Elections and the timing of devaluations

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Abstract

This paper presents a rational political budget cycle model where devaluation acts as a tax on consumption due to a cash-in-advance constraint. Competent governments can signal their competency by reducing the rate of devaluation prior to elections. When voters also ignore the degree to which governments are opportunistic, i.e. the extent to which they are willing to distort the economy for electoral gain, an incompetent, opportunistic incumbent can reduce the rate of devaluation in the run-up to an election. The main theoretical implication in either setup, that the rate of devaluation is significantly higher in the months following an election, is consistent with evidence drawn from 26 countries in Latin America.

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1. Introduction

It has long been recognized that devaluations are politically sensitive events. In a classic paper, Cooper (1971) pointed out that devaluations in developing countries impose sizable political costs on finance ministers, who tend to leave shortly after the devaluation takes place. In addition, on occasions devaluations have led to the fall of the government. To the extent that devaluations impose significant political costs, this should affect the government’s incentives regarding the timing of exchange
rate adjustments. In particular, we expect that governments will try to avoid devaluations in the run-up to elections, and postpone them until after elections have taken place.

To formalize the temptation of the government to manipulate exchange rate policy, we develop a model with opportunistic politicians. Devaluation is politically costly because it acts as a tax on consumption. Politicians differ in their degree of competence and, other things equal, incompetent governments need higher taxes (i.e., higher devaluation) to provide the same level of public good. Under asymmetric information, opportunistic governments can try to exploit the trade-off between devaluation today and devaluation tomorrow, delaying the adjustment to provide a signal of competence and thus improve their electoral chances. This puts the logic of the Sargent and Wallace (1981) unpleasant monetarist arithmetic in a political economy framework.

Our model can be placed within the rational political budget cycle (RPBC) approach developed by Rogoff (1990), where fiscal impulses are the driving factor of political cycles. In this paper, we apply the RPBC approach to the behavior of exchange rates, an ingredient of political cycles that has been overlooked in the literature, which has focused mainly on the closed economy (exceptions to this are Stein and Streb, 1998, and Mishra, 1999). The typical assumption in models with opportunistic politicians is that the only informational asymmetry regards the degree of competence of the government (Rogoff and Sibert, 1988; Rogoff, 1990; Persson and Tabellini, 1990). The assumption of asymmetric information regarding competence alone is enough to obtain political exchange rate cycles. However, we recognize a second dimension over which there may be incomplete information: voters do not know just how opportunistic the incumbent is. One of the features of the resulting equilibrium is that we move away from the unappealing result in earlier opportunistic models that only competent governments distort economic policy for political reasons (cf. criticism of rational opportunistic models in Alesina et al., 1997, p. 32).

According to our model, the government’s temptation to increase the rate of devaluation has a precise timing: after the elections. There are plenty of episodes that reveal the political manipulation of exchange rates around elections. Ben-Porath (1975) noted that the closest a devaluation ever came to precede an election in Israel was 18 months, suggesting that exchange rate adjustments were avoided in the run-up to elections. Cardoso (1991) remarked that, in the 1986 Cruzado plan, ‘another election loomed, and, in the best Brazilian political tradition, corrective actions were placed on hold. This time the new measures (i.e., the devaluation) were announced immediately after the (legislative) elections’. In the failed Primavera Plan in Argentina, the reduction of the rate of crawl was widely interpreted as an attempt to moderate inflation before the 1989 presidential elections (Heymann, 1991). And, in the 1994

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1 Drazen (2001) provides theoretical and empirical grounds to prefer fiscal channels to monetary surprises as the basis for political cycle models.

2 Early models (Nordhaus, 1975) assumed backward-looking voters instead.
Mexican Peso crisis, Obstfeld and Rogoff (1995) noted that the skepticism over exchange rate commitments prevailing in Mexico was compounded by the government’s previous track record of devaluing in years of presidential elections. There is also more systematic evidence on the relationship between elections and the timing of devaluations. We extend the previous empirical literature using a methodology that tries to encompass all possible ways in which exchange rate adjustments may be delayed. The pattern that emerges, using data from 26 Latin American countries, is clear: the rate of devaluation tends to increase after elections, typically after the new government is inaugurated.

The plan of this paper is as follows. Section 2 introduces the economic model, with a cash-in-advance constraint that makes nominal devaluation a form of distortionary taxation. Section 3 studies what happens with the economy once a political system is introduced, in an incomplete information setup where voters are uncertain about how competent and how opportunistic politicians are. Section 4 looks at how the implications of the model relate to evidence on elections and timing of devaluations drawn from Latin-American countries. Section 5 presents the conclusions.

2. The economic model: devaluation as a tax

We work with a two-period small open economy with a cash-in-advance constraint. Agents need to hold money in order to consume. Devaluation, through its effect on the nominal interest rate, acts as a distortionary tax on consumption. Although tax smoothing is the optimal policy, Section 3 will show that an opportunistic incumbent may have incentives to deviate from this policy to enhance its electoral chances, exploiting a trade-off between present and future devaluation.

2.1. Trade-off between current and future consumption

Goods are non-storable. Labor can be used to produce either a private good $y_{ct}$, or a public good, $y_{gt}$. Production functions are linear in employment: $y_{ct} = l_{ct}$, $y_{gt} = l_{gt}$. Labor supply is constant, so $l = l_{ct} + l_{gt}$. With competitive firms, real wages $W_t/P_t = 1$.

The government provides a constant amount $y_{gt} = g$ of the public good each period. The private good is tradable. By the law of one price, the domestic price $P_t = E_t P_t^*$, where $E_t$ is the nominal exchange rate, and $P_t^*$ is the international price. Henceforth, $P_t^* = 1$ for $t = 1, 2$.

A central bank issues fiat money $M_t$ which has no nominal return. Agents can also hold bonds $B_t$, which are indexed to the exchange rate, so that their nominal rate of return $i_t$ is determined by the interest parity condition, $1 + i_t = (1 + i^*)(1 + e_t)$, where $e_t = (E_t - E_{t-1})/E_{t-1}$ is the rate of devaluation and $i^*$ is the constant external interest rate.

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3 This allows to abstract from the choice between public and private goods. Since labor supply is inelastic, the leisure/work decision is also ignored.
By a cash-in-advance (CIA) constraint, $M_t \geq C_t$, consumers need to hold money to make consumption expenditures $C_t = P_t^e c_t$. Firms and the government pay wages at the beginning of each period with bonds. We assume that bonds can be exchanged for money balances within the period, so it is not necessary for consumers to hold money between periods. Consumers have to discount bonds to obtain money, so they forgo interest on cash holdings needed to make consumption expenditures during the period.4 Since firms can redeem the bonds at the end of the period, they do not need to hold money between periods either. Hence, there is no end-period problem.

Devaluation acts as a tax on consumption, through the nominal rate of interest. The seigniorage revenues, $S_t = i_t M_t$, are transferred back to the government. This resembles the concept of seigniorage typically used by the Federal Reserve Board, i.e. the nominal interest rate payments on government bonds avoided by the issue of non-interest bearing liabilities.

The per-period government budget constraint is $G_t + i_t D_{t-1} = S_t + \Delta D_t$, where $D_t$ is debt and $G_t = W_t l_{gt}$. Let $\Gamma = \sum_{t=1}^{2} (G_t/E_t)/(1 + i^*)^{t-1} = \sum_{t=1}^{2} l_{gt}/(1 + i^*)^{t-1}$. Assuming initial and final debt are zero, the intertemporal budget constraint implies that

$$\Gamma = \sum_{t=1}^{2} \frac{S_t/E_t}{(1 + i^*)^{t-1}}$$

Eq. (1) simply states that the present discounted value of expenditures, measured in terms of foreign currency, is equal to the present discounted value of taxes.

