
<i>drb</i>	0.00005* (0.00003)							
<i>reerg</i>		0.0069 (0.0111)						
<i>checks</i>			-0.0635 (0.0612)					
<i>stabs</i>			0.6145** (0.2576)					
<i>state</i>				-0.2315** (0.1116)				
<b>No. of Obs.</b>	367	254	475	385	462	501	377	462
<b>No. of Spells</b>	130	90	154	132	157	160	137	---
<b>No. of Exits</b>	110	81	132	119	140	141	123	---
<b>Log pseudo-likelihood</b>	-400.3203	-262.9188	-517.7568	-439.1742	-525.4056	-559.5359	-469.0596	-265.2377
<b>Wald <math>\chi^2</math></b>	76.91***	48.93***	79.43***	65.46***	129.34***	49.37***	56.65***	---

Notes: Estimated coefficients are reported and robust standard errors are reported in the parentheses below. \*\*\*, \*\* and \* indicate the significance levels of 1%, 5% and 10%, respectively. The Efron approximation (Efron, 1977) is applied to handle tied failures in the Cox model. Year dummies are included in Column (e) but not reported. Duration dummies are included in the discrete time proportional hazard model but not reported.

**Table 6. Estimated Nonlinear Effects of Political Fractionalization on Delays**

<i>Variables</i>	<i>Coefficient</i>
<i>frac</i>	-0.7966*** (0.3001)
<i>frac*rgdppcg</i>	0.1112** (0.0452)
<i>debt0</i>	0.0027*** (0.0008)
<i>dlinf</i>	1.4293*** (0.2700)
<i>govgdp</i>	0.0256 (0.0160)
<i>rgdppcg</i>	-0.0511* (0.0267)
<i>trade</i>	0.0019 (0.0021)
<b>No. of Obs.</b>	462
<b>No. of Spells</b>	157
<b>No. of Failures</b>	140
<b>Log pseudo-likelihood</b>	-549.2987
<b>Wald <math>\chi^2</math></b>	79.14***

Notes: Estimated coefficients are reported and robust standard errors are reported in the parentheses below. \*\*\*, \*\* and \* indicate the significance levels of 1%, 5% and 10%, respectively. The Efron approximation (Efron, 1977) is applied to handle tied failures in the Cox model.

Table 7. Allowing for Unobserved Heterogeneity in the Cox Models

	(a)	(b)	(c)	(d)
<i>frac</i>	-0.6803** (0.3429)			
<i>polcon</i>		-0.8919** (0.4093)		
<i>cohesion</i>			-0.2545** (0.1078)	
<i>herftot</i>				0.6859** (0.3464)
<i>debt0</i>	0.0030*** (0.0010)	0.0022** (0.0009)	0.0029*** (0.0011)	0.0030*** (0.0010)
<i>dlinf</i>	1.2047*** (0.4560)	1.2401*** (0.4055)	0.9199* (0.4877)	1.2020*** (0.4555)
<i>govgdp</i>	0.0289* (0.0172)	0.0244 (0.0157)	0.0380** (0.0182)	0.0288* (0.0172)
<i>rgdppcg</i>	0.0044 (0.0171)	0.0029 (0.0160)	0.0010 (0.0171)	0.0043 (0.0170)
<i>trade</i>	0.0020 (0.0024)	0.0029 (0.0022)	0.0028 (0.0025)	0.0019 (0.0024)
<b>No. of Obs.</b>	462	446	445	462
<b>No. of Spells</b>	157	157	153	157
<b>No. of Exits</b>	140	141	136	140
$\chi^2(\mathbf{H}_0: \boldsymbol{\theta} = \mathbf{0})$	0.45	0.00	0.99	0.44
<b>Log pseudo-likelihood</b>	-551.5256	-554.8372	-532.7094	-551.5375
<b>Wald <math>\chi^2</math></b>	24.24***	27.96***	24.46***	24.26***

Notes: Estimated coefficients are reported and standard errors are reported in the parentheses below. \*\*\*, \*\* and \* indicate the significance levels of 1%, 5% and 10%, respectively. The Efron approximation (Efron, 1977) is applied to handle tied failures in the Cox model.