

Politicians, Uncertainty and Reforms*

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Abstract

How does uncertainty affect the incentives of office motivated politicians to invest in costly reforms that pay out in the future? What are the implications for welfare and for the design of optimal political institutions? We address these questions in a citizen-candidate model where political ability is ex-ante unknown and investment in reforms is unobservable. Elections allow to keep well-performing politicians, but politicians make too little reforms in an attempt to signal high ability and hence influence their reappointment probability. Our analysis delivers a number of novel results. Similarly to the existing literature, incumbent governments have too weak an incentive to invest in reforms. Contrary to the conventional wisdom, however, we find that uncertainty makes reforms politically more viable. Due to this effect, uncertainty can in some cases increase social welfare. Second, we use the model to study the effect of imposing a one-term limit and to characterize the optimal level of political compensation. We find that a one-term limit promotes reforms, but it is welfare reducing when political ability is sufficiently heterogenous. High rewards, instead, attract candidates with a higher expected ability into politics, but worsen their incentive to invest in reforms. Since uncertainty reduces the downward bias in reforms, it also increases the optimal political reward. Finally, we discuss existing empirical support for the model and provide new evidence that economic volatility promotes reforms in a panel of 20 OECD countries.

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1 INTRODUCTION

Among the fundamental questions in political economy are why governments often fail to adopt reforms that are widely believed to be welfare-improving and what conditions make the adoption of such reforms more likely. For example, while most observers tend to agree that reforms aimed at promoting product market competition, providing free access to markets and reducing public debt are often essential to preserve economic growth, the extent to which such measures are adopted varies enormously across countries. The existing literature has identified several explanations for an anti-reform bias in policy making. Among the most popular ones are the political power of interest groups who may lose from reforms (e.g., Grossman and Helpman, 2001) and uncertainty about the distribution of gains and costs (e.g., Fernandez and Rodrik, 1991). It has also been argued, both in theory and in empirical work, that economic conditions and particularly crisis may affect both the reelection prospect of incumbent policy makers and the constraints that they face in choosing reforms (e.g., Alesina et. al. 2006).

In this paper, we provide a new model of politicians and elections that emphasizes the role of uncertainty as a key determinant of the choice of reforms. Similarly to the literature, our model suggests that incumbent governments may have too weak an incentive to invest in reforms. Contrary to existing works, however, we find that uncertainty is likely to make reforms politically more viable. We then explore the implications of our mechanism for social welfare and discuss normative aspects.

Our theory builds on the premise that reforms may entail an electoral cost to incumbent politicians undertaking them. The basic idea is that the cost of reforms (e.g., higher taxes) is immediately observable by voters, while their actual implementation and payoffs often are not. In such a situation, the incumbent may not dare to embark in welfare increasing reforms for the fear of loosing votes and hence office. This bias against reforms holds even when citizens are fully rational and aware of political incentives, provided that two conditions are satisfied. First, ability of politicians should not be directly observable to voters, so that it must be inferred on the basis of performance. Second, there must be an informational asymmetry between citizen and the incumbent so that the actual investment in reforms with future returns should not be observed by voters. These assumptions immediately generate a “political cost” of reforms: there is an incentive to invest less in reforms in an effort to signal high ability and thus increase the reelection probability. It is important to emphasize that this result does not require myopic behavior by any agent. In equilibrium, expectations are rational so that voters correctly foresee the strategy of the incumbent and his expected ability conditional on observed performance. Yet, the choice to underinvest is still sustained by hidden information out of equilibrium: the fact

that the politician can deviate from his equilibrium strategy in ways unknown to voters.¹

Interestingly, the “political cost” of reforms depends crucially on the sources of uncertainty affecting the precision of information. If observable measures of performance are poor signals of ability, for instance because the economy is going through a period of high turbulence, voters endogenously assign low weight to performance when deciding whether to reelect the incumbent or not. This reduces the electoral cost of investing in reforms (at the expenses of current performance) perceived by the policy makers. Thus, perhaps surprisingly, the type of uncertainty highlighted in this paper promotes unambiguously the adoption of efficient reforms. Despite this, the welfare effects are less clear-cut because of a second effect: uncertainty worsens electoral selection and lowers the expected ability of reelected politicians. We provide a simple condition for welfare to increase (decrease) with various forms of uncertainty.

The high tractability of our model allows us to develop a number of interesting extensions. We start by showing that the main results are robust to alternative assumptions about the incumbent’s knowledge of his own political ability. Then, we use the model to answer two substantive normative questions. First, since the political cost of reforms arises because incumbents care about reelection, we ask under what conditions imposing a one-period term limit may be welfare improving. We find that a term limit promotes reforms, but it is welfare reducing when political ability is sufficiently heterogeneous. Second, we extend the model to study the role of political rewards. On one hand, in our theory the political cost of reforms is proportional to the value of holding office and thus to the generosity of the explicit and implicit rewards granted to elected politicians. On the other, a large literature emphasizes that political rewards are important for attracting talented agents into politics. By incorporating the latter mechanism, we can use our model to characterize the optimal level of political compensation and what it depends upon. We find that the socially optimal political reward should be higher when underinvestment is less severe, i.e., in countries where there is less transparency, economic performance is more volatile and where ability is more dispersed.

Finally, the last part of the paper is devoted to discussing the empirical relevance of our theory. First, we review existing evidence in favor of both the assumptions and implications of the model. Second, we provide a first attempt at testing one of the key results: that economic uncertainty increases the likelihood and size of reforms. Using data for a panel of 20 OECD countries observed over the period 1975-2000 and indicators of trade-policy and fiscal-policy reforms, we find that tariff and deficit cuts are more likely to be

¹Glaeser, Ponzetto and Shapiro (2005) shows how a similar mechanisms may explain strategic extremism in a model where policy statements are not directly observable and parties compete for voters.

undertaken and are larger in magnitude during periods of high economic volatility. These results are robust to the inclusion of country-fixed effect and hold after controlling for economic crises and other political variables. While preliminary, this evidence lends support to our theoretical model and we hope it will motivate more extensive investigations.

The conflict of interest between voters and politicians is an old theme in a vast literature.² Our paper builds on agency models where the role of elections is to select the most competent politician. This approach has been used extensively (e.g. see Nordhaus, 1975, Alesina, 1987, Rogoff and Sibert, 1988, Rogoff, 1990, Persson and Tabellini, 1990, Lohman, 1998 and Drazen, 2000a) to explain political business cycles, i.e., the incentive incumbents may have to perform well before elections so as to appear talented to the voters. Despite many similarities, these papers do not study the role of uncertainty and economic shocks on political incentives to undertake reforms. Contrary to the literature on electoral accountability, initiated by Barro (1973), we abstract from the disciplining role of elections. Recent contributions by Alesina and Tabellini (2007, 2008) compare models of electoral accountability and career-concerns to study how the optimal accountability mechanism depends on the characteristics of policy tasks. The effect of political competition and compensation in selecting politicians (both before and after elections) has been studied by Caselli and Morelli (2004), Besley (2004), Besley (2005), Besley and Smart (2007) Mattozzi and Merlo (2008). Once again, none of these papers focuses on uncertainty and on the choice of reforms.

Prominent contributions on the political economy of reforms in the presence of uncertainty are Fernandez and Rodrik (1991), Ciccone (2004), Cukierman et al. (1992), Alesina and Drazen (1991). The influential paper by Fernandez and Rodrik (1991) has shown how uncertainty regarding the distribution of gains and losses may lead to a *status quo bias*. Alesina and Drazen (1991) have instead shown that reforms may be postponed due to a war of attrition. Drazen (2000b) discusses why reforms may be more likely in periods of crisis. Alesina and Cukierman (1990), instead, have shown that uncertainty allows the politicians to follow their most preferred policy, even at the expenses of voters. Similarly to these paper, we find that politicians may have a bias against adopting reforms. Yet, to our knowledge, the result that uncertainty *lowers* the political cost of reforms is entirely novel. Finally, a recent and growing literature on institutional change has emphasized that (adverse) economic shocks may speed up the transition towards more democratic political regimes (see for example the seminal work by Acemoglu and Robinson, 2001 and 2006, and the evidence in Brückner and Ciccone, 2009). Differently from these papers, however, we restrict attention to economic reforms in representative democracies only.

²Persson and Tabellini (2000) provide an excellent introduction to this literature.

Finally, the general insight that uncertainty may improve the equilibrium along some dimensions in agency models has been explored in Dewatripont, Jewitt and Tirole (1999), Holmström (1999), and Prat (2005), among others. Yet, the fact that uncertainty may improve welfare by stimulating the adoption of reforms with future payoffs has not been made in the literature and appears of first order relevance to understand the political economy of reforms.

