Addendum to Transparency and Economic Policy*

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Abstract

We provide a multiperiod model of political competition in which voters imperfectly observe the electoral promises made to other voters. Imperfect observability generates an incentive for candidates to offer excessive transfers even if voters are homogeneous and taxation is distortionary. Government spending is larger than in a world of perfect observability. Transfers are partly financed through government debt, and the size of the debt is higher in less transparent political systems. The model provides an explanation of fiscal churning; it also predicts that groups whose transfers are less visible receive higher transfers, and that imperfect transparency of transfers may lead to underprovision of public goods. From the policy perspective, the main novelty of our analysis is a separate evaluation of the transparency of spending and the transparency of revenues. We show that the transparency of the political system does not unambiguously improve efficiency: transparency of spending is beneficial, but transparency of revenues can be counterproductive because it endogenously leads to increased wasteful spending.

1 Introduction

The issue of (the lack of) transparency of government activity has recently received a lot of attention beyond academic circles. For instance, the IMF published a book in 2001 titled *Manual on Fiscal Transparency* containing recommendations on how budgetary institutions and national accounts should be organized in order to enhance transparency. The OECD published a similar volume in 2000 titled *Best Practices for Budget Transparency.* Fiscal transparency is perceived to be essential for informed decision making, for guaranteeing a minimal accountability, and for maintaining fiscal discipline.

A dramatic example of the problems that may arise because of lack of transparency are the recent episodes of social unrest in Hungary in September 2006. The prime minister Ferenc Gyurcsány accidentally revealed that his government had covered up the budget deficit's true size excluding from the budget the costs of reforms to pensions or road construction. Similarly, major discrepancies were found in Greece's fiscal accounts that appear to have been manipulated in order to gain entry into the Eurozone. Eurostat announced in October 2004 that the Greek budget deficit was 4.1 percent of output in 2000, 3.7 percent in 2001 and 2002, and 4.6 percent in 2003. This stands in stark contrast with the figures given by Athens and relayed by Eurostat in March 2004 which were 2.0 percent for 2000, 1.4 percent in 2001 and 2002, and 1.7 percent in 2003. If Eurostat can be fooled by clever accounting, what hope do ordinary voters have of making informed choices among competing parties with respect to their fiscal platforms? What are the consequences of this lack of information?

The purpose of this paper is to undertake a systematic analysis of the effects of transparency on several dimensions of government activity, and to use this analysis to provide some insights on the optimal design of fiscal institutions. In particular, we study the impact of transparency on budget deficits,[1] on the size of government spending, and for the timing and (in)efficiency of taxation. We show that the issue of transparency is more delicate than might be expected from the recommendations made by the IMF and by the OECD. Consistent with these recommendations, we show that the transparency of public spending is desirable. However, as long as the transparency of transfers is imperfect, the transparency of revenues may be counterproductive. In particular, when transparency of revenues is low, taxation is more distortionary and this inefficient taxation may have positive effects because it reduces the equilibrium level of government spending (thereby giving some analytical backing to the McCarthy quote that "the only thing that saves us from the bureaucracy is its inefficiency").[2]

The idea that voters' imperfect information may have an effect on policy goes back at least to Downs (1957), and has received a lot of recent attention. We focus on a basic form of imperfect information that has been largely ignored. In our model, voters are uncertain about aggregate government spending and aggregate government revenues. In a static environment this uncertainty need not affect voting decisions: a voter's welfare depends only on his own transfers and taxes, and

[1] Several papers have recently investigated the links between (lack of) transparency and budget deficits. For instance, see Milesi-Ferretti (2003), Shi and Svensson (2006) and Alt and Lassen (2006).

[2] See also Brennan and Buchanan (1977) and Krusell, Quadrini and Ríos-Rull (1996) for models in which an improvement in tax-collection efficiency may decrease welfare since it increases inefficient government spending.

is unaffected by aggregate policy choices. However, in a dynamic setting, aggregate transfers and taxes determine the size of government debt and hence future taxes and transfers. Therefore, current voting decisions *are* affected by information about the magnitude of aggregate policy choices.