The per period budget constraint for the representative consumer is that total income plus interest earned on initial bond holdings, net of cash holdings, equals consumption expenditures plus financial asset accumulation, $Y_t + i_t(B_{t-1} - M_t) = C_t + \Delta B_t$, where $Y_t = W_t(l_{yt} + l_{gt})$. Let gross wealth $\Omega = \sum_{t=1}^{2} (Y_t/E_t)/(1 + i^*)^{t-1} = \sum_{t=1}^{2} l_t/(1 + i^*)^{t-1}$. With non-satiation, no assets will be left over at the end of $t = 2$. With no initial asset holdings, the inter-temporal budget constraint implies that the present discounted value of consumption plus the cost of holding money will equal wealth:

$$\Omega = \sum_{t=1}^{2} \frac{(C_t + i_t M_t)/E_t}{(1 + i^*)^{t-1}}$$

From $S_t = i_t M_t$, (1), and (2), there is a linear trade-off between current and future consumption. This reflects the economy’s resource constraint.

$$c_2 = (1 + i^*)(\Omega - \Gamma - c_1)$$

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4 We follow the Lucas (1980) CIA specification, which differs from Svenson (1983), where the market for goods precedes the market for bonds, so consumers need to hold money balances between periods. Cf. Obstfeld and Rogoff (1996), and Nicolini (1998) for alternative CIA specifications.
2.2. The consumer’s problem

Preferences of the representative consumer are additive over time, with a subjective discount factor of $1/(1+\delta)$. The per-period utility function has a constant intertemporal elasticity of substitution $\sigma$, where $0 < \sigma \leq 1$.

$$U = \sum_{t=1}^{\infty} \frac{u(c_t)}{(1+\delta)^{t-1}} \begin{cases} u(c_t) = \ln c_t & \text{if } \sigma = 1, \sigma = 1 \frac{(1+i_1)}{(1+i_2)} \end{cases}$$  \tag{4}

The first-order conditions for consumption are derived maximizing utility, subject to the wealth and CIA constraints (interest rates will be positive in equilibrium, so the CIA constraint will be binding). Letting $\delta = \bar{i}^*$, the time path of consumption depends on nominal interest rates (this is a discrete time analog of the continuous time result in Calvo, 1986).

$$u'(c_2) = \frac{(1+i_2)}{(1+i_1)}; \quad u'(c_1) = c_1^{1/\sigma} \Rightarrow \frac{c_2}{c_1} = \left(1 + \frac{i_1}{i_2}\right)^{-1} \tag{5}$$

2.3. The government’s problem

A benevolent government sets interest rates to maximize consumer utility. The way it implements the desired interest rates is by setting the devaluation rate, given that both variables are linked by the interest parity condition. The Pareto optimal policy requires the maximization of utility (4) subject to resource constraint (3), and yields the following first order condition:

$$\frac{u'(c_2)}{u'(c_1)} = 1 \tag{6}$$

In order to obtain consumption smoothing, the Pareto optimal policy has to be implementable taking into account the consumers first-order condition (5). It is easy to see by comparing conditions (5) and (6) that consumption smoothing can be achieved with a constant interest rate $\bar{i}$. Hence, the policymaker can actually implement the first best.\footnote{The intertemporal elasticity of substitution is typically smaller than 1. Reinhart and Végh (1994) report that most estimates of $\sigma$ are significantly above zero, but below 0.80. Cf. also Obstfeld and Rogoff (1996).}

Denote tax rates by $\tau_t = i_t/(1+i_t)$. With constant interest rates, taxes are constant, so the optimal solution $\bar{\tau}$ is consistent with the Barro (1979) result of tax smoothing under distortionary taxation. When $\tau_1 = \tau_2 = \bar{\tau}, \bar{\tau} = \Gamma/\Omega$, i.e., the tax rate is given by the ratio of the present discounted value of government expenditure to wealth. The fact that $\Gamma/\Omega$ lies between 0 and 1 implies that $\bar{\tau} > 0$, so the cash-in-advance constraint is binding.\footnote{There is no time consistency problem, because the Pareto solution coincides with the Ramsey solution.}
3. The political model: devaluation as a signal

Though tax smoothing is optimal from a welfare perspective, there is a trade-off between present and future devaluation. Under asymmetric information, an opportunist government may have incentives to exploit this trade-off for political purposes, reducing taxes (i.e., the rate of devaluation) before elections.

Standard opportunistic models assume that opportunism is common knowledge. In this setup, a competent incumbent will separate out, as in Rogoff (1990), picking a lower rate of devaluation than incompetent incumbents. Analytically, this result is a straightforward consequence of the application of the logic of political budget cycles to an open economy.

Under the assumption of two-dimensional asymmetric information introduced in this paper, voters ignore both the degree of competence and the degree of opportunism of incumbent governments. There is also a tendency to postpone hikes in the rate of devaluation until after elections. However, the ones who distort policy here are incompetent, opportunistic, incumbents.

3.1. Heterogeneity in competency and opportunism

An incumbent can be either competent \( \theta_t = 1 \) or incompetent \( \theta_t = 0 \) to run the government, as in Rogoff (1990). A competent government needs less employment to produce a given amount of the public good.

\[
y_{gt} = (1 + \theta_t)l_{gt}, \quad \text{where} \quad \theta_t = 0, 1
\]

There is retrospective voting, because the incumbent’s competence after elections depends on competence before elections (the transitory competency in Rogoff and Sibert, 1988). The incumbent has an informational advantage regarding its competence, which voters observe with a one period lag. This implies that, though exchange rate policy is visible to voters in the short run, other components of fiscal policy are only observed the following period.

Unlike previous political cycle models, we consider the consequences of the fact that on top of uncertainty regarding the incumbent’s competence, there is asymmetric information on opportunism \( k \) of candidates. Opportunism is reflected by how much an incumbent values sticking to power, beyond any commitment towards public welfare. A non-opportunistic incumbent has the same utility function as the representative consumer \( k = 0 \), but an opportunistic incumbent derives additional pleasure from holding office \( k = K > 0 \). Let \( z_t = 1 \) when candidate is incumbent, and \( z_t = 0 \) when not. An incumbent’s utility is thus

\[
Z = U + \sum_{t=1}^{2} \frac{z_t k}{(1 + \delta)^{t-1}}, \quad \begin{cases} k = 0 \text{ for non-opportunistic} \\ k = K \text{ for opportunistic} \end{cases}
\]

While the assumption of asymmetric information regarding competence is standard in the literature, our assumption of asymmetric information regarding opportunism is not. As
we will show below, this assumption is not crucial for us to obtain the political cycles in exchange rates. However, we think it is both realistic, and theoretically interesting.

The fact that not all politicians are willing to go to the same lengths in order to gain or retain office is nicely illustrated in Tufte (1978), who makes the point using quotes from politicians and economic advisors. Nixon, for example, is portrayed as a politician who is well aware of the importance of manipulating the economy in order to win elections, particularly after losing the 1960 election by a narrow margin. Gerald Ford, in contrast, appears to have been non-opportunistic. Tufte reports that, shortly before the 1976 presidential elections, William Seidman, a top economic advisor to Ford, said:

‘I think Mr. Fords chances of reelection are very good. As for the economic lull, we considered the use of stimulus to make sure we didn’t have a low third quarter, but the president didn’t want anything to do with a short-term view’.

If politicians are in fact different in this regard, it is natural to assume the existence of asymmetric information, since opportunism is a characteristic of the preferences of individuals, which are not observable and are revealed only indirectly through their actions. Heterogeneity regarding opportunism appears, for example, in recent work on governance by Dixit (2001), who includes the existence of honest, dishonest and opportunistic agents ‘to make the model richer and more realistic’.7

3.2. Symmetric information

As a benchmark for the signaling game, we characterize optimal policies under symmetric information. In the first period, a competent incumbent has $h_1 = 1$, an incompetent, $h_1 = 0$. If the incumbent is reelected, competency in the second period equals competency in the first, $h_2 = h_1$; if not, the second period incumbent is competent with probability $p_2 = q$, where $q$ is the probability that an opponent picked at random is competent. The possible levels of public expenditure can be ranked as follows: $G(0, 0) > G(0, q) > G(1, q) > G(1, 1)$, where $G(h_1, q) = qG(1, 1) + (1 - q)G(h_1, 0)$ is expected government expenditure given first period competency $h_1$ and probability $q$ a competent is selected in the second period. By resource constraint, consumption $c_{2h}$ in states $h = d$ (good, i.e. $h_2 = 1$) and $h = b$ (bad, i.e. $h_2 = 0$) is

$$c_{2h} = (1 + \delta)(\Omega - G(h_1, h_2) - c_1)$$  \hspace{1cm} (9)

In a Pareto optimum, the marginal utility of current consumption must equal the expected marginal utility of future consumption,

$$u'(c_1) = \rho_2 u'(c_{2d}) + (1 - \rho_2) u'(c_{2h})$$  \hspace{1cm} (10)

Optimal consumption $\tilde{c}_1$ is determined by (9) and (10). $\tilde{c}_1$ is increasing in competency (Lemma 1, Appendix A), so $\tilde{c}_1(0, 0) < \tilde{c}_1(0, q) < \tilde{c}_1(1, q) < \tilde{c}_1(1, 1)$.

Weinschelbaum (1998) introduces differences in the level of honesty in a principalagent model of corruption where purchase costs can be low or high.
Voters decide on the basis of future expected utility under the alternative candidates, as in Persson and Tabellini (1990). Indirect utility of voters $V(q_2, \theta_1, \rho_2)$ is increasing in probability $\rho_2$ that incumbent is competent (by the envelope theorem, $\frac{dV}{d\rho_2} = u(\tilde{c}_{2d}) - u(\tilde{c}_{2b})/(1 + \delta > 0)$. Hence, voters want to reelect competent incumbents, to assure $\rho_2 = 1 > q$, and replace incompetent incumbents, to have chance $\rho_2 = q > 0$ of getting a competent government.

To implement the Pareto allocations as a competitive equilibrium, the government faces two constraints. First, the government budget constraint must be satisfied in each state $h = d, b$.

$$\Gamma(\theta_1, \theta_2) = \frac{\tau_1}{1 - \tau_1} c_1 + \frac{\tau_2}{1 - \tau_2} \frac{c_{2h}}{1 + i^*}$$  \hspace{1cm} (11)

where the right-hand side of (11) represents the present discounted value of government revenues.