The rest of the paper is organized as follows. Section 2 builds a two-period model of elections where an incumbent must choose how much to invest in reforms with future payoffs. It derives the main results of the paper: reforms entail a political cost and uncertainty may reduce it. Section 3 explores the robustness of the main results, studies the welfare effect of imposing a one-period term limit and shows how to use the model to build a theory of optimal political rewards. Section 4 discusses the existing evidence in support of the model and presents a novel test of a key prediction: in a panel of OECD countries, times of high economic uncertainty are associated with a higher propensity to implement reforms. Section 5 concludes.

2 POLITICIANS, ELECTIONS AND REFORMS

We study a citizen-candidate model with two time periods. In the first period, a politician of unknown ability makes decisions about an unobservable investment in reforms with a payoff in the second period. Between periods, there is an election in which voters choose between the incumbent and a challenger. Elections serve the purpose of ousting bad performing politicians. However, this selection *ex-post* also affects the incentives the incumbent faces *ex-ante*. We use this model to study the political determinants of the choice of reforms, with a particular focus on the role of uncertainty.

2.1 PREFERENCES AND TECHNOLOGY

The economy is populated by a continuum of risk neutral agents which live for two periods and discount the future at rate $\beta \in [0, 1]$. Expected utility of the representative citizen is described by

$$W = \mathbb{E} [y_t + \beta y_{t+1}], \tag{1}$$

where y_t is a suitable measure of economic performance (e.g., income per capita) in period t , which in turn depends on the actions of a politician. In the first period, a citizen is drawn at random to conduct economic policy and reforms, and for this he receives a reward

γ for each period in office. Hence, his expected utility is

$$U = W + (1 + \beta p) \gamma, \quad (2)$$

where p is the probability of being reelected in the second period.³

Economic performance in the two periods, y_t and y_{t+1} , depends on the ability of the politician in office, θ_t , his choice of investment in economic reforms, r , and a random shock ε_t :

$$\begin{aligned} y_t &= \theta_t - r + \varepsilon_t \\ y_{t+1} &= \theta_{t+1} + f(r) + \varepsilon_{t+1} \end{aligned}$$

Investing in reforms, r , has a cost in terms of current economic performance and a future return $f(r)$, where the return function $f(r)$ is assumed to be increasing, concave and twice differentiable with $f'(0) = \infty$ and $f'(\infty) = 0$.⁴ Ability of the politician in office at time t , θ_t , is unknown both to the citizens and to the incumbent, but it is drawn from a known distribution $\theta \sim N(\bar{\theta}, \sigma_\theta^2)$.⁵ Finally, ε_t is an i.i.d. shock drawn from a known distribution $\varepsilon \sim N(0, \sigma_\varepsilon^2)$ and uncorrelated to ability ($\mathbb{E}[\theta\varepsilon] = 0$).⁶

The agency game between the citizens and the politician can be summarized as follows. The politician chooses reforms, r , before observing the realization of θ_t and ε_t , so as to maximize his payoff (2). After observing y_t only, citizens decide whether to keep the incumbent at $t + 1$ or to replace him with a new draw, so as to maximize (1). There are two important asymmetries between the incumbent politician and the society at large. First, the politician cares about social welfare (W), but also about his probability to stay in office, with a weight equal to γ on the latter goal. Second, citizens only observe y_t and not the actual choice of investment in reforms r .

2.2 VOTERS

We solve the model backward: first, we find the election rule chosen by citizens and then we solve for the investment in reforms by the incumbent. Citizens face an inference problem: they want to reelect a politician with a high θ , but they only observe the noisy signal $y_t = \theta_t - r + \varepsilon_t$. Thus, they must form expectations on the ability of the incumbent

³The citizen-candidate model provides the simplest microfoundation for a political objective function that is an average of social welfare, W , and the private benefit, γ .

⁴Investment in reforms is defined as a continuous variable for analytical tractability.

⁵We relax the assumption that ability is unknown to the incumbent in Section 3.

⁶We have assumed that ability does not affect the productivity of reforms for simplicity. All the qualitative results in the paper generalize to the case $f(r, \theta)$ and $f_\theta > 0$.

conditional on y_t . Citizens know the distributions of θ and ε , and they can foresee the equilibrium level of reforms that the politician will choose, r^e (to be solved in the next section). Given this information, as in standard signal-extraction problems, the posterior beliefs on the incumbent's political ability is:

$$\hat{\theta}_t = \mathbb{E}[\theta | y_t] = \frac{\sigma_\varepsilon^2}{\sigma_\theta^2 + \sigma_\varepsilon^2} \bar{\theta} + \frac{\sigma_\theta^2}{\sigma_\theta^2 + \sigma_\varepsilon^2} (y_t + r^e). \quad (3)$$

That is, the posterior expectation is a weighted average of the “prior”, $\bar{\theta}$, and the observed signal, $y_t + r^e$, with weights that depend on the precision of the signal: as the variance of noise increases relative to the variance of ability, the signal becomes less and less informative and the posterior expectation converges to the unconditional mean.

Note also that the distribution of the posterior belief on the incumbent's ability is normal:

$$\hat{\theta}_t \sim N\left(\bar{\theta}, \frac{\sigma_\theta^4}{\sigma_\theta^2 + \sigma_\varepsilon^2}\right).$$

Intuitively, $\hat{\theta}_t$ has the same mean as θ , but a smaller variance.

Given (3), it is optimal to reelect the incumbent if the belief of his ability is above average, $\hat{\theta}_t \geq \bar{\theta}$, that is if $y_t \geq \bar{y}$, with

$$\bar{y} = \bar{\theta} - r^e. \quad (4)$$

Thus, the election rule takes a simple threshold form: voters support the incumbent if current economic performance exceeds a critical level. To find r^e , we now turn to the politician's problem.

2.3 POLITICIANS

The incumbent politician chooses investment in reforms, r , so as to maximize his expected utility (2), given the voting strategy of citizens (4) and his information set. Hence, investment in reforms solves:

$$\max_r \left\{ \bar{\theta} - r + \beta [\mathbb{E}\theta_{t+1} + f(r)] + (1 + \beta p) \gamma \right\}$$

subject to:

$$\begin{aligned} p &= \Pr(y_t \geq \bar{y}) = \Pr(\theta - r + \varepsilon_t \geq \bar{y}) \\ &= 1 - G(\bar{y} + r) \end{aligned}$$

where $G(\cdot)$ is the cumulative density of the realization $(\theta + \varepsilon_t)$, which is normally distributed with mean $\bar{\theta}$ and variance $\sigma_\varepsilon^2 + \sigma_\theta^2$.

Note that p is a decreasing function of r :

$$\frac{\partial p}{\partial r} = -g(\bar{\theta} - r^e + r) < 0.$$

That is, a marginal increase in r lowers the observed realization of y_t and thus the probability to meet the threshold for reelection. Note also that, by distorting the signal, reforms may also affect $\mathbb{E}\theta_{t+1}$. However, it turns out that in a rational expectation equilibrium the election rule maximizes $\mathbb{E}\theta_{t+1}$ so that an envelope argument guarantees that $\partial\mathbb{E}\theta_{t+1}/\partial r = 0$.

Thus, the first order condition to the incumbent's problem is:

$$\beta f'(r) = 1 - \frac{\partial p}{\partial r} \beta \gamma. \quad (5)$$

The LHS of (5) represents the marginal benefit of reforms, equal to the discounted marginal product of r . The RHS is the marginal cost, which has two components. The first one is the social cost of r due to foregone output today. The second component, instead, is what we call the “political cost” of reforms: by investing more in reforms the policy maker lowers current output and thus his perceived probability to be reelected. This cost to the politician is proportional to the (discounted) value of staying in office, γ .

2.4 EQUILIBRIUM

In the rational expectation equilibrium, citizens correctly predict reforms so that we can impose $r = r^e$. Thus:

$$-\frac{\partial p}{\partial r} = g(\bar{\theta}) \equiv \bar{g} = [2\pi(\sigma_\theta^2 + \sigma_\varepsilon^2)]^{-1/2},$$

because $G \sim N(\bar{\theta}, \sigma_\theta^2 + \sigma_\varepsilon^2)$ and reforms satisfy:

$$\beta f'(r) = 1 + \beta \bar{g} \gamma. \quad (6)$$

The reelection probability turns out to be

$$p = \Pr(\theta_t + \varepsilon_t \geq \bar{\theta}) = \frac{1}{2},$$

which is just equal to the unconditional probability that the incumbent be more able than the population average. Thus, in equilibrium the choice of reform does not affect the

probability of reelection. Yet, what drives the “political cost” of reforms (i.e., $\partial p/\partial r = \bar{g} < 0$ in 5) is hidden information out of equilibrium: the fact that politicians can deviate from their equilibrium strategy in ways unknown to voters. Note also that the “political cost” of reforms would disappear if there were no uncertainty about θ .