We explore these ideas in a model in which candidates compete in an electoral campaign, committing to transfers and taxes to voters. Voters' imperfect information on the aggregate choices made by politicians generates a rich set of implications about government policy. To see how this type of imperfect information may have an impact, suppose that all voters are identical, that taxation creates distortions, and that there are two identical periods. In such a world, there is no scope for government. If voters are perfectly informed, no candidate offers any transfers and any taxes. However, if voters cannot observe aggregate choices, offering nothing is no longer an equilibrium. When transfers are not observable, a candidate cannot be held politically accountable for the cost of such transfers. Thus, a candidate has an incentive to secretly offer some transfers: this increases the chance that the recipients vote for the candidate. In equilibrium then, all voters are offered transfers, and voters understand that these transfers result in deficits. When voters observe an imperfect signal of aggregate transfers, this effect is still present but the size of these transfers and deficits decreases with the precision of the signal. Thus, more transparent governments have lower deficits and transfers.

More subtle and novel effects arise when voters' information is of a more disaggregated nature. Specifically, we consider the case in which voters receive separate information about revenues in addition to the information about transfers. Due to improved smoothing of tax distortions across periods, enhanced transparency of taxes leads to more efficient financing of any *exogenously fixed* amount of transfer spending. However, paradoxically, the overall effect of enhanced transparency of revenues is to increase inefficiencies. This is because transfers *endogenously* increase in response to the more efficient financing due to the reduction in the marginal political cost of offering such transfers. Thus, in equilibrium, wasteful transfers rise in response to increased revenue transparency. This implication of our model should of course be interpreted with caution, but the analysis does point out a basic asymmetry in the political incentives generated by the lack of transparency of taxes, and those generated by the lack of transparency of spending.

The model also provides an explanation and an evaluation of the phenomenon of fiscal churning, i.e., "useless tax and expenditure flows which increase the size of the budget but which are mutually offsetting and thus impose an unnecessary burden." (Musgrave and Musgrave 1988). In other words, many individuals are simultaneously taxpayers and recipients of government transfers (in various forms). These two way transactions between individuals and the public sector are inefficient since both taxes and transfers generate distortions. A Pareto-improving fiscal reform would involve netting-out these taxes and transfers so that those who are net recipients of resources would pay no taxes, and those who are net payers of resources would receive no transfers. The OECD has recently calculated the amount of fiscal churning that takes place in eleven selected OECD countries (OECD Economic Outlook 1998). According to these calculations, fiscal churning varies from 6.5% of GDP in Australia to 34.2% for Sweden. On average, the OECD reports that churning constitutes one third of all government expenditure in these countries.[3] In our model fiscal churning emerges as

[3]These numbers are not entirely reliable definitions of churning because they do not properly account for social

an equilibrium outcome when voters are imperfectly informed. Thus, the model can explain why netting-out does not take place.[4]

We then consider a number of extensions to our basic settings. We study the consequences of differential transparency across groups. If transfers to some groups are more easily detectable, such groups receive lower transfers in equilibrium. An interesting feature of this analysis is that political systems with the same *average* transparency may have markedly different outcomes: candidates' incentives are affected by the marginal groups, those with the lowest transparency. We show that this feature of the model is also consistent with the finding by Palda (1997) that fiscal churning rises with income. We also extend our basic setting to allow for spending on public goods in order to study the effects of transparency on the composition of government spending between socially wasteful transfers and beneficial public goods. We find that imperfect transparency may lead to the underprovision of public goods. An empirical prediction of the model is that more transparent fiscal systems should have a smaller fraction of spending on transfers along with smaller deficits.

This paper contributes to the large literature on the link between fiscal institutions and fiscal performance.[5] Many contributions to this literature do not provide formal models. There is however a growing formal and empirical literature that examines the link between constitutions and economic policy.[6] This paper also contributes to the literature on the political economy of budget deficits.[7] Recent papers have connected economic policy with the transparency of the political process. Milesi-Ferretti (2003), Shi and Svensson (2006) and Alt and Lassen (2006) obtain that higher transparency reduces incentives to accumulate debt. Also related is Alesina, Campante and Tabellini (2008) that argues that when voters can not observe deficits, debt and taxation are larger than their efficient levels.

Several recent papers are concerned with the effects of inferior information on the ability of politicians to shirk or to extract rents (e.g., Besley and Burgess (2002)). Other papers consider models with an agent of uncertain ability and discuss the effect of imperfect information on the incentives of the agent. In Besley and Smart (2007) better information reduces discipline, increases rent seeking, but improves selection. Prat (2006) introduces a distinction between information on the consequence of the agent's action and information directly on the agent's action. The second

insurance. However, it appears that churning is an important phenomenon. Palda (1997) made similar calculations for Canada and he estimates churning of 15.2% to 49.2% of government spending. Lindbeck (1985) and Musgrave and Musgrave (1988) note that a characteristic of modern fiscal systems is that gross transfers are much larger than net transfers. See also Tanzi and Schuknecht (2000) for a discussion of fiscal churning.