Second, the government is restricted in its choice of $\tau_1$ by the behavior of consumers. Consumers satisfy the following condition in market equilibrium (which boils down to (5) if $\rho_2 = 1$):

$$u'(c_1) = \rho_2 u'(c_{2d}) \frac{1 - \tau_2d(\theta_1, \rho_2)}{1 - \tau_1(\theta_1, \rho_2)} + (1 - \rho_2) u'(c_{2b}) \frac{1 - \tau_{2b}(\theta_1, \rho_2)}{1 - \tau_1(\theta_1, \rho_2)}$$  \hspace{1cm} (12)

Eqs. (11) and (12) determine the level of the tax rate $\tau_1$ necessary to implement a given level of consumption $c_1$. Without asymmetric information, the best the incumbent can do is to set taxes optimally to implement Pareto allocation $\tilde{c}_1(\theta_1, \rho_2)$. The optimal tax $\tilde{\tau}_1(\theta_1, \rho_2)$ is decreasing in competency (Lemma 2), so $\tilde{\tau}_1(0, 0) > \tilde{\tau}_1(0, q) > \tilde{\tau}_1(1, q) > \tilde{\tau}_1(1, 1)$. In equilibrium, a competent who knows it will be reelected sets $\tilde{\tau}_1(1, 1) = \tilde{\tau}_2(1, 1)$, while an incompetent who knows it will be thrown out sets $\tilde{\tau}_1(0, q) = \alpha \tilde{\tau}_{2d}(0, q) + (1 - \alpha) \tilde{\tau}_{2b}(0, q)$, where $0 < \alpha \leq \rho_2$ (Lemma 3). If there were no opportunism, these results would also carry over to the case of asymmetric information, to which we now turn.

### 3.3. One-dimensional asymmetric information

The timing of the signaling game is as follows. Voters have priors that the candidates are competent with probability $q$ and incompetent with probability $1 - q$. Nature then endows candidates with a certain competency, which is private information. The government sets taxes $\tau_1$, which are observed by consumers before deciding consumption $c_1$. At the end of the first period, elections are held. In the post-election period, the government sets $\tau_2$ so as to obey the budget constraint. A key assumption in the literature on opportunistic cycles is that, though competence is not directly observable, the degree of opportunism $k$ is known to be high and equal to $K$. We now derive a Perfect Bayesian Equilibrium when opportunism is common knowledge. This standard RPBC model provides a reference point against which to compare the model with two-dimensional asymmetric information.

The incumbent decides the level of current taxes, and hence consumption, taking into account voter reactions. In a separating equilibrium, let high consumption be the signal $c_{1h}^*$
only a competent incumbent is willing to send. This signal will guarantee reelection, since voters will infer \( \theta_1 = 1 \). Given that in a separating equilibrium an incompetent will not be reelected, the best choice of low consumption for an incompetent is the optimal consumption \( \tilde{c}_1(0, q) \) derived above, that takes into account that with probability \( q \) the replacement will be competent. Given voters reactions in a separating equilibrium, we will have that

\[
c_1 = \tilde{c}_1(0, q) \Rightarrow \text{Pr}(\text{reelection}) = 0
\]

\[
c_1 = c^*_1 \Rightarrow \text{Pr}(\text{reelection}) = 1
\]

For out of equilibrium values of consumption, we assume that voters will attach a zero probability of competence unless \( c_1 > c^*_1 \), when expected competency will be 1 and the incumbent will be reelected for sure.

To find the actual \( c^*_1 \), the signaling game can be couched in terms of the temptation to signal, \( T(c^1_1, \theta_1, K) \), the personal benefit from being reelected, \( B(K) \), net of the welfare cost, \( C(c^1_1, \theta_1) \):

\[
T(c^1_1, \theta_1, K) = B(K) - C(c^1_1, \theta_1)
\]

\[
= \frac{K}{1 + \delta} - [V(\tilde{c}_1(\theta_1, q), \theta_1, q) - V(c^*_1, \theta_1, \theta_1)]
\]

The personal benefit \( B(K) \) from picking \( c^*_1 \) is the utility \( K \) of being in office in the second period. The welfare cost \( C(c^1_1, \theta_1) \) of signaling is the difference between indirect utility when type \( \theta_1 \) incumbent implements \( \tilde{c}_1(\theta_1, q) \) and is not reelected (so future incumbent is competent with probability \( q \)), and utility when it signals \( c^*_1 \) and is reelected (so future incumbent is either competent, \( \theta_1 = 1 \), or incompetent, \( \theta_1 = 0 \), for sure). The welfare cost can be broken down in two components:

\[
C(c^1_1, \theta_1) = [V(\tilde{c}_1(\theta_1, q), \theta_1, q) - V(\tilde{c}_1(\theta_1, \theta_1), \theta_1, \theta_1)] + [V(\tilde{c}_1(\theta_1, \theta_1), \theta_1, \theta_1) - V(c^*_1, \theta_1, \theta_1)]
\]

The first term on the RHS is a net wealth component. The wealth component captures the welfare change, evaluated at the optimal intertemporal consumption for type \( \theta_1 \), when \( \rho_2 \) changes from \( q \) to \( \theta_1 \), a welfare loss with incompetent (\( \rho_2 \) falls to 0), a gain with competent (\( \rho_2 \) rises to 1). The second term is a cyclical component. The cyclical component captures the welfare loss due to the distortion in the optimal time profile of consumption.

Fig. 1 shows the least-cost separating equilibrium \( c^*_1 \), at point \( B(K) = C(c^*_1, 0) \) where the benefit equals the cost of signaling for an incompetent incumbent.

At \( c^*_1 \), the temptation to signal for a competent incumbent is positive because the signaling costs of a competent incumbent are lower. This can be established in two steps. First, \( C(\tilde{c}_1(1, 1), 0) > 0 > C(\tilde{c}_1(1, 1), 1) \) at \( \tilde{c}_1(1, 1) \), since the welfare effects of an incompetent’s reelection are negative due to the cyclical distortion, that comes on top
of a negative wealth component, whereas the reelection of a competent brings about a positive wealth effect on welfare without any cyclical distortion.\(^8\) Second, differentiation of (15) shows that, due to the concavity of the utility function, the slope of the cost function for the incompetent is steeper than that for a competent for \(c^*_1 > \tilde{c}_1(1, 1)\), which ensures that the cost curves do not cross.

If the cost for an incompetent of sending signal \(\tilde{c}_1(1, 1)\) were larger than the benefit from reelection, \(c^*_1 = \tilde{c}_1(1, 1)\) and consumption would be constant over time. Denote by \(k^*\) the critical threshold that leads the incompetent incumbent to be indifferent between mimicking \(\tilde{c}_1(1, 1)\) or not, \(T(\tilde{c}_1(1, 1), 0, k^*) = 0\). When \(K > k^*\), we characterize opportunism as high. Hence,\(^8\)

**Proposition 1.** With asymmetric information on competency, and high opportunism, there is a separating equilibrium that leads to a consumption cycle. A competent picks \(c^*_1 > \tilde{c}_1(1, 1)\). An incompetent picks \(\tilde{c}_1(0, q)\).

When opportunism \(K\) is high, signal \(c^*_1\) is larger than \(\tilde{c}_1(1, 1)\) so there is a consumption cycle. To implement this solution, the separating signal in terms of taxes, \(\tau^*_1\), will be smaller than optimal taxes \(\tilde{\tau}_1(1, 1)\), so this implies a political budget cycle as in Rogoff (1990).

Separating equilibria with higher \(c^*_1\) than Fig. 1 (and hence lower taxes than \(\tilde{\tau}_1\)) can be discarded by application of the ChoKreps intuitive criterion, using equilibrium dominance.

\(^8\) At \(c^*_1 = c_1(1, 1)\) signaling costs attain a minimum for a competent, while for incompetent minimum is at \(c^*_1 = c_1(0, 0)\).
arguments to restrict out-of-equilibrium beliefs. If the range of signals is unbounded, pooling equilibria are also unintuitive.9

### 3.4. Two-dimensional asymmetric information

We now analyze the signaling game under asymmetric information on competency and opportunism. There are both non-opportunistic incumbents, \( k = 0 \), and opportunistic incumbents, \( k = K \). The voters priors are that the incumbent is opportunistic with probability \( s \). We first characterize a Perfect Bayesian Equilibrium in terms of consumption. As a solution to the game, we posit the partially pooling equilibrium depicted in Table 1.10

The intuition is simple. A non-opportunistic, incompetent, incumbent always picks \( \tilde{c}_1(0, q) \), which results in \( \tilde{c}_1(0, q) \), and loses the elections. A high level of consumption \( \tilde{c}_1(1, 1) \) can thus work as an informative signal. From the viewpoint of voters, the conditional probability that the incumbent is competent, if signal \( c_1 = \tilde{c}_1(1, 1) \) is observed, is \( \rho^c = q/(q + (1 - q)s) \). As long as \( s < 1 \) (i.e., as long as the probability of non-opportunistic types is non-zero), \( \rho^c \) will be higher than \( q \), the probability that somebody elected at random is competent. Voters that maximize expected utility will thus reelect an incumbent that delivers \( c_1 \), and replace an incumbent that delivers \( \tilde{c}_1(0, q) \). To define beliefs for out-of-equilibrium signals, we assume that the voters reactions are as follows:

\[
\begin{align*}
c_1 < \tilde{c}_1(1, 1) & \Rightarrow \Pr(\text{reelection}) = 0 \\
c_1 \geq \tilde{c}_1(1, 1) & \Rightarrow \Pr(\text{reelection}) = 1
\end{align*}
\]

A competent incumbent will be willing to pick \( c_1(1, 1) \) since that is its first best. For an incompetent incumbent that is opportunistic to be tempted to mimic \( \tilde{c}_1(1, 1) \), high opportunism, i.e. \( K > k^* \), is required.