Finally, we can solve for $\mathbb{E}\theta_{t+1}$ and ex-ante expected social welfare, given the behavior of citizens and politicians. In particular, we have:

$$\begin{aligned}\mathbb{E}\theta_{t+1} &= (1-p)\bar{\theta} + p\mathbb{E}\left(\theta_{t+1} \mid \hat{\theta}_t \geq \bar{\theta}\right) \\ &= \bar{\theta} + \frac{\delta}{2}\end{aligned}$$

where δ represents the “selection effect”, that is, the difference between the ex-ante expected ability of a reelected incumbent and the average ability of a newly elected politician. This is equal to the average of the posterior belief truncated from below at $\bar{\theta}$, minus the unconditional mean:

$$\delta = \frac{2\sigma_\theta^2}{\sqrt{(\sigma_\theta^2 + \sigma_\varepsilon^2)} 2\pi}. \quad (7)$$

Note that reelected politicians tend to be better than the average and more so when ability is highly dispersed (there is no benefit from selection if politicians are all alike) and when noise is low (so that it is less likely to reelect bad but lucky politicians).

Expected *ex-ante* social welfare is then:

$$W = \bar{\theta} - r + \beta \left[\bar{\theta} + \frac{\delta}{2} + f(r) \right]. \quad (8)$$

where r solves (6). The above equilibrium is inefficient. A benevolent social planner subject to the same information set would choose reforms r^{FB} so as to equate the social benefit to the social cost:

$$\beta f'(r^{FB}) = 1.$$

Comparing this to (6), it is immediate to see that the level of reforms chosen by the politician is suboptimally low. This inefficiency arises from the political cost that reforms impose on the incumbent in terms of a lower perceived probability to be reelected.⁷ In sum:

Proposition 1 *In the above environment, investment in reforms, r , is below the level that would maximize social welfare.*

⁷The same distortion leading to suboptimal reforms would arise even in the absence of elections if future political compensation was increasing in current economic performance, as empirically show by Di Tella and Fisman (2004) using data on US gubernatorial salaries.

2.5 UNCERTAINTY, REFORMS AND WELFARE

How does uncertainty affect the willingness to undertake reforms and welfare? To answer these questions, first note that there are two sources of uncertainty: the random ability draw (θ) and the shock ε (noise). These in turn determine the variance of economic performance in equilibrium, $Var(y_t) = \sigma_\varepsilon^2 + \sigma_\theta^2$. The next Proposition characterizes the impact of both sources of uncertainty on r .

Proposition 2 *The equilibrium level of reforms is increasing in the variance of both noise (σ_ε^2) and ability (σ_θ^2), and it is decreasing in the level of political compensation (γ):*

$$\frac{\partial r}{\partial \sigma_\varepsilon^2} \geq 0; \quad \frac{\partial r}{\partial \sigma_\theta^2} \geq 0; \quad \frac{\partial r}{\partial \gamma} \leq 0.$$

Proof. See Appendix ■

The first notable result is that *uncertainty promotes reforms by lowering their political cost, $\bar{g}\gamma$* . To see why, recall that incumbents are reluctant to embark in reforms with future payoffs because they are afraid that their economic cost may be interpreted by voters as low ability. However, when ability and shocks are highly dispersed, the reelection probability depends more on the realization of θ and ε , rather than on the choice of r (formally, \bar{g} decreases as σ_ε^2 and σ_θ^2 rise). It follows that there is a lower incentive to inflate current performance at the expenses of reforms. On the contrary, for a given \bar{g} , a high value of being in office γ means that the incumbent cares more about reelection and this increases the political cost of reforms. Note also that there is an interesting interaction between these effects in that the impact of uncertainty is strong when the reward at stake is high and the impact of γ is strong when uncertainty is low.

In the next proposition, we characterize how uncertainty and political reward affect the *ex-ante* expected social welfare (8).

Proposition 3 *Social welfare is increasing in the average ($\bar{\theta}$) and the dispersion of political ability (σ_θ^2), and decreasing in political compensation (γ):*

$$\frac{\partial W}{\partial \bar{\theta}} \geq 0; \quad \frac{\partial W}{\partial \sigma_\theta^2} \geq 0; \quad \frac{\partial W}{\partial \gamma} \leq 0.$$

The effect of the variance of noise (σ_ε^2) on social welfare is ambiguous:

$$\frac{\partial W}{\partial \sigma_\varepsilon^2} \geq 0 \iff \bar{g}\gamma^2 > -f''(r)\sigma_\theta^2 \quad \text{with} \quad \lim_{\sigma_\varepsilon^2 \rightarrow \infty} \frac{\partial W}{\partial \sigma_\varepsilon^2} = 0^-.$$

Proof. See Appendix ■

The effect of $\bar{\theta}$ is straightforward: welfare is increasing in the average ability of population. The effects of σ_θ^2 and γ are also unambiguous. More dispersion in political ability increases reforms (as seen from Proposition 2) and also increases the selection premium of elections, δ (as can be seen from 7). Given that reforms are always suboptimally low, welfare must increase. On the contrary, a higher γ increases the political cost of reforms thereby lowering r (see Proposition 2) and welfare.

The variance of noise (σ_ε^2) has instead two opposite effects on welfare. On the one hand, Proposition 2 shows that noise promotes investment in reforms and this tends to increase social welfare. On the other hand, by making luck relatively more important, a higher noise raises the probability to oust a talented incumbent or to confirm a bad one. Thus, σ_ε^2 reduces the selection premium, δ , and hence social welfare. The former effect dominates, so that noise turns out to be welfare improving, when reforms are relatively more important than selection. This is the case when the political cost of reforms, $\bar{g}\gamma$, is high (so that underinvestment is severe) and ability is more concentrated (low σ_θ^2). Given that $\lim_{\sigma_\varepsilon^2 \rightarrow \infty} \bar{g} = 0$, the negative welfare effect must dominate if noise is sufficiently high.

3 EXTENSIONS

In this section, we consider a number of extensions and applications of the basic model. First, we show that uncertainty lowers the political cost of reforms even under the alternative assumption that incumbent politicians know their ability. Second, we use the model to explore the welfare effect of ruling out reelection by imposing a one-period term limit. Finally, we extend the model to study the socially optimal level of political compensation.

3.1 ASYMMETRIC INFORMATION OF POLITICAL ABILITY

If the incumbent knows his ability θ_i before choosing reforms, the voting strategy does not change since citizens can only condition their choice on y_t and they cannot disentangle θ_i from ε_t . This means that they stick to the rule of reelecting any incumbent delivering an outcome above the expected mean, $y_t \geq \bar{\theta} - \bar{r}^e$, where \bar{r}^e is the equilibrium level of reform adopted by the average politician. The problem facing incumbent i is now different:

$$\max_r \{ \theta_i - r_i + \beta [p_i \theta_i + (1 - p_i) \bar{\theta} + f(r_i)] + (1 + \beta p_i) \gamma \}$$

subject to:

$$\begin{aligned} p &= \Pr(y_t \geq \bar{y}) = \Pr(\theta_i - r_i + \varepsilon_t \geq \bar{\theta} - \bar{r}^e) \\ &= 1 - H(\bar{\theta} - \theta_i - \bar{r}^e + r_i), \end{aligned}$$

where H is the c.d.f. of $\varepsilon \sim N(0, \sigma_\varepsilon^2)$. The perceived reelection probability, p , is still decreasing in reforms:

$$\frac{\partial p}{\partial r_i} = -h(\bar{\theta} - \theta_i - \bar{r}^e + r_i).$$

The first order condition to the incumbent's problem becomes:

$$\beta f'(r_i) = 1 - \beta \frac{\partial p}{\partial r} (\theta_i - \bar{\theta} + \gamma).$$

The main difference with respect to equation (5) is that investment in reforms now varies with ability. In particular, incumbents with very low ability (with $\theta_i < \bar{\theta} - \gamma$) now overinvest in reforms to voluntarily reduce their reelection probability, because the cost of having a bad politician outweighs the private benefit of remaining in office. Better politicians (with $\theta_i > \bar{\theta} - \gamma$) adopt too little reforms, as in the previous section. The average-ability incumbent ($\theta_i = \bar{\theta}$) chooses $r = \bar{r}$ so that

$$\beta f'(\bar{r}) = 1 + \beta \bar{h} \gamma$$

with $\bar{h} = [2\pi\sigma_\varepsilon^2]^{-1/2}$. This implies that the average politician now makes less reforms than in section 2.4, because it faces less uncertainty (he knows θ_i). Yet, higher volatility, σ_ε^2 , increases the average level of reforms, as in Proposition 2. Thus, while there is now heterogeneity in the choice of reforms, uncertainty still reduces the *average* political cost of reforms.