[4] In median voter models of redistributive politics (Roberts 1977, Meltzer and Richard 1981) netting-out of voters' fiscal positions is not feasible by construction because very limited fiscal tools are available to the government. Everyone is a recipient of transfers and anyone with an income is a tax payer. However, these assumptions are made for reasons of tractability, and it is not clear that all churning can be attributed to constraints on fiscal tools available to governments. It seems useful to understand whether churning could emerge in a model that does not impose it via constraints on the feasible set of policies available to the government. Furthermore, it seems implausible to argue that the large degree of variation in churning across countries that has been discussed by the OECD could be explained exclusively by different constraints on the fiscal instruments. By investigating whether churning can emerge absent such constraints, we can begin to understand the role of the political process in generating such different outcomes.

[5] See for instance, Von Hagen (1992), von Hagen and Harden (1994), and Poterba and von Hagen (1999).

[6] See Persson and Tabellini (2003) for a survey of this literature.

[7] Persson and Tabellini (2000) provide a detailed survey of this literature.

type of information can induce bad incentives because the agent faces an incentive to disregard useful private signals. Strömberg (2004) discusses the role of mass media in informing voters, and shows that more informed voters obtain higher transfers. Levy (2007 a and b) consider models of decision making in committees whose members are driven by career concerns. In her models transparency concerns the degree of revelation of the votes of individual members. She shows that the degree of transparency affects the likelihood of adopting reforms, and finds that secretive committees may lead to superior outcomes. Mattozzi and Merlo (2007 a and b) provide models in which political parties compete with the private sector to hire talented workers. Higher transparency may hurt parties' hiring abilities.

2 A Model of Electoral Campaigns

We build on the static model of redistributive politics provided by Lindbeck and Weibull (1987).[8] This framework is more flexible than a standard median voter model because it allows offers targeted to different groups. This flexibility is necessary for two reasons. First, concerns about lack of transparency voiced in the institutional literature often relate to hidden taxes or transfers targeted to special interests, and the median voter model is not suited to an analysis of this issue. Second, in our view, it is useful to provide an analysis of fiscal churning that does not "assume" its existence because of limited redistributive tools.

We proceed by progressively departing from Lindbeck and Weibull as follows. First, in order to allow for distortionary taxations, we introduce endogenous labor supply. Second, we extend the model to consider two elections with an intertemporal linkage provided by debt. In an intertemporal setting, offers made to other voters are important because aggregate promises have implications for the size of government debt, and debt has to be repaid out of future taxes. Third, we introduce imperfect voter information about aggregate promises in order to understand the role of transparency.[9]

2.1 Economy

There is a unit measure of voters living in an economy where there is a single consumption good. Each voter has the same utility function $u(c-\gamma(l))$ over consumption c and labor l, where u is strictly increasing and concave, γ is strictly increasing and convex. Both u and γ are assumed to be differentiable three times. We assume that all workers receive the same wage which is normalized to 1.

A voter who receives a lump-sum transfer y and pays taxes on labor income according to a proportional rate t faces the following budget constraint

$$c = y + (1-t)\,l. \tag{1}$$

[8] See also Dixit and Londregan (1996).

[9] The focus of the Lindbeck-Weibull model is redistribution across heterogeneous groups. In contrast, in order to isolate the effects of transparency, we restrict attention to the case of identical groups. See Proposition 3.1 and Section 4.2 for some discussion of the effects of heterogeneity.

Each voter chooses c and l to maximize $u(c - \gamma(l))$ subject to (1). Thus, labor supply $l(t)$ is given by

$$\gamma'(l(t)) = 1 - t \tag{2}$$

and tax revenue from this voter is

$$T = tl(t). \tag{3}$$

Note that taxes are distortionary. We denote by $U(y,t) = u(c - \gamma(l(t)))$ the voter's indirect utility function over taxes and transfers, and we call these the voter's *material preferences* over the policy platforms.