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9 The results may require \( \tau_1 < 0 \). To assure the liquidity constraint remains binding at negative interest rates, avoiding a liquidity trap, cash balances outstanding at the end of the first period are assumed worthless (e.g. a new currency will replace the old, which will no longer be legal tender).

10 This equilibrium is also called semi-separating (Gibbons, 1992). No separating equilibrium exists beyond level of opportunism which requires positive signaling costs for competent incumbents to separate out (Streb, 2001).
Proposition 2. With asymmetric information on competency and opportunism, and high opportunism, there is a partially pooling equilibrium that leads to a consumption cycle. A competent picks $c^*_s = c_1(1, 1)$. An incompetent that is highly opportunistic mimics $c^*_s$, while a non-opportunistic incompetent picks $c_1(0, q)$.

This partially pooling equilibrium survives the application of the ChoKreps intuitive criterion: given the behavior of voters in (16), competent governments have no incentive to signal with a consumption cycle, because it does not increase their chances of reelection, and it would distort the optimal time profile of consumption. To put it differently, incumbents don’t need to prove their competency. They just need to show that the probability that they are competent is greater than the probability $q$ that a replacement is competent. Signal $c^*_s = c_1(1, 1)$ is enough to achieve that goal.

To implement allocation $c^*_s = c_1(1, 1)$ there is a slight difference with the symmetric information case. The expectation the incumbent will be competent is no longer 1, but rather $\rho^s < 1$, since the incumbent may be an opportunistic incompetent. For an intertemporal elasticity of substitution $\sigma = 1$, it is still optimal for a competent to set $\sigma^* = \sigma^*_1(1, 1)$, as under symmetric information, because $c_1$ only depends on current taxes $\tau_1$. When $0 < \sigma < 1$, however, $c_1$ also depends on future taxes $\tau_2$, and hence on probabilities $\rho^s$ and $1 - \rho^s$ that $\tau_2$ may be low or high. A competent incumbent has to set $\sigma^* < \sigma^*_1(1, 1)$ to implement $\bar{c}_1(1, 1)$. The reason is that with a level of risk aversion higher than log utility, consumers reduce their level of first period consumption when the probability of high taxes in the second period rises from 0 to $1 - \rho^s$. A competent incumbent who knows it will be in office in the second period implements a tax $\tau_1$ lower that $\bar{c}_1(1, 1)$, in order to smooth consumption completely (Lemma 4 in Appendix A).

In summary, Proposition 2 implies that consumption, tax and devaluation cycles arise with probability $(1 - q)s$, due to incompetent, opportunistic incumbents that try to masquerade as competent incumbents. What is the specific role of asymmetric information on opportunism? This assumption is not what drives the political budget cycle, since there is also a cycle when opportunism is common knowledge. What is different in Proposition 2 is that it captures the realistic feature that incompetent incumbents may also distort economic policy under certain conditions. In fact, the traditional setup in which opportunism is common knowledge can be seen as a particular case of our more general model.

3.5. Substitution and signaling effects

The signaling games put the consumption boom in Calvo (1986) in a political economy setting. Low taxes (and low devaluation) lead to high consumption, and help the government get reelected. In Calvo (1986), the lack of credibility of the stabilization program affects the effective price of consumption, and induces consumers to substitute present consumption for future consumption, generating a consumption boom. In our

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11 The result does not depend on the existence of a non-opportunistic incumbent, but rather of type $k < k^*$. In fact, if the types of opportunism $k$ are uniformly distributed over $[0, \bar{k}]$ and $\bar{k} > k^*$, the same result in Proposition 2 goes through with $s = 1 - (k^*/\bar{k})$. 
paper, imperfect credibility is not an assumption, but rather the consequence of incomplete information regarding the competence of the incumbent.

Under asymmetric information, tax \( \tau_1 \) has a two-fold effect on consumption \( c_1 \). A lower \( \tau_1 \) leads to higher \( c_1 \) due to intertemporal substitution. But there is also a signaling effect: if \( \tau_1 \) falls to \( \tau_1^* \), it raises expectations about current and future competency. This leads consumers to expect lower taxes in the future. When \( 0 < \sigma < 1 \), this news gives an added boost to \( c_1 \) (cf. Lemma 5 for case of two-dimensional asymmetric information).

In a partially pooling equilibrium voters will not know whether or not they are experiencing a temporary consumption boom. Low taxes will not be sustainable if an incompetent incumbent is exploiting the trade-off between current and future taxes (Lemma 6). As in the Sargent and Wallace (1981) trade-off, if an incumbent lowers current devaluation by incurring debt, it will later have to resort to higher devaluation to pay off that debt. If the incumbent can buy time by waiting until after elections to adjust, this policy can bring the government an electoral benefit.

4. Empirical implications of the model

We now draw the implications of our model on opportunistic politicians for the behavior of exchange rates around elections, and confront the predictions to empirical evidence from Latin America.

4.1. Political devaluation cycles

To relate the model in Section 3 to the empirical evidence, we now draw its implications in terms of the average rate of devaluation around elections. It is convenient to distinguish the cases \( \sigma = 1 \), and \( 0 < \sigma < 1 \).

First take \( \sigma = 1 \). Under symmetric information, a competent incumbent smooths taxes, so \( \tilde{e}_1(1,1) = \tilde{e}_2(1,1) \). An incompetent incumbent sets the devaluation rate optimally, given that it will be replaced by a competent with probability \( q \) and by an incompetent with probability \( 1 - q \), picking \( \tilde{e}_1(0,q) = q\tilde{e}_{2d}(0,q) + (1 - q)\tilde{e}_{2h}(0,q) \). Consequently, in expected value the rate of devaluation is constant around elections (Proof in Appendix A). In contrast, the asymmetric information setups deliver electoral cycles. We demonstrate the results under two-dimensional asymmetric information. As before, a competent incumbent picks \( \varepsilon'_1 = \tilde{e}_1(1,1) \) and is reelected. An incompetent government that is not too opportunistic chooses a high devaluation rate \( \tilde{e}_1(0,q) \) and loses the elections. On the other hand, highly opportunistic, incompetent, incumbents mimic the competents signal \( \varepsilon'_1 < \tilde{e}_1(0,q) \) to be reelected. By the intertemporal trade-off in Lemma 6, this leads to \( \varepsilon_{2h}(\varepsilon'_1) > \tilde{e}_2(0,0) \) in the second period (cf. Appendix A). This establishes

**Proposition 3** (Case \( \sigma = 1 \)). Under symmetric information, the average rate of devaluation around elections is constant. Under two-dimensional asymmetric information, the average rate of devaluation rises after elections if and only if \( s > 0 \) (i.e., if and only if there is a positive probability that the incumbent is highly opportunistic).
When $0 < \sigma < 1$, the comparison is more complicated. Under symmetric information, a competent incumbent smooths taxes, setting a constant rate of devaluation, $\tilde{e}_1(1, 1) = \tilde{e}_2(1, 1)$, but an incompetent incumbent optimally sets $\tilde{e}_1(0, q) > q\tilde{e}_2d(0, q) + (1 - q)\tilde{e}_2b(0, q)$. In expected value, the rate of devaluation falls after elections, which is what is needed to smooth consumption (Proof in Appendix A). As a consequence, under two-dimensional asymmetric information it is not enough to have $s > 0$ to assure that the average rate of devaluation rises after elections. This proportion has to be large enough. A sufficient condition is $s \geq 1/2$, i.e. that highly opportunistic incumbents be a majority (cf. Appendix A).12

**Proposition 4** (Case $0 < \sigma < 1$). Under symmetric information, the average rate of devaluation falls after elections. Under two-dimensional asymmetric information, the average rate of devaluation rises after elections if $s \geq 1/2$.

When governments manipulate the exchange rate, they manipulate it in the same direction as the episodes that motivate our study: postponement of devaluations until after elections. By Propositions 3 and 4, we should expect the average rate of devaluation to rise after elections if most incumbents are highly opportunistic.