3.2 TERM LIMIT

A key reason why reforms are too low is that incumbents care not only about social welfare, but also their reelection. Thus, a simple way to perfectly align the incentives of policy makers to those of the society would be to rule out the possibility of reelection by imposing a one-period term limit. This would set both p and $\partial p/\partial r$ to zero and restore the first best investment in reforms. By excluding reelection, however, citizens forego the opportunity of retaining well performing incumbents, who are expected to be better than a new random draw. Thus, the model suggests the existence of a trade-off between reforms and selection. A one-term limit is socially optimal if it grants an ex-ante expected social welfare, W^{TL} , higher than W in (8):

$$W^{TL} - W = [\beta f(r^{FB}) - r^{FB}] - [\beta f(r) - r] - \beta \frac{\delta}{2} > 0,$$

or

$$\beta \frac{\delta}{2} < [\beta f(r^{FB}) - r^{FB}] - [\beta f(r) - r] \quad (9)$$

This condition is more likely to hold when selection is not very effective, i.e., when δ is low. It holds trivially when politicians are all alike ($\sigma_\theta^2 = 0$). On the contrary, it is never satisfied as $\sigma_\theta^2 \rightarrow \infty$, for the selection premium becomes infinite and there is no underinvestment in reforms. More generally, when σ_θ^2 increases, the LHS of condition (9) rises because there is more to gain from ex-post selection, while the RHS falls, since the incentive to underinvest in reforms becomes weaker. Hence, there is a threshold level of ability heterogeneity below which setting a term limit is optimal.

Proposition 4 *For any level of economic volatility, σ_ε^2 , there exists a threshold degree of heterogeneity in political ability, $\tilde{\sigma}_\theta^2$, such that for $\sigma_\theta^2 < \tilde{\sigma}_\theta^2$ a term limit is socially optimal.*

What is the impact of volatility (σ_ε^2) on the desirability of setting a one-term limit? The variance of shocks, σ_ε^2 , does not affect W^{TL} , but has ambiguous effects on W , as discussed in Proposition 3. On the one hand, an increase in σ_ε^2 worsen selection (δ falls), on the other it increases reforms. Volatility reduces the desirability of a term limit when welfare is increasing in σ_ε^2 .

3.3 OPTIMAL POLITICAL REWARD

Another way to align the incentives of policy makers to those of the society without losing the benefit of selection would be to set $\gamma = 0$, so that incumbents do not care about reelection. Although such a remedy is unlikely to be feasible in practice, for γ includes psychological rents and private benefits that may be difficult to dissipate, there is another reason why it may not work. As emphasized in a large literature, political compensation is crucial to attract more talented agents in the political arena. Introducing this effect allows us to use the model for addressing the following important normative questions: is there an optimal level of political compensation and what does it depend upon?

To this end, we now add a stage where individuals from different ability distributions decide whether or not to run for public office by comparing the political payoff to their outside option. In particular, assume that there are different types of citizens, indexed by c . The ability of a citizen of type c is drawn from the distribution $\theta^c \sim N(\bar{\theta}^c, \sigma_\theta^2)$ with $\bar{\theta}^c \in [0, \theta^{\max}]$. That is, different types draw their ability from distributions with different averages, $\bar{\theta}^c$, but with the same variance, σ_θ^2 .⁸ We also assume that the type of a

⁸That the variance does not vary across types is for simplicity only.

citizen is an observable characteristic. For instance, it could correspond to education or job experience. Since social welfare is increasing in average ability, citizens would like to choose politicians drawn from the distribution with the highest $\bar{\theta}^c$.

As before, citizens who hold public office receive utility W plus the additional reward γ . However, we now assume that they must give up their private occupation, with a value of $\omega\theta^c$. Thus, the factor $\omega > 0$ can be interpreted as the market value of ability. A citizen of type c will be willing to hold public office if the expected payoff of a political career is greater than or equal to his expected outside option:

$$W + \left(1 + \frac{\beta}{2}\right)\gamma + \frac{\beta}{2}\omega\bar{\theta}^c \geq W + (1 + \beta)\omega\bar{\theta}^c. \quad (10)$$

In equilibrium, candidates will be drawn from the group with the highest $\bar{\theta}^c$ consistent with (10). It follows that the average ability of political candidates is higher, the higher the benefit from office:

$$\bar{\theta} = \min \left[\frac{\gamma}{\omega}, \theta^{\max} \right].$$

As seen in the previous subsection, a higher reward from office reduces welfare via lower investment in reforms. However, now it has a new positive welfare effect: it increases the expected ability of politicians. The tension between these two forces suggests the existence of a socially optimal level of political compensation. To find it, we solve the following problem:

$$\max_{\gamma} W = (1 + \beta) \frac{\gamma}{\omega} - r(\gamma) + \beta \left[\frac{\delta}{2} + f(r(\gamma)) \right].$$

The first order condition for an interior solution is:

$$MB = \frac{1 + \beta}{\omega} = -\frac{\partial r}{\partial \gamma} [\beta f'(r) - 1] = MC \quad (11)$$

The LHS of (11) is the marginal benefit of political reward: one additional unit of compensation increases expected political ability by $1/\omega$. The RHS is instead the marginal cost: an extra unit of γ biases reforms downward ($\partial r/\partial \gamma < 0$) and the cost of this is proportional to the severity of underinvestment in equilibrium, $[\beta f'(r) - 1] > 0$.

To characterize the optimal compensation, in Figure 1 we plot both MB and MC as a function of γ . The MB curve is represented by the dashed, flat, line. The MC curve (solid line) starts at zero ($\gamma = 0 \rightarrow \beta f'(r) = 1$) and may be non monotonic (the Figure shows two possible cases). Its slope is analyzed formally in Lemma 1:

Lemma 1 *The marginal cost of γ is increasing if and only if*

$$f''(r)^2 > f'''(r)\bar{g}\gamma.$$

Proof. *See Appendix* ■

The condition in Lemma 1 is always satisfied at $\gamma = 0$ and also if $f'''(r) < 0$. Yet, when $f'''(r) > 0$ (e.g., for $f = r^\alpha$ with $0 < \alpha < 1$), the slope of MC may turn negative. In what follows, we restrict attention to the interesting case in which MB and MC intersect once and only once over the relevant range $\gamma \in [0, \omega\theta^{\max}]$. Under this restriction, the solution, γ^* , to (11) is unique and interior, and the MC curve must be positively sloped at γ^* . We then study the comparative statics of γ^* to changes in parameters.

Proposition 5 *Optimal political reward (γ^*) is increasing in the variance of both noise (σ_ε^2) and ability (σ_θ^2), and it is decreasing in the market value of ability (ω):*

$$\frac{\partial \gamma^*}{\partial \sigma_\varepsilon^2} \geq 0; \quad \frac{\partial \gamma^*}{\partial \sigma_\theta^2} \geq 0; \quad \frac{\partial \gamma^*}{\partial \omega} \leq 0.$$

Proof. *See Appendix* ■

An increase in uncertainty (due to either ability dispersion or noise) affects the marginal cost of political compensation while leaving its marginal benefit unaffected. From Proposition 2, uncertainty increases investment in reform, r , which in turn lowers $f'(r)$ and MC in (11). Moreover, higher uncertainty means that chance plays a bigger role in reelection, implying that r becomes less reactive to γ . This second effect tends to reduce MC even further. As a result, optimal political compensation increases both with σ_ε^2 and σ_θ^2 . On the contrary, an increase in the market value of ability, ω , makes it more costly to attract highly qualified candidates thereby lowering the marginal benefit of γ , with no effect on MC . As a result, the optimal political compensation falls when ω increases.

4 EMPIRICAL EVIDENCE

In this section we review existing empirical findings in support of the main assumptions underlying the model. We also present original evidence corroborating one of the main results: higher economic volatility increases both the probability and the intensity of reforms.