2.2 Politics

Voters are divided into groups indexed by $i \in \{1, 2, ..., N\}$. We assume for simplicity that each group has the same mass of individuals $1/N$. In addition to material preferences, voters also have *ideological preferences* over two candidates, denoted by R and L. Each voter in group i is endowed with a personal ideological parameter x, which captures the additional utility that the citizen enjoys if party R is elected. For each individual, x is the realization of an independent draw of a random variable X_i *i.i.d.* across groups, distributed according to a distribution F_i with density f_i. This ideological parameter is meant to capture additional elements of the political platforms of the two parties which are not related to economic policy. Examples are issues such as foreign policy, religious values, gun control, etc. We assume that candidates are office motivated, so they have no interest in policy *per se*. In each period candidates compete for election, making to each group of voters i a binding promise consisting of a transfer y_i and a tax rate t_i.[10] Thus, candidate promises cannot depend on the specific ideological parameter x of an individual voter (which they do not observe), but they can depend on group identity i. The definition of a group describes the extent of targetability of promises: for instance, we can think of groups as defined by geographic locations or some relevant demographic characteristics. The number of groups therefore represents the extent of targetability of fiscal instruments.[11]

In our setup, it is equivalent to describe candidates' platforms in terms of transfers y_i and *tax rates* t_i, or transfers y_i and *tax revenues* $T_i = t_i l(t_i)$. This is because candidates will always choose to be on the increasing side of the Laffer curve, and thus $t_i = t(T_i)$ is the unique tax rate that

[10]The assumption that candidates commit to their campaign platform is admittedly strong but, in our view, is a useful benchmark. In Gavazza and Lizzeri (2008) we consider a model of an incumbent government with re-election concerns that chooses policies without commitment, and we show that the results are robust to these alternative assumptions.

[11]An implicit assumption in our specification of platforms is that taxation can be targeted as finely as transfers. This may initially seem unrealistic if one focuses on a narrow notion of income taxation. However, it is important to keep in mind that all the deductions and tax credits that are incorporated in the tax code generate special tax treatment for favored groups. Thus, as a matter of principle (and practice), it seems to us that there is no order of magnitude difference in the targetability of taxes and transfers. Any difference in the relative degree of targetability of the two instruments could be incorporated in our model by defining different subsets of groups for taxes and transfers. In order to avoid excessively complicating the analysis we ignore this problem in the current paper.

generates T_i tax revenues. For analytical simplicity, we will define candidates' strategies in terms of tax rates t or in terms of tax revenues T interchangeably.

3 Benchmarks

3.1 One Election

We first obtain candidates' vote shares as a function of platforms. Suppose a voter in group i with ideological preference x is promised transfers y_i^L and taxes T_i^L by candidate L and transfers y_i^R and taxes T_i^R by candidate R. Then this voter votes for candidate L if and only if

$$U\left(y_i^L, t\left(T_i^L\right)\right) - U\left(y_i^R, t\left(T_i^R\right)\right) > x.$$

Thus, the probability that voter i votes for candidate L given $\left(y_i^L, T_i^L\right)$ and $\left(y_i^R, T_i^R\right)$ is

$$F_i\left(U\left(y_i^L, t\left(T_i^L\right)\right) - U\left(y_i^R, t\left(T_i^R\right)\right)\right).$$

Because there are infinitely many voters in each group, $F_i\left(U\left(y_i^L, t\left(T_i^L\right)\right) - U\left(y_i^R, t\left(T_i^R\right)\right)\right)$, is also the fraction of group i voters who vote for candidate L. Adding across groups, we obtain candidate L's total vote share

$$S_L = \frac{1}{N}\sum_{i=1}^{N} F_i\left(U\left(y_i^L, t\left(T_i^L\right)\right) - U\left(y_i^R, t\left(T_i^R\right)\right)\right). \tag{4}$$

Party R's vote share is $1 - S_L$.

Given candidate R's platform $\left(\left(y_i^R, T_i^R\right)\right)_{i=1}^{i=N}$, candidate L chooses $\left(\left(y_i^L, T_i^L\right)\right)_{i=1}^{i=N}$ to maximize S_L subject to the non-negativity constraints

$$y_i^L, T_i^L \geq 0 \text{ for all } i$$

and the aggregate budget constraint

$$\sum_{i=1}^{N} T_i^L = \sum_{i=1}^{N} t_i^L l\left(t_i^L\right) \geq \sum_{i=1}^{N} y_i^L \tag{5}$$

where $t_i^L = t\left(T_i^L\right)$.

As in Lindbeck and Weibull (1987), in order to guarantee existence of a pure strategy equilibrium we assume that the objective function of both candidates is strictly concave