The results under one-dimensional asymmetric information on competence and common knowledge of opportunism would be similar in that there will be political devaluation cycles. However, the cycles will not be produced by incompetent incumbents who try to masquerade as competent. Rather, the devaluation cycle is produced by competent incumbents.13

In summary, the setup with two-dimensional asymmetric information on competency and opportunism, as well as the standard setup with asymmetric information on competency, implies that the rate of devaluation rises after elections if the degree of opportunism of political candidates is sufficiently large and widespread.

The paper assumes that the range of signals is not limited. If signals were limited to, say, devaluations being non-negative, even under one-dimensional asymmetric information no separating equilibrium exists beyond a certain level of opportunism $k$. Instead, there would be a partially pooling equilibrium qualitatively similar to that depicted in Propositions 3 and 4, in that incompetent incumbents distort policy producing political devaluation cycles around elections. The analytical novelty of Propositions 3 and 4 is that they are derived without need of imposing any limit on the range of feasible signals.

12 In Dixit (2001), his presumption is that Opportunists comprise a large portion of the population, and that Honest and Dishonest types have smaller proportions. This is enough to drive our own results.

13 We sketch the argument. When $\sigma = 1$, the average rate of devaluation rises after elections because competent incumbents signal with low devaluation before elections, while incompetent incumbents smooth the rate of devaluation. When $0 < \sigma < 1$, expected devaluation after elections falls with incompetent incumbents, and rises with competent incumbents. Since the cycle produced by competent incumbents is increasing in $K$, the average rate of devaluation after elections rises if $K$ is sufficiently high.
4.2. The evidence

Having discussed the empirical implications of the opportunistic model, we now turn to some new evidence, drawn from the experience of 26 countries in Latin America and the Caribbean, regarding the pattern of exchange rates around presidential elections. The sample period is 1960 to 1994. Data on nominal exchange rates is taken from the International Finance Statistics of the IMF. Data on election dates is based on Nohlen (1993), and on the Lijphart Elections Archive in the World Wide Web.

This evidence is meant to complement the work of Edwards (1994), Klein and Marion (1997) and Gavin and Perotti (1997). Edwards (1994) studied the timing of 39 large devaluations (15% or more) in democratic regimes in developing countries, finding they tended to occur early on in the term. Klein and Marion (1997) studied the duration of exchange rate pegs to the US dollar for 17 Latin American countries in the 1956-1991 period, finding that the likelihood that a peg would be abandoned increased immediately after an executive transfer. Gavin and Perotti (1997), in a study of fiscal policy in Latin America, found that the likelihood that a shift from fixed to flexible exchange rate regimes would occur increased significantly right after an election had taken place.

Gavin and Perotti focus only on regime switches from fixed to flexible. Therefore, they disregard episodes of step devaluations. In contrast, Klein and Marion consider step devaluations as the end of a spell and the beginning of another. However, since Klein and Marion only studied the abandonment of pegs, they do not capture changes in the rate of crawl of the exchange rate, or in depreciation in the case of managed floating regimes, which are other ways in which depreciations may be delayed. Our methodology is intended to encompass all possible ways in which delayed depreciations may occur.

While the model in Section 3 makes no distinction between elections and executive transfers, in the data we distinguish between these two dates. The methodology we use is very simple. First, we pull together all 131 presidential elections in Latin America and the Caribbean over the sample period (in parliamentary regimes, presidential elections refer to the election of a new government). We consider a 19-month window centered on each election. For each episode, month 0 corresponds to the month of the election, month 1 to the month prior to the election, and so on. We then average, for each of the 19 months in the window (9 through 9), the rate of nominal depreciation across all episodes. The average nominal rate of depreciation, month by month, is presented in Fig. 2. In order to lessen the effects of outliers, we worked with geometric averages rather than arithmetic averages.

The pattern in the figure is striking, and provides support to the hypothesis that devaluations are delayed until after elections. In months 2, 3 and 4 after an election, the

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14 Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Trinidad & Tobago, Uruguay and Venezuela are in sample. Frieden et al. (2001) study these countries more broadly.
average rate of nominal depreciation is more than 2 percentage points higher than for other months. The largest effect occurs 2 months after the election, when the average rate of nominal depreciation reaches 7%, around 4.5 percentage points higher than in other months.

Second, Fig. 3 shows the rate of devaluation around constitutional government changes applying the same methodology (118 episodes). Non-constitutional government changes (such as coups) were excluded, since they may be endogenous to changes in the exchange rate.

The effect after government changes is even stronger. The average devaluation 1 month after the change is greater than 10%, and around 7 percentage points higher than in other months. The fact that devaluations occur 2 to 4 months after the elections is a reflection of the fact that the lag between the election and the change in government is in most cases between 1 and 3 months.

To verify if the increase in the rate of devaluation in Figs. 1 and 2 is statistically significant, we regressed the rate of depreciation (more precisely, log(1+depreciation), in order to reduce the effects of outliers) on dummy variables that capture the position of each period within the window relative to the election or constitutional government change. Since Fig. 2 suggests that deprecations tend to be larger in months 2 through 4 after elections, we include a dummy that takes a value of 1 for these observations. For comparison, and because devaluations may be delayed prior to elections, we also include a dummy for periods 1 through 3 before the election. The results are presented in Table 2.
The first regression in Table 2, using Ordinary Least Squares, shows that the increase in the rate of depreciation in months 2 through 4 is positive and significant. The rate of depreciation in this period increases by 1.55 percentage points. A comparison with the constant suggests that the average rate of depreciation more than doubles during this

Fig. 3. Nominal exchange rate depreciation around constitutional government changes (118 episodes).

The first regression in Table 2, using Ordinary Least Squares, shows that the increase in the rate of depreciation in months 2 through 4 is positive and significant. The rate of depreciation in this period increases by 1.55 percentage points. A comparison with the constant suggests that the average rate of depreciation more than doubles during this
period. The coefficient for the months 1 through 3 before elections, in contrast, is not significant. Similar results are obtained when we use country fixed effects (regression two in Table 2). In this case, the rate of depreciation increases by 1.85 percentage points in post-electoral periods, which represents an increase over other periods of 125 percent.

A number of countries in our sample—Bahamas, Barbados, Belize, Guyana, Jamaica, Suriname and Trinidad Tobago—have parliamentary systems, in which elections are not necessarily exogenous events. In all of these countries, members of parliament are elected for a maximum of 5 years, but the Prime Minister can call elections before that period, after dissolving the Parliament. Prime Ministers could be tempted to anticipate elections when the economy is strong, and exchange rate adjustments are not needed. Conversely, they could anticipate elections if they foresee that adjustments to the exchange rate will be needed before the scheduled dates. It is interesting to check whether our results are robust to the exclusion of parliamentary countries, in which the timing of elections can be determined endogenously.

Columns three and four in Table 2 present the results (with fixed effects) for presidential and parliamentary countries, respectively. For presidential countries, the effect is larger than for all countries combined. In this case, the average depreciation in the months 2 through 4 after elections is 2.6 percentage points larger than it is in other months. In contrast, we find no evidence of electoral devaluation cycles in our sample of parliamentary countries, which are mostly small countries with no independent monetary policy.\(^{15}\)

The last two regressions in Table 2 present the results of depreciations around constitutional government changes. In this case, guided by the results in Fig. 3, we used month 1 after the constitutional government change as an explanatory variable, as well as months 4 through 6 before the government change. This ensures that the pre-government change dummy also corresponds, in the great majority of cases, to a pre-electoral period. Results are qualitatively similar to those around elections, but the coefficient is larger in this case. The period immediately following a government change is characterized by an average depreciation 4.5 percentage points higher than in other periods. The rate of depreciation in this period is three times that in other periods, and the results are robust to the inclusion of country fixed effects.\(^{16}\)

Table A.1 in Appendix A presents similar regressions, but including each of the 19 periods inside the window as separate dummies. These regressions probably present the results in the cleanest possible way, since we are not imposing any structure at all on the data. In the case of elections, the dummies 2, 3 and 4 months after elections are positive and significant.\(^{17}\) In the case of government changes, the dummies in the month of a

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\(^{15}\) Most parliamentary countries in our sample have had no changes in parity (except for switching from pound to dollar in the mid 1970s). Out of 45 election episodes, in only eight had the currency been previously devalued.

\(^{16}\) When parliamentary governments are excluded, the coefficient for the post-government change period increases to 0.067.

\(^{17}\) In the fixed effects estimate, the dummy 1 month before elections is positive and significant. This may be due to the Primavera plan in Argentina, when the peso depreciated by almost 400 percent a month before the May 1989 presidential election. Once Argentina is dropped from the sample, the dummy becomes insignificant. Failed attempts to postpone devaluation are not captured by our theoretical model, which assumes the government does not face credit rationing so it can control the rate of devaluation.
government change, and 1 and 2 months after, are positive and significant. The largest effect corresponds to the month after the government change where the dummy indicates a jump of 5 percentage points in the rate of devaluation. These results confirm the fact that devaluations tend to be postponed until after elections, and are concentrated 1 month after government changes.