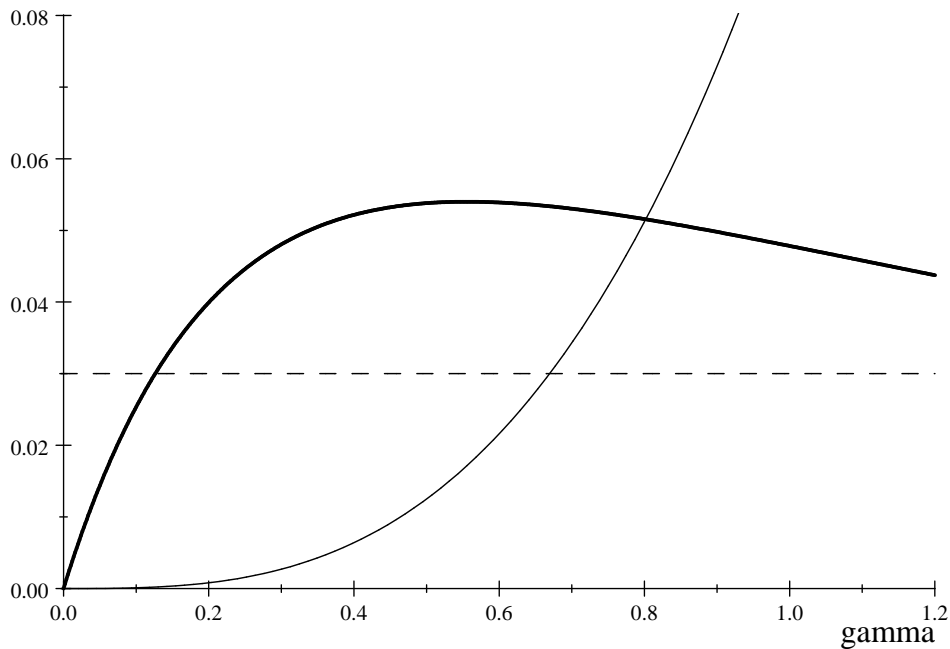


Figure 1: Solid: $MC(\gamma)$, Dashed: $MB(\gamma)$

4.1 ASSUMPTIONS, RESULTS AND EXISTING EVIDENCE

Economic performance and reelection probability. A key feature of the model is that the reelection probability depends on current economic performance and that citizens vote retrospectively. This hypothesis received early support in the works of Fair (1978, 2008) and Kiewiet and Rivers (1985). In particular, Kiewiet and Rivers (1985) find, using data on U.S. and Western European elections, that a 1-percent decline in real income is associated with a reduction of the incumbent party's vote share of between 0.5 percent and 1 percent. More recently, a series of papers have provided evidence that good economic performance increases the likelihood that politicians in power are reelected. Brender and Drazen (2008) show on a sample of 73 countries that high growth during the term in office increases reelection probability, especially in developed countries. Buti et al. (2010) find that, over a sample of 21 OECD countries, high levels and growth rates of the cyclical component of GDP have a positive impact on reelection probability. Wolfers (2007) provides evidence from U.S. gubernatorial elections that good economic performance increases the chances of reelection for the incumbent party. He also finds that voters seem to reelect governors based on the state performance relative to the national average and not in absolute terms. This suggests that citizens are indeed rational in inferring ability

from economic performance.

Political reward and selection of politicians. We have assumed that higher political reward attracts into political career candidates with higher expected ability. Recent evidence lends support to this view. Besley (2004), using US gubernatorial data, finds that a higher pay increases ideological congruence between elected governors and their citizens. Structural estimates by Diermeier et al. (2005) and Keane and Merlo (2007) show that an increase in a Congressman's pay raises the likelihood that he or she reruns for office, while a salary reduction discourages politicians, especially the most skilled ones, from seeking reelection. Ferraz and Finan (2009), using data on legislators in Brazilian municipal governments, find that higher compensation raises the quality of candidates in terms of education, previous occupation and political experience. Gagliarducci and Nannicini (2009), using data on Italian municipalities before and after an exogenous 33% wage increase enacted in 2000, find positive effect of compensation on ex-ante selection of candidates and elected politicians in terms of educational attainment and occupation.

The determinants of reforms. Early empirical works on the determinants of reforms (see, among others, Alesina and Ardagna, 1998, Drazen and Easterly, 2001, Hamann and Prati, 2002) show that the adoption of stabilization plans reducing inflation, government deficit and the black market premium, is more likely in periods of crisis, i.e., when inflation, deficit and black market premium are particularly high. Alesina et al. (2006), provide specific evidence that this correlation is consistent with the predictions of the war of attrition model (Alesina and Drazen, 1991). Recent contributions show that periods of economic crisis favor the adoption of structural reforms targeted to the markets for financial instruments (Abiad and Mody, 2003) goods and services, and labor (Høj et al., 2006). Although our model does not have implications on the behavior of reforms over the business cycle, its prediction could be reconciled with this evidence if volatility were higher in periods of crisis, as suggested by Hnatovska and Loayza (2005). Despite the availability of data on reforms and economic volatility, there is to our knowledge no empirical evidence on the relationship between these two variables. We provide a preliminary test of this correlation in the next section.

4.2 ECONOMIC VOLATILITY AND REFORMS

One of the main results in the paper is that an increase in the variance of the unexpected component of economic performance induces the incumbent politician to invest more in reforms. In this section we test this prediction using annual data from 20 OECD countries

observed between 1975 and 2000.⁹ We focus on government deficit stabilization and trade reforms. Both interventions entail a present cost for the society (e.g., a fall in tariff revenue, job losses in import-competing sectors, tax increase or expenditure cut required to reduce public deficit) and are widely recognized to be beneficial for economic growth and welfare in the long run. Although the results of the model refer to the intensive margin of reforms (a positive r is always chosen), we study how economic volatility is empirically related to both the size (intensive margin) of reforms and the likelihood that these are adopted (extensive margin).

We follow the existing literature and use the annual variation in central government deficit as a ratio of GDP (DEFICIT), from the IMF Government Finance Statistics (2001), as a measure of the intensive margin of fiscal reforms. The extensive margin of this reform is captured, as it is often done in the literature, by a dummy taking value 1 for annual variations in DEFICIT below the 20th percentile of the empirical distribution, corresponding to drops by more than 1.17 percentage points, and zero otherwise. Our measure of trade policy (TRADETAX) is total revenues from taxes on international trade and transactions (from the IMF Government Finance Statistics, 2001) expressed as a share of the total volume of trade (value of Import plus Export). This is a proxy of the average tariff rate. To be consistent with the definition of deficit reforms, we would be induced to proxy the extensive margin of trade liberalizations with a dummy taking value 1 if the annual variation in TRADETAX lies below the 20th percentile, corresponding to a fall by more than 0.16 percentage points. Yet, such a change seems rather small to identify a significant reform. Thus, we take as a threshold the 10th percentile, associated to a reduction in tariffs by more than 0.35 percentage points.¹⁰

Our main explanatory variable is the variance of the unexpected component of economic performance, measured by the 5-year standard deviation of the output gap (SD), i.e., the difference between the actual and the potential GDP over potential GDP, as computed by the OECD based on estimations of the production functions. This economic volatility indicator is more suited than the simple standard deviation of the growth rate of GDP since it is meant to capture unexpected variations in economic performance. A positive coefficient in the estimates for the likelihood of reforms, and a negative coefficient in the regressions for the intensive margin would lend support to the prediction of Proposition 2.

⁹These countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States.

¹⁰The graphical evidence and regression output that follow do not change if we adopt the less restrictive definition. Results are available upon request.

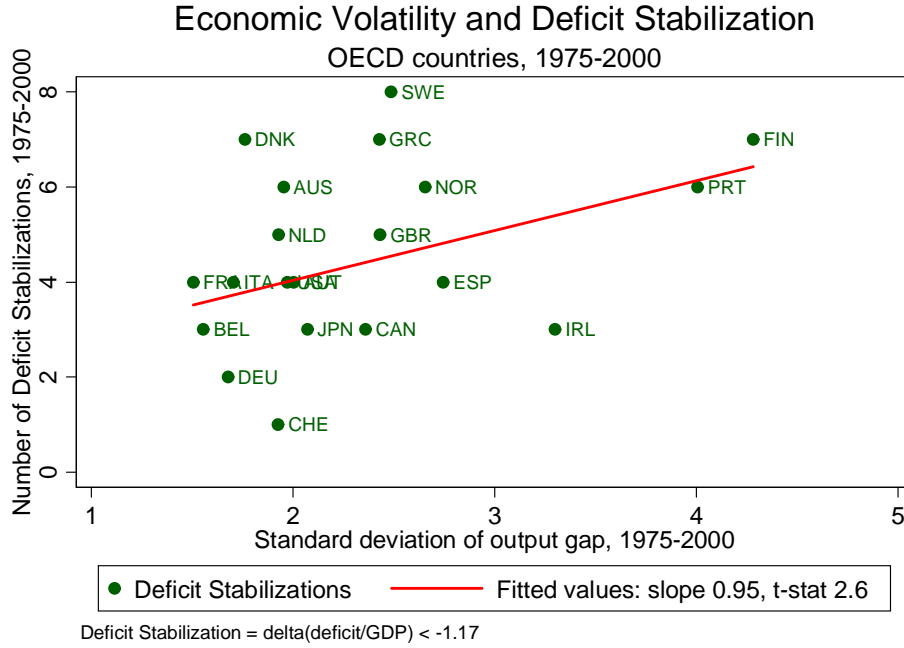


Figure 2: Economic Volatility and Deficit Stabilizations.

Figures 2 and 3 plot the overall number of reforms observed between 1975 and 2000 in the sample against the standard deviation of the output gap in the same period and provide a synthetic description of the data. The lines interpolating the points exhibit positive and significant slopes for both deficit stabilization reforms and trade liberalization.¹¹ This is a first indication that the relationship predicted by the model may hold in the data.

We take a step further in the empirical evaluation of our theory by performing panel estimations for the intensive and extensive margins of both reforms. First, we estimate the following equation for the intensive margin of reforms:

$$r_{it} = \alpha + \beta r_{it-1} + \gamma SD_{it-1,t-5} + \lambda X_{it-1} + \eta_i + \nu_{it}, \quad (12)$$

where r_{it} is the policy variable r (either DEFICIT or TRADETAX) observed in country i in year t , $SD_{it-1,t-5}$ is the 5-year standard deviation of the output gap observed in country i between $t-5$ and $t-1$ (i.e., in the 5 years prior to the reform), X_{it-1} is a vector of other lagged control variables, η_i is a fixed effect accounting for country-specific factors and ν_{it} is the error term. All regressors are lagged one period to account for the fact that policies

¹¹The trade liberalization reforms of EU member countries in Figure 3 were mostly adopted before accession.

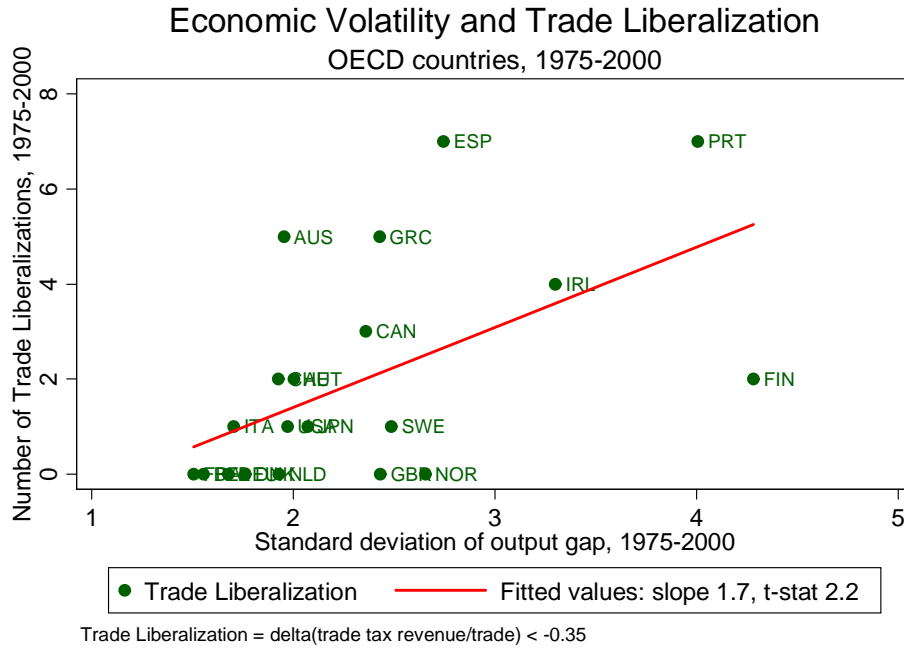


Figure 3: Economic Volatility and Trade Liberalizations.

may be decided the year before they are enacted, and to avoid simultaneity. We include among the regressors the lagged dependent variable to control for the fact that reforms may depend on the previous level of deficit and tariffs. Due to this, OLS estimates are not consistent. We overcome this problem by first implementing the Kiviet (1995) correction of the standard errors.¹² We then turn to system GMM estimation.

Among the control variables in X we include an indicator of economic crises (CRISIS) to account for the hypothesis that bad times may be more suited to adopt reforms. Following previous papers on crises and reforms (see Høj et al., 2006 among others), we define economic crises as episodes of output gap below -4 per cent, and include this indicator in our regressions.¹³ We also follow the empirical literature on reforms controlling for political variables as electoral years (election), left-wing governments (left), and governments in the first two years of office (younggov). These indicators are obtained from the 2006 release of the Database of Political Institutions compiled by the World Bank.

Estimates of $\gamma < 0$ would lend support to the prediction of Proposition 2, that higher

¹²Since our panel is unbalanced, we implement this correction as proposed by Bruno (2005).

¹³Controlling for the lagged level of the output gap instead of the crisis dummy does not deliver significant estimates, hence we do not report those specifications.

economic volatility promotes reforms reducing government deficit and trade tariffs. A coefficient $\beta < 1$ would imply that countries starting with higher deficit and tariffs tend to experience, *ceteris paribus*, larger reforms of budget stabilization and trade liberalization.¹⁴

Table 1 reports the estimated coefficients with robust and consistent standard errors under alternative specifications of equation (12). Panel A focuses on government deficit as a share of GDP. The estimates for lagged DEFICIT in the first row, significant and smaller than one, confirm the result from the literature on fiscal stabilization that countries with larger deficits tend to implement stronger policies of deficit reduction. The coefficients for the standard deviation of the output gap in the second row, negative and significant, lend support to the prediction of the model. Quantitatively, the effects are large: a one per cent increase in SD from its mean (1.85 per cent) is followed on average by a 0.30 percentage points reduction in the deficit/GDP ratio. For the average country, this means a shift from a 0.2 percentage points increase to a 0.1 percentage points fall in deficit over GDP. When controlling for economic crises, we do not obtain significant estimates, but the size and significance of the coefficient for volatility are marginally reduced. Accounting for political variables, in columns 4-6, does not deliver significant results a part from the association of larger deficits with left-wing governments.¹⁵

Panel B reports the results for trade reforms. As in Panel A, the coefficients for lagged TRADETAX in the first row, all significant and smaller than one, imply that countries starting with higher tariffs experience larger drops in tariffs, i.e., trade liberalizations. The coefficients in the second row, always negative and significant at least at the 10 per cent confidence level, lend support to the model prediction that higher volatility is followed by a larger reduction in tariffs. When controlling for the occurrence of economic crises (columns 2-3), we do not obtain any significant result, suggesting that bad economic performance does not systematically lead to trade liberalization. In columns 4-6 we control for political variables. The estimates suggest that political conditions such as the celebration of elections, the ideological orientation of the government or its tenure in the present legislature do not systematically affect trade policy.

The Kiviet (1995) correction of the standard errors performed in Table 1 does not address the problems of endogeneity or simultaneity of the regressors that may arise in the estimation of equation (12). We tackle these issues adopting Blundell and Bond (1998)

¹⁴We also estimated equation (12) with the annual change in DEFICIT or TRADETAX, $dr_{it,t-1}$, as a dependent variable, but without implementing the Kiviet (1995) correction. The estimates for *SD* and the other control variables, available upon request, are quantitatively very similar to the ones reported in this section.

¹⁵When interacting political variables with economic volatility and/or economic crises, we do not obtain significant coefficients. For this reason we did not report any of these specifications.

approach to dynamic panel data, and estimate the following system

$$dr_{it} = \alpha + \beta dr_{it-1} + \gamma dSD_{it-1,t-5} + \lambda dX_{it-1} + \nu_{it} \quad (13)$$

$$r_{it} = \alpha + \beta r_{it-1} + \gamma SD_{it-1,t-5} + \lambda X_{it-1} + \eta_i + \nu_{it}, \quad (14)$$

where the lagged dependent variable and the other regressors (considered as predetermined) are instrumented with their lagged levels in equation (13) and differences in equation (14). We estimate the system by two-step Generalized Method of Moments with moment conditions $E[dr_{it-s}(\nu_{it} - \nu_{it-1})] = 0$ for $s \geq 2$, and $E[dz_{it-s}(\nu_{it} - \nu_{it-1})] = 0$ for $s \geq 2$ on the predetermined variables z , for equation (13); $E[dr_{i,t-s}(\eta_i + \nu_{i,t})] = 0$ and $E[dz_{i,t-s}(\eta_i + \nu_{i,t})] = 0$ for $s = 1$ for equation (14). The validity of the instruments is granted under the hypothesis that the residuals from (13) are not second order serially correlated. Coefficient estimates are consistent and efficient if both the moment conditions and the no-serial correlation are satisfied. To validate the estimated model, we apply a Hansen J-test of overidentifying restrictions, and a test of second-order serial correlation of the residuals.

Table 2 reports the results from system GMM regressions for deficit and tariffs. Given that political variables did not emerge as significant determinants of reforms in Table 1, we omit them from the specifications. The coefficient estimates are very similar in size and significance to those reported in Table 1, confirming that deficit and tariffs tend to drop more when starting from high levels, and that economic volatility induces more pronounced reforms of government budget stabilization and trade liberalization. Economic crises do not seem to affect much these policies. The estimated models are validated since the p-values for the AR(2) and the Hansen test reject, respectively, the hypothesis of second-order serial correlation of the residuals and the endogeneity of the instruments.¹⁶

Although our theoretical model delivers results for the intensive margin of reforms, it can be modified to express the results in terms of the likelihood that a policy intervention of a certain minimum size is adopted. In this case Proposition 2 would predict the likelihood that a reform be adopted to be increasing in the variance of the shocks to economic performance. As a second test of our theory, we estimate panel logit regressions for the likelihood that the reform dummies equal one:

$$\Pr [REFORM_{it} = 1 | Z_{it}] = \frac{1}{1 + e^{-Z_{it}}},$$

¹⁶The Hansen J-test exhibits p-values close to unity, suggesting the presence of overfitting. Unfortunately, given the limited cross-sectional relative to the time-series dimension, even using the minimum number of lags as instruments, is not enough to avoid this problem.

for

$$Z_{it} = a + br_{it-1} + cSD_{it-1,t-5} + gX_{it-1} + h_i + u_{it},$$

where $REFORM_{it}$ is the dummy indicator of extensive reforms, SD and X are the same as described above, h_i is a country-specific fixed effect and u_{it} is the error term. Note that, when accounting for country fixed effects, the sample may shrink if there are countries that did not experience any reform and are therefore uninformative. To use all the information in the data, we also estimate the logit with random effects. The results reported in Table 3 are in line with the evidence on the intensive margin in Tables 1 and 2. Reforms are more likely when and where they are more needed, i.e., government deficit and tariffs are high, and the economy is more volatile. Also in this case, economic crises are not significantly associated to reforms.