5. Conclusions

We presented a rational political budget cycle (RPBC) model for an open economy, where elections play a key role in explaining the timing of movements in nominal exchange rates. This paper extends the RPBC approach in two directions. First, by concentrating on the closed economy, previous RPBC models had overlooked the influence of elections on nominal exchange rates. If the rate of devaluation, which equals the rate of inflation in a one-sector model, acts as a tax on consumption through a cash-in-advance constraint, the pattern of postponing adjustments until after elections is a simple extension of the prediction of RPBC models in closed economies that taxes are lowered (by competent incumbents) before elections, and raised afterwards.

The second extension is more fundamental, and applies to political budget cycles in open and closed economies. To the standard setup of this class of models, which introduces incomplete information regarding the competence of the government, we added a twist: incomplete information regarding the degree to which the incumbent is opportunistic. As a result, we obtained a partially pooling equilibrium where the opportunistic incompetent deviates from optimal policy, rather than the standard separating equilibrium where the competent deviates to signal its competence. In the run-up to an election, an incompetent, opportunistic government can be tempted to reduce the rate of devaluation, increasing it after elections take place.

We contrasted the predictions of our RPBC model, which in either of its two variants implies that adjustments tend to be delayed until after elections, with evidence around the time of elections. The findings are consistent with the main implication of our theoretical model: the rate of devaluation is significantly higher in the months following an election, as compared to the months preceding it, being concentrated 1 month after the government change. The question remains open on whether this pattern in our sample of Latin American countries applies elsewhere. The fact that governments tend to postpone adjustments until after elections can also be used to explain why exchange rates can become over-valued before elections. However, the distinction between tradables and non-tradables must be introduced to address this issue. We do this in another paper.

In the model, a larger rate of devaluation is bad because devaluations are higher with incompetent governments. There are, of course, alternative stories why larger devaluations might lead the government to lose voter support. Devaluations may be contractionary, or

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18 The dummy 3 months before government change is positive and significant. This can again be traced to the failed Primavera Plan in Argentina, when the date of change in government became endogenous, as the presidential transition was anticipated several months in the midst of the crisis.
they may reduce the income of the median voter. There may also be reputational reasons, unlinked to reelection (politicians concerned about their place in history, for example), to try to shift the blame of adjustment to the incoming incumbent. The model assumes rational expectations, which may be less justified in voting models where each voter continues to have a vote despite consistent mistakes. Voters may be uninformed, and some may even be impressionable voters that respond to persuasive campaigning, not to news on economic policies and fundamentals (Baron, 1994). It would not be difficult to obtain cycles if voters are assumed irrational. Yet the assumption of rationality is important, as it imposes discipline on the researchers. The assumption that debt is not observable at the time of elections is a simplification adopted for tractability, but all that is actually needed is incomplete information on some budget items. We believe the story behind our model is simple, plausible, and is consistent with the facts.

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Appendix A

Lemma 1. $\tilde{c}_1$ is increasing in competency.

Differentiating (10) with respect to $\theta_1$, using $\partial c_2 / \partial \theta_1 = -(1 + i^*) (\partial \Gamma / \partial \theta_1 + \partial c_1 / \partial \theta_1)$, and $\partial \Gamma(\theta_1, \theta_2) / \partial \theta_1 = -g / (1 + \theta_1)^2 < 0$,

$$\frac{\partial \tilde{c}_1}{\partial \theta_1} = -\left[ \rho_2 \tilde{c}_{2d}(\theta_1, \rho_2)^{-1/\sigma-1} \frac{\partial \Gamma(\theta_1, 1)}{\partial \theta_1} + (1 - \rho_2) \tilde{c}_{2h}(\theta_1, \rho_2)^{-1/\sigma-1} \frac{\partial \Gamma(\theta_1, 0)}{\partial \theta_1} \right] > 0$$

$$= \frac{\tilde{c}_1^{-1/\sigma} + \rho_2 \tilde{c}_{2d}(\theta_1, \rho_2)^{-1/\theta-1} + (1 - \rho_2) \tilde{c}_{2h}(\theta_1, \rho_2)^{-1/\sigma-1}}{1 + i^*}$$

(A.1)

Differentiating (10) with respect to $\rho_2$, using $\partial c_2 / \partial \rho_2 = -(1 + i^*) \partial c_1 / \partial \rho_2$,

$$\frac{\partial \tilde{c}_1}{\partial \rho_2} = \frac{\sigma [\tilde{c}_{2h}(\theta_1, \rho_2)^{-1/\sigma} - \tilde{c}_{2d}(\theta_1, \rho_2)^{-1/\sigma}] / (1 + i^*)}{\tilde{c}_1^{-1/\sigma} + \rho_2 \tilde{c}_{2d}(\theta_1, \rho_2)^{-1/\sigma-1} + (1 - \rho_2) \tilde{c}_{2h}(\theta_1, \rho_2)^{-1/\sigma-1}} > 0$$

(A.2)
Lemma 2. $\bar{\tau}_1$ is decreasing in competency.

By (9) and (11), for $h = d, b$,

$$1 - \tau_{2h} = \frac{(1 - \tau_1) \frac{c_{2h}}{1 + i^*}}{(1 - \tau_1) \Theta - c_1}$$

(A.3)

Using (A.3) to eliminate $\tau_{2h}$ in (12),

$$1 - \tau_1 = c_1^{-1/\sigma + 1} + \rho_2 c_{2d}^{-1/\sigma + 1} + (1 - \rho_2) \frac{c_{2b}^{-1/\sigma + 1}}{1 + i^*}$$

(A.4)

Evaluated at $\tilde{c}_1(\theta_1, \rho_2)$, (A.4) determines $\tilde{c}_1(\theta_1, \rho_2)$. Differentiating $\tilde{\tau}_1$ with respect to $\theta_1$, using (10), (12), Lemma 1 on $\partial \tilde{c}_1 / \partial \theta_1, \Omega = (c_1 / 1 - \tau_1) + [c_{2h} / (1 + i^*)] / 1 - \tau_{2h}$, and $c_{2d}(\theta_1, \rho_2) / 1 - \tau_{2d}(\theta_1, \rho_2) = c_{2b}(\theta_1, \rho_2) / 1 - \tau_{2b}(\theta_1, \rho_2)$,

$$\frac{\partial \tilde{\tau}_1}{\partial \theta_1} = \frac{-\tilde{c}_1^{-2/\sigma} + \rho_2 \tilde{c}_{2d}^{-2/\sigma - 1} + (1 - \rho_2) \tilde{c}_{2b}^{-2/\sigma - 1}}{(1 + \theta_1)^2} \left(1 + \frac{\rho_2 (1 - \rho_2) \tilde{c}_{2d}^{-1/\sigma} \tilde{c}_{2b}^{-1/\sigma}}{\sigma (1 + i^*)} \frac{\tilde{c}_{2d} \tilde{c}_{2b}}{\tilde{c}_{2d} + \tilde{c}_{2b}} \right) < 0$$

(A.5)

Differentiating $\tilde{\tau}_1$ with respect to $\rho_2$, using facts above and Lemma 1 on $\partial \tilde{c}_1 / \partial \rho_2$,

$$\frac{\partial \tilde{\tau}_1}{\partial \rho_2} = \frac{\tilde{c}_{2d} - \tilde{c}_{2b}}{(1 + \theta_1) \Omega} \left(\frac{\tilde{c}_1^{-1/\sigma - 1}}{1 + i^*} + \rho_2 \tilde{c}_1^{-1/\sigma - 1} + (1 - \rho_2) \tilde{c}_1^{-1/\sigma - 1} \right)$$

(A.6)

Lemma 3. $\tilde{\tau}_1(\theta_1, \rho_2) = \alpha \tilde{c}_{2d}(\theta_1, \rho_2) + (1 - \alpha) \tilde{c}_{2b}(\theta_1, \rho_2)$, where $0 < \alpha \leq \rho_2$, and $\tilde{c}_{2d}(\theta_1, \rho_2) < \tilde{c}_{2b}(\theta_1, \rho_2)$, $\tilde{c}_1(\theta_1, \rho_2) < \tilde{\tau}_1(\theta_1, \rho_2)$ for $0 < \rho_2 < 1$.

By (10), $1 = \rho_2 (\tilde{c}_1(\theta_1, \rho_2) / \tilde{c}_{2d}(\theta_1, \rho_2))^{1/\sigma} + (1 - \rho_2) (\tilde{c}_1(\theta_1, \rho_2) / \tilde{c}_{2b}(\theta_1, \rho_2))^{1/\sigma}$.

Denoting by $\alpha$ and $1 - \alpha$ the two terms on the RHS, and plugging these definitions into (12), $\tilde{\tau}_1(\theta_1, \rho_2)$ is a weighted average of future taxes. By (9) and (11), $\tilde{\tau}_{2d}(\theta_1, \rho_2) - \tilde{\tau}_{2b}(\theta_1, \rho_2) = [\Gamma(\theta_1, 0) - \Gamma(\theta_1, 1)] / [\Omega - c_1 / (1 - \tau_1)] > 0$. Thus, $\tilde{\tau}_{2d}(\theta_1, \rho_2) < \tilde{\tau}_1(\theta_1, \rho_2)$ for $\rho_2 < 1$. For $\rho_2 = 0$, $\tilde{\tau}_1(\theta_1, 0) = \tilde{\tau}_{2b}(\theta_1, 0) = \tilde{\tau}_2(\theta_1, 0)$, and for $\rho_2 = 1$, $\tilde{\tau}_1(\theta_1, 1) = \tilde{\tau}_{2d}(\theta_1, 1) = \tilde{\tau}_2(\theta_1, 1)$.
Lemma 4. $\tau_i^s = \tilde{\tau}_1(1,1)$ for $\sigma = 1$, and $\tau_i^s = (1,1)$ for $0 < \sigma < 1$.

With $\tau_i^s$, consumers expect $\Gamma(1,1)$ with probability $\rho^s$, and $\Gamma(0,0)$ with probability $1 - \rho^s$. To implement $\tilde{c}_1(1,1)$, a competent incumbent must set $\tau_i^s$ so

$$1 - \tau_i^s = \frac{\tilde{c}_1(1,1)^{-1/\sigma} + \rho^s \tilde{c}_2(1,1)^{-1/\sigma+1} + (1 - \rho^s) \tilde{c}(0,0)^{-1/\sigma+1}}{\tilde{c}_1(1,1)^{-1/\sigma} \Omega}$$  \hspace{1cm} (A.7)

Differentiating with respect to $\rho^s$, this derivative is null for $\sigma = 1$, and positive for $0 < \sigma < 1$:

$$\frac{d\tau_i^s}{d\rho^s} = \frac{\tilde{c}_2(1,1)^{-1/\sigma+1}}{\tilde{c}_1(1,1)^{-1/\sigma} \Omega} \left[ \left( \frac{\tilde{c}_2(1,1)}{\tilde{c}_2(0,0)} \right)^{1/\sigma-1} - 1 \right] \geq 0$$  \hspace{1cm} (A.8)

Lemma 5. $\frac{dc_1}{d\tau_1} < 0$ for $0 \leq 1$. At $\tau_i^s$, there is discrete downward jump for $0 < \sigma < 1$.

As to substitution effect, differentiating (A.4) with respect to $\tau_1$ for a given expected competency is negative for $0 < \sigma < 1$:

$$\frac{\partial c}{\partial \tau_1} = \frac{-\Omega \frac{c_1}{1 - \tau_1} + \left( \frac{1}{\sigma} - 1 \right) \left( q \left( \frac{c_1}{c_2} \right)^{1/\sigma} + (1 - q) \left( \frac{c_1}{c_2} \right) \right)}{1 + \frac{1}{\sigma - \tau_1}} < 0$$  \hspace{1cm} (A.9)

Expectations on competency ($\theta_1$, $\rho_2$) jump from $(0, q)$ to $(\rho^s, \rho^s)$ at $\tau_1 = \tau_i^s$, so taxes have a signaling effect at that point. The signaling effect can be broken down in two parts, considering: (i) that the good state in the second period becomes more probable, since $\rho^s > q$, and (ii) that $Pr(\theta_1 = 1) = \rho^s$ instead of $Pr(\theta_1 = 1) = 0$, so in the good state in the second period more consumption will be available. By differentiation of (A.4), for given taxes 1, it is straightforward to show that $\partial c_1/\partial \rho_2 > 0$ and $\partial c_1/\partial Pr(\theta_1 = 1) > 0$ when $0 < \sigma < 1$, so there is an added indirect signaling effect of low $\tau_1$ on consumption. For $\sigma = 1$, both $\partial c_1/\partial \rho^s = 0$ and $\partial c_1/\partial Pr(\theta_1 = 1) = 0$, so only the positive substitution effect of low taxes is at work.

Lemma 6. $\frac{d\tau_2(0,0)}{d\tau_1} < 0$ for $\tau_1 \geq \tilde{\tau}_1(0, q)$.

Differentiating (A.3) with respect to $\tau_1$ for $\theta_1(\theta_2) = (0, 0)$,

$$\frac{d\tau_2(0,0)}{d\tau_1} = \frac{\frac{c_1}{1 - \tau_1} \left( 1 - \tau_2(0,0) \right)}{\Omega \frac{c_1}{1 - \tau_1}} \left( 1 - \tau_1 \right) - \frac{\tau_2(0,0) - \tau_1}{c_1} \frac{dc_1}{d\tau_1}$$

$$< \frac{\frac{c_1}{1 - \tau_1} \frac{dc_1}{d\tau_1} \tau_2(0,0) - \tau_1}{\Omega \frac{c_1}{1 - \tau_1}} \frac{dc_1}{d\tau_1} \frac{c_1}{c_1}$$  \hspace{1cm} (A.10)

By Lemma 5, $\frac{dc_1}{d\tau_1} < 0$, so (A.10) is negative if $\tau_2(0,0) - \tau_1 > 0$. At $\tau_1 = \tilde{\tau}_1(0, q)$, $\tau_2(0,0) = \tilde{\tau}_2(0, q)$. Since $\tilde{\tau}_2(0, q) > \tilde{\tau}_1(0, q)$ by Lemma 3, $d\tau_2(0,0)/d\tau_1$ at $\tau_1(0, q)$. For
\( \tau_1 < \hat{\tau}_1(0,q) \), \( d\tau_2/d\tau_1 < 0 \) implies \( \tau_2(0,0) > \hat{\tau}_{2b}(0,q) \), so \( \tau_2(0,0) - \tau_1 \) is even more positive, assuring result.

**Proof of Proposition 3.** (Case \( \sigma = 1 \)). (i) Symmetric information: \( E[\tilde{\varepsilon}_1] = E[\tilde{\varepsilon}_2] \).

A competent sets \( \tilde{\tau}_1(1,1) = \tilde{\tau}_2(1,1) \). By interest parity condition, \( 1 + \varepsilon_i = 1/[(1 + i^*)^\sigma (1 - \tau_i)] \), so \( \tilde{\varepsilon}_1(1,1) = \tilde{\varepsilon}_2(1,1) \). By (A.4) and (A.3), an incompetent incumbent sets \( \tilde{\tau}_1(0,q) \) so that

\[
1 - \tilde{\tau}_1(0,q) = \left( 1 + \frac{1}{1 + i^*} \right) \frac{\tilde{\varepsilon}_1}{\Omega} \frac{1 - \tilde{\tau}_{2b}(0,q)}{1 - \tilde{\tau}_{2d}(0,q)}
\]

(A.11)

By interest parity condition, (A.11), and (10),

\[
q\tilde{\varepsilon}_{2d}(0,q) + (1 - q)\tilde{\varepsilon}_{2b}(0,q) = \frac{1}{1 + i^*} \left( \frac{q}{1 - \tilde{\tau}_{2d}(0,q)} + \frac{(1q)}{1 - \tilde{\tau}_{2b}(0,q)} \right) - 1
\]

\[
= \frac{1}{1 + i^*} \frac{\Omega}{\tilde{\varepsilon}_{2d}(0,q) + (1 - q)\tilde{\varepsilon}_{2b}(0,q)} - 1 = \frac{1}{1 + i^*} \frac{\Omega}{\tilde{\varepsilon}_1} - 1 = \tilde{\varepsilon}_1(0,q)
\]

(A.12)

(ii) Asymmetric information: \( E[\tilde{\varepsilon}_2] E[\varepsilon_1] = (1 - q)s(\tau_2(0,0)^s) > 0 \) when \( s > 0 \).

By Lemma 4 a competent incumbent picks \( \tau^*_i = \tilde{\tau}_1(1,1) \) to implement \( \tilde{\varepsilon}_1(1,1) \), so \( \varepsilon_i^* = \tilde{\varepsilon}_1(1,1) = \tilde{\varepsilon}_2(1,1) \). An incompetent with low opportunism sets \( \tilde{\varepsilon}_1(0,q) = q\tilde{\varepsilon}_{2d}(0,q) + (1 - q)\tilde{\varepsilon}_{2b}(0,q) \). A highly opportunistic incompetent mimics \( \tilde{\varepsilon}_1(1,1) \) to be reelected, so \( \tilde{\varepsilon}_2(0,0) > \tilde{\varepsilon}_{2b}(0,q) \) by Lemma 6. By Lemma 3, \( \tilde{\varepsilon}_{2b}(0,q) > \tilde{\varepsilon}_1(0,q) \), and by Lemma 2 \( \tilde{\varepsilon}_1(0,q) > \tilde{\varepsilon}_1(1,1) \), so \( \tilde{\varepsilon}_2(0,0) > \tilde{\varepsilon}_1(1,1) \).

**Proof of Proposition 4.** (Case \( \sigma = 1 \)). (i) Symmetric information. \( E[\tilde{\varepsilon}_2] E[\varepsilon_1] = (1 - q)|q\tilde{\varepsilon}_{2d}(0,q) + (1 - q)\tilde{\varepsilon}_{2b}(0,q)|0 \).