The estimates in Tables 1-3 provide support to one of the main theoretical predictions of our model. To make our results more comparable with those in the literature on deficit stabilization and crises (e.g., Alesina et al., 2006), we reestimate the baseline equations of Tables 1-3 for DEFICIT replacing the economic crisis indicator with a fiscal crisis indicator (CRISIS_DEF) taking value one when the deficit to GDP ratio is lower than the twentieth percentile (7.5 percentage points). The results reported in Table 4 lend support both to our theoretical prediction and to the crisis argument, since the coefficients for economic volatility and fiscal crises are negative and significant in the regressions for the annual variations in deficit and positive and significant in the panel logits for the likelihood of stabilization reforms. This suggests that our model and the war of attrition may not be mutually exclusive in explaining reforms, and that enriching our set-up to study how reforms vary along the cycle could be an interesting avenue for future research.

5 CONCLUSIONS

The contributions of this paper can be summarized as follows. First, we have formalized in a fully-rational model the popular idea that politicians perceive an electoral cost in adopting costly reforms with future benefits. As Jean-Claude Juncker, Prime Minister of Luxembourg and President of the Eurogroup once said, “We all know what to do, but we don’t know how to get reelected once we have done it.” Second, we have shown that uncertainty is likely to make reforms politically more viable. Third, while uncertainty promotes the adoption of welfare-enhancing reforms, it may also worsen political selection. As a result, the net welfare effect may be ambiguous. Fourth, we have shown that imposing a term limit promotes reforms, but it is welfare reducing when political ability is sufficiently heterogeneous. Fifth, by assuming that rewards from holding office motivate

more talented agents into politics, we have used the model to study the optimal level of political compensation. Our theory suggests that the optimal reward should trade off the benefit of higher expected ability with the cost of more underinvestment in reforms. It follows that politicians should be rewarded more when ability is relative more important than reforms.

Even if our results have been derived in a two-period model, we expect them to hold at least qualitatively in an infinite horizon setup. A simple way to show this would be by assuming that the agency game between voters and politicians is repeated and that incumbents have a two-term limit. Adding a richer time structure and some persistence in both noise and ability shocks would instead allow to examine learning and reputation, and would certainly be an interesting extension. Another limitation of our approach is that it takes uncertainty as exogenous. In many instances, for example when uncertainty arises from global economic shocks or from a lack of transparency rooted in institutions or cultural traits, this is a reasonable approximation. Yet, some political reforms may be aimed precisely at lowering uncertainty, either by means of economic stabilization or through improved monitoring and accountability procedures. Thus, allowing policy makers to affect the degree of uncertainty they are exposed to seems an interesting direction for future research.

Finally, in the last section of the paper we have discussed the existing evidence consistent with our model and provided new support for one of its key predictions: that trade and fiscal policy reforms seem to be more likely and of larger magnitude during periods of high economic volatility. We view these results as encouraging and we hope they will stimulate a more extensive empirical investigation of the so far under-explored link between economic instability and the adoption of reforms.

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6 APPENDIX

6.1 PROOF OF PROPOSITION 2

Implicit differentiation of (6) with respect to σ_ε^2 , σ_θ^2 and γ yields:

$$\begin{aligned}\frac{\partial r}{\partial \sigma_\varepsilon^2} &= \frac{\gamma}{f''(r)} \frac{\partial \bar{g}}{\partial \sigma_\varepsilon^2} > 0 \\ \frac{\partial r}{\partial \sigma_\theta^2} &= \frac{\gamma}{f''(r)} \frac{\partial \bar{g}}{\partial \sigma_\theta^2} > 0 \\ \frac{\partial r}{\partial \gamma} &= \frac{\bar{g}}{f''(r)} < 0,\end{aligned}$$

since the density of a Normal distribution at the mean is decreasing in its variance ($\partial\bar{g}/\partial\sigma_x^2 < 0$ for $x = \varepsilon, \theta$) and marginal returns to reforms are assumed to be decreasing ($f''(r) < 0$).

6.2 PROOF OF PROPOSITION 3

Differencing social welfare (8) w.r.t. θ , σ_θ^2 and $\gamma \sigma_\varepsilon^2$ yields

$$\frac{\partial W}{\partial \theta} = 1 + \beta > 0,$$

$$\frac{\partial W}{\partial \sigma_\theta^2} = [\beta f'(r) - 1] \frac{\partial r}{\partial \sigma_\theta^2} + \frac{\beta}{2} \frac{\partial \delta}{\partial \sigma_\theta^2} > 0$$

since $\partial r / \partial \sigma_\theta^2 > 0$ from Proposition 2 and $\partial \delta / \partial \sigma_\theta^2 > 0$,

$$\frac{\partial W}{\partial \gamma} = [\beta f'(r) - 1] \frac{\partial r}{\partial \gamma} \leq 0$$

since $\partial r / \partial \gamma < 0$ from Proposition 2, and

$$\frac{\partial W}{\partial \sigma_\varepsilon^2} = [\beta f'(r) - 1] \frac{\partial r}{\partial \sigma_\varepsilon^2} + \frac{\beta}{2} \frac{\partial \delta}{\partial \sigma_\varepsilon^2}.$$

After replacing the term in the bracket with the f.o.c. ($\bar{g}\gamma$), the derivative $\partial r / \partial \sigma_\varepsilon^2$ from Proposition 2, and $\partial \delta / \partial \sigma_\varepsilon^2 = \sigma_\theta^2 \bar{g} / \sigma_\theta^2 + \sigma_\varepsilon^2$, obtains:

$$\frac{\partial W}{\partial \sigma_\varepsilon^2} = -\frac{\beta}{2} \frac{\bar{g}}{\sigma_\theta^2 + \sigma_\varepsilon^2} \left[\bar{g}\gamma \frac{\gamma}{f''(r)} + \sigma_\theta^2 \right].$$

This is positive if and only if the term in brackets is negative, i.e., $\partial W / \partial \sigma_\varepsilon^2 \geq 0 \iff \bar{g}\gamma^2 > -f''(r) \sigma_\theta^2$.

For $\sigma_\varepsilon^2 \rightarrow \infty$ $\bar{g} \rightarrow 0$, hence

$$\lim_{\sigma_\varepsilon^2 \rightarrow \infty} \frac{\partial W}{\partial \sigma_\varepsilon^2} = -(0) \sigma_\theta^2 = 0^-.$$

6.3 PROOF OF LEMMA 1

Differencing the marginal cost of political reward w.r.t. γ yields

$$\frac{\partial MC}{\partial \gamma} = -\left(\frac{\partial r}{\partial \gamma}\right)^2 \beta f''(r) - \frac{\partial^2 r}{\partial \gamma^2} [\beta f'(r) - 1]$$

that, after replacing $\partial r/\partial\gamma$ from Proposition 2, $\partial^2 r/\partial\gamma^2 = -(\partial r/\partial) f'''(r)/f''(r)$ and the term in brackets from the f.o.c., becomes

$$\frac{\partial MC}{\partial\gamma} = -\beta \frac{\bar{g}^2}{f''(r)} \left[1 - \frac{f'''(r)}{f''(r)^2} \bar{g}\gamma \right].$$

This expression is positive if and only if the term in brackets is positive, i.e.

$$\frac{\partial MC}{\partial\gamma} > 0 \text{ iff } f''(r)^2 > f'''(r) \bar{g}\gamma.$$

6.4 PROOF OF PROPOSITION 5

Equation (11) can be rewritten as

$$\frac{1 + \beta}{\omega} = MC.$$

Implicit differentiation w.r.t. σ_x^2 for $x = \varepsilon, \theta$ delivers:

$$\frac{\partial\gamma^*}{\partial\sigma_x^2} = - \frac{\partial MC}{\partial\sigma_x^2} / \frac{\partial MC}{\partial\gamma}$$

with

$$\frac{\partial MC}{\partial\sigma_x^2} = - \frac{\partial^2 r}{\partial\gamma \partial\sigma_x^2} \beta \bar{g}\gamma - \frac{\partial r}{\partial\gamma} \frac{\partial r}{\partial\sigma_x^2} \beta f''(r).$$

Assuming that the condition in Lemma 1 is satisfied, $\partial\gamma^*/\partial\sigma_x^2 > 0$ if and only if $\partial MC/\partial\sigma_x^2 < 0$. To prove this, we first obtain the cross derivative of r

$$\frac{\partial^2 r}{\partial\gamma \partial\sigma_x^2} = \frac{\partial r}{\partial\gamma} \left[\frac{\partial \bar{g}}{\partial\sigma_x^2} \frac{1}{\bar{g}} - \frac{f'''(r)}{f''(r)} \frac{\partial r}{\partial\sigma_x^2} \right],$$

then replace it in the expression for $\partial MC/\partial\sigma_x^2$ and substitute for $\partial r/\partial\sigma_x^2$ from Proposition 2 to obtain

$$\frac{\partial MC}{\partial\sigma_x^2} = - \frac{\partial r}{\partial\gamma} \frac{\partial \bar{g}}{\partial\sigma_x^2} \frac{\beta\gamma}{f''(r)^2} \left[2f''(r)^2 - f'''(r) \bar{g}\gamma \right].$$

Given that $\partial r/\partial\sigma_x^2 < 0$ and $\partial \bar{g}/\partial\sigma_\varepsilon^2 = \partial \bar{g}/\partial\sigma_\theta^2 < 0$, $\partial MC/\partial\sigma_\varepsilon^2 = \partial MC/\partial\sigma_\theta^2 < 0$ if and only if $2f''(r)^2 > f'''(r) \bar{g}\gamma$, which is necessarily satisfied if the condition in Lemma 1 holds. Hence, provided that Lemma 1 is satisfied, $\partial\gamma^*/\partial\sigma_x^2 > 0$.

Table 1. Economic Volatility and Reforms. Panel Fixed Effects
Panel A. Deficit

DEFICIT_1	0.843*** [0.047]	0.825*** [0.046]	0.855*** [0.050]	0.844*** [0.047]	0.841*** [0.046]	0.839*** [0.046]
SD_1	-0.332** [0.148]	-0.263* [0.155]		-0.331** [0.148]	-0.278* [0.151]	-0.339** [0.148]
CRISIS_1		-0.633 [0.419]	-0.873** [0.424]			
election_1				0.041 [0.248]		
left_1					0.529* [0.301]	
younggov_1						0.382 [0.270]
R-squared	0.568	0.571	0.567	0.568	0.572	0.57
Observations	346	346	329	346	346	346
Countries	20	20	20	20	20	20

Panel B. Trade

TRADETAX_1	0.920*** [0.021]	0.918*** [0.021]	0.942*** [0.024]	0.920*** [0.021]	0.918*** [0.021]	0.921*** [0.021]
SD_1	-0.027* [0.014]	-0.034** [0.016]		-0.027* [0.014]	-0.028* [0.015]	-0.027* [0.014]
CRISIS_1		0.048 [0.043]	0.005 [0.040]			
election_1				0.004 [0.029]		
left_1					-0.011 [0.035]	
younggov_1						-0.009 [0.029]
R-squared	0.876	0.876	0.874	0.876	0.876	0.876
Observations	289	289	272	289	289	289
Countries	19	19	18	19	19	19

Note. Dependent variables: DEFICIT = government deficit as a share of GDP in Panel A, and TRADETAX = trade tax revenues as a share of trade (import+export) in Panel B. Regressors are the lagged values of: DEFICIT; TRADETAX; SD = standard deviation of the output gap over the previous five years; CRISIS = dummy taking value 1 if the output gap is less or equal to -4; election = dummy for legislative and/or executive elections; left = dummy for left-wing governments; younggov = dummy for governments in the first two years of office. Regressions are performed with least squares with country-fixed effects. Standard errors, reported in brackets, are corrected for heteroskedasticity and consistency using Kiviet (1995) procedure. ***, ** and * denote significance at 1, 5 and 10 per cent level.

Table 2. Economic Volatility and Reforms. System-GMM

DEFICIT_1	0.837***	0.834***	0.827***			
	[0.050]	[0.045]	[0.055]			
TRADETAX_1				0.932***	0.936***	0.833***
				[0.023]	[0.039]	[0.088]
SD_1	-0.253*	-0.335**		-0.027**	-0.030*	
	[0.146]	[0.163]		[0.011]	[0.016]	
CRISIS_1		0.199	-0.266		0.044	0.079
		[0.484]	[0.429]		[0.056]	[0.108]
AR(2)	0.398	0.409	0.357	0.757	0.759	0.276
Hansen-J test	0.99	0.99	0.99	0.99	0.99	0.99
Observations	346	346	346	289	289	289
Countries	20	20	20	19	19	19

Note. Estimation is performed with system-GMM. Dependent variables are the differences and levels of: DEFICIT = government deficit as a share of GDP in columns 1-3, and TRADETAX = trade tax revenues as a share of trade (import+export) in columns 4-6. Regressors are lagged differences and levels of: DEFICIT; TRADETAX; SD = standard deviation of the output gap over the previous five years; CRISIS = dummy taking value 1 if the output gap is less or equal to -4. All regressors are instrumented with lagged levels and differences. P-values for the AR(2) test of residuals serial correlation and for the Hansen J-test of instrument validity are reported. Standard errors, reported in brackets, are robust and corrected for finite sample using Windmeijer (2005) procedure. ***, ** and * denote significance at 1, 5 and 10 per cent level.

Table 3. Economic volatility and the likelihood of reforms
Panel A. Deficit Reform

DEFICIT_1	0.153*** [0.047]	0.163*** [0.050]	0.154*** [0.049]	0.084** [0.036]	0.083** [0.037]	0.074** [0.036]
SD_1	0.290* [0.159]	0.248 [0.167]		0.245* [0.136]	0.253* [0.149]	
CRISIS_1		0.382 [0.494]	0.618 [0.464]		-0.06 [0.455]	0.23 [0.412]
Observations	342	342	342	346	346	346
Countries	19	19	19	20	20	20
Country-FE	Yes	Yes	Yes	No	No	No

Panel B. Trade Reform

TRADETAX_1	1.083*** [0.336]	1.138*** [0.348]	0.898*** [0.288]	1.050*** [0.225]	1.072*** [0.232]	0.964*** [0.206]
SD_1	0.503** [0.221]	0.562** [0.230]		0.537*** [0.191]	0.600*** [0.212]	
CRISIS_1		-0.564 [0.658]	-0.075 [0.633]		-0.461 [0.653]	0.178 [0.611]
Observations	196	196	196	313	313	313
Countries	11	11	11	19	19	19
Country-FE	Yes	Yes	Yes	No	No	No

Note. Dependent variables: Deficit Reform = dummy taking value 1 if the annual change in DEFICIT is less than or equal to -1.17%, zero otherwise (Panel A); Trade Reform = dummy taking value 1 if the annual change in TRADETAX is less than or equal to -0.35%, zero otherwise (Panel B). Covariates are lagged values of: DEFICIT = government deficit as a share of GDP; TRADETAX = trade tax revenues as a share of trade; SD = standard deviation of the output gap over the previous five years; CRISIS = dummy taking value 1 if the output gap is less or equal to -4. Regressions are performed with panel logit with and without country-fixed effects. Standard errors are reported in brackets. ***, ** and * denote significance at 1, 5 and 10 per cent level.

Table 4. Economic Volatility, Deficit Crises and Reforms

	LSDV	LSDV	Sys-GMM	Sys_GMM	Logit FE	Logit FE	Logit RE	Logit RE
DEFICIT_1	0.725***	0.779***	0.685***	0.743***	0.260***	0.141***	0.208***	0.081**
	[0.047]	[0.053]	[0.078]	[0.110]	[0.070]	[0.047]	[0.058]	[0.040]
SD_1	-0.351**		-0.236*		0.300*		0.261*	
	[0.148]		[0.119]		[0.157]		[0.137]	
CRISIS_DEF_1	-1.317***	-1.218***	-1.952**	-1.112*	1.502**	0.188	1.661***	0.136
	[0.434]	[0.438]	[0.876]	[0.567]	[0.675]	[0.322]	[0.589]	[0.297]
R-squared	0.577	0.569						
AR(2)			0.325	0.397				
Hansen J-test			1	1				
Observations	346	346	346	346	342	439	346	439
Countries	20	20	20	20	19	20	20	20
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	No	No

Note. Dependent variables: DEFICIT in levels (columns 1-2), and in differences and levels (columns 3-4); Deficit Reforms = dummy with value 1 for d(DEFICIT) less than or equal to -1.17%, zero otherwise. Regressors are lagged levels and differences (in columns 3-4) of: SD = standard deviation of the output gap over the previous five years; CRISIS_DEF = dummy taking value 1 if DEFICIT is less than or equal to -7.5. Regressions for DEFICIT are performed with least squares with country-fixed effects (columns 1-2) and System GMM (columns 3-4); regressions for Deficit Reform are performed with panel logit with and without country fixed effects. Robust standard errors with Kiviet and Windmeijer corrections are reported in brackets. ***, ** and * denote significance at 1, 5 and 10 per cent level.