A competent sets \( \tilde{\tau}_1(1,1) = \tilde{\tau}_2(1,1) \), so \( \tilde{\varepsilon}_1(1,1) = \tilde{\varepsilon}_2(1,1) \). As to an incompetent, we start by proving two preliminary results. First, differentiating (10) for \( (\theta_1, \rho_2) = (0, q) \),

\[
\frac{d\tilde{\varepsilon}_1}{d\sigma} = \frac{q\tilde{\varepsilon}_{2d}^{-1/\sigma} \ln \tilde{\varepsilon}_{2d}^{-1/\sigma} + (1 - q)\tilde{\varepsilon}_{2b}^{-1/\sigma} \ln \tilde{\varepsilon}_{2b}^{-1/\sigma} - \tilde{\varepsilon}_1^{-1/\sigma} \ln \tilde{\varepsilon}_1^{-1/\sigma}}{1 + i^*}
\]

(A.13)
To see this, let \( \bar{x}_2^{1/2}, \bar{x}_2^{1/2} \), and \( f(x) = \ln x \). By (10), the numerator of (A.13) equals \( qf(\bar{x}_2) + (1-q)f(q\bar{x}_2 + (1-q)\bar{x}_2) \). Since \( f(x) \) is convex, the numerator is positive. Second, differentiating in Lemma 3,

\[
\frac{dx}{d\sigma} = \frac{x \left( \frac{1}{\sigma} \ln \frac{\tilde{c}_2d(0,q)}{\tilde{c}_1(0,q)} + \left( \frac{1}{\tilde{c}_1} + \frac{1 + i^*}{\tilde{c}_2d(0,q)} \right) \frac{d\tilde{c}_1}{d\sigma} \right)}{1 + i^*} > 0 \tag{A.14}
\]

Let \( Q = (\tilde{c}_1(0,q) - (\cdots + \cdots))/(1 + \tilde{c}_1(0,q)) \). From (A.4), (A.3), and Lemma 3, an incompetent sets \( c_1(0,q) \) so

\[
1 - \tilde{c}_1 = \frac{\tilde{c}_1 + \frac{x\tilde{c}_2d}{1 + i^*} + \frac{(1-x)\tilde{c}_2h}{1 + i^*}}{\Omega}, \tag{A.15}
\]

\[
1 - \tilde{c}_2h = \frac{(1 - \tilde{c}_1)\frac{\tilde{c}_2h}{1 + i^*} + \frac{x\tilde{c}_2d}{1 + i^*} + \frac{(1 - x)\tilde{c}_2h}{1 + i^*}}{\tilde{c}_2d(0,q)\tilde{c}_2h(0,q)}
\]

Using (A.15),

\[
Q = \frac{\tilde{c}_2d\tilde{c}_2h - [x\tilde{c}_2d + (1-x)\tilde{c}_2h][q\tilde{c}_2h + (1-q)\tilde{c}_2d]}{\tilde{c}_2d(0,q)\tilde{c}_2h(0,q)} \tag{A.16}
\]

Since \( \tilde{c}_2d(0,q)\tilde{c}_2h(0,q) > 0 \), the sign of \( Q \) depends on sign of numerator \( N \). By Proposition 3, \( N = 0 \) for \( \sigma = 1 \). Differentiating \( N \) with respect to \( \sigma \):

\[
\frac{dN}{d\sigma} = -\frac{(1 + i^*)(q - x)\frac{d\tilde{c}_1}{d\sigma} + (q\tilde{c}_2h(0,q) + (1-q)\tilde{c}_2d(0,q))\frac{dx}{d\sigma}}{(\tilde{c}_2d(0,q) - \tilde{c}_2h(0,q))^{-1}} \tag{A.17}
\]

Since \( q - x > 0 \) for \( 0 < q < 1 \), \( d\tilde{c}_1/d\sigma > 0 \), and \( dx/d\sigma > 0 \), \( dN/d\sigma < 0 \). Hence, sign \( N > 0 \) for \( 0 < \sigma < 1 \).

(ii) Asymmetric information. \( E[\tilde{c}_2] - E[\tilde{c}_1] > 0 \) if \( s \geq 1/2 \).

A competent incumbent picks \( \tau^*_1 < \tilde{\tau}_1(1,1) \) by Lemma 4. Since \( c_1 = \tilde{c}_1(1,1) \), future tax receipts have to rise: \( \tau_2(1,1) > \tau^*_1 \), and \( \tilde{\epsilon}_2(1,1) > \tilde{\epsilon}_1 \). A non-opportunistic incompetent sets \( \tilde{\epsilon}_1(0,q) > q\tilde{\epsilon}_2d(0,q) + (1-q)\tilde{\epsilon}_2h(0,q) \), by Proposition 4(i). An incompetent that is opportunistic mimics \( \tilde{\epsilon}_1(0,q) \). By Lemma 6, \( \tilde{\epsilon}_2(0,0) > \tilde{\epsilon}_2h(0,q) \), and by Lemma 3, \( \tilde{\epsilon}_2h(0,
\( q > \tilde{\varepsilon}_1(0, q) \), so \( \varepsilon_2(0, 0) > \varepsilon_1^* \). Given these facts, a sufficient condition for \( E[\varepsilon_2] - E[\varepsilon_1] > 0 \) is \( s \geq 1/2 \), since then

\[
\frac{E[\varepsilon_2] - E[\varepsilon_1]}{1/2(1 - q)} > \frac{s(\varepsilon_2(0, 0) - \varepsilon_1^*) + (1 - s)(q\tilde{\varepsilon}_{2d}(0, q) + (1 - q)\tilde{\varepsilon}_{2b}(0, q) - \tilde{\varepsilon}_1(0, q))}{1/2} \]

\[
> \varepsilon_2(0, 0) - \varepsilon_1^* + q\tilde{\varepsilon}_{2d}(0, q) + (1 - q)\tilde{\varepsilon}_{2b}(0, q) - \tilde{\varepsilon}_1(0, q) \\
= \varepsilon_2(0, 0) + \tilde{\varepsilon}_{2d}(0, d) + (1 - q)(\tilde{\varepsilon}_{2b}(0, q) - \tilde{\varepsilon}_{2d}(0, q)) - \tilde{\varepsilon}_1(0, q) - \varepsilon_1^* \\
> \tilde{\varepsilon}_{2b}(0, q) + \tilde{\varepsilon}_{2d}(0, q) - \tilde{\varepsilon}_1(0, q) - \varepsilon_1^* \geq 0
\]

(A.18)

We now prove the last inequality. By Lemma 4, \( \varepsilon_1^* \leq \tilde{\varepsilon}_1(1, 1) \). Let \( H(q) = \tilde{\varepsilon}_{2b}(0, q) + \tilde{\varepsilon}_{2d}(0, q) - \tilde{\varepsilon}_1(0, q) \). At \( q = 0 \), \( \tilde{\varepsilon}_{2b}(0, 0) = \tilde{\varepsilon}_1(0, 0) \), by tax smoothing, and \( \tilde{\varepsilon}_{2d}(0, 0) = \tilde{\varepsilon}_1(1, 1) \) because in both cases public expenditure \( \tilde{\varepsilon}_2 = g/2 \), and tax bases \( \tilde{\varepsilon}_{2d}(0, 0) = \tilde{\varepsilon}_1(1, 1) \). Hence, \( H(0) = \tilde{\varepsilon}_1(1, 1) \), and \( H(0) - \varepsilon_1^* \geq 0 \). Differentiating \( H(q) \),

\[
\frac{dH}{dq} = \frac{1}{1 + \imath*} \left( \frac{\sigma \tilde{\varepsilon}_{2d}(0, q)}{\sigma q} + \frac{\sigma \tilde{\varepsilon}_{2b}(0, q)}{\sigma q} - \frac{\sigma \tilde{\varepsilon}_1(0, q)}{\sigma q} \right) \frac{1}{(1 - \tilde{\varepsilon}_{2d})^2} + \frac{1}{(1 - \tilde{\varepsilon}_{2b})^2} - \frac{1}{(1 - \tilde{\varepsilon}_1)^2} \]  

(A.19)

Table A.1. Dependent variable: monthly depreciation rate

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(continued on next page)
Substituting the derivatives in the RHS of (A.19), $dH/dq > 0$ if

$$
\frac{1}{\tilde{c}_{2d}} + \frac{1}{\tilde{c}_{2b}} + \frac{1}{\tilde{c}_1} \geq \left( \frac{\tilde{c}_{2d}}{\tilde{c}_{2b}} \right)^{1/\sigma} - 1 \left( \frac{1}{\tilde{c}_{2d}} - \frac{1}{\tilde{c}_{2b}} \right) \left( \frac{1}{1 + i^*} - \frac{1}{1 + \frac{\tilde{c}_{2d}}{1 + i^*}} \right)
$$

(A.20)

Since $\tilde{c}_{2d}(0, q) > \tilde{c}_{2b}(0, q)$, (A.20) is satisfied, so $H(q) \geq \tilde{c}_1(1, 1)$ for all $q$.

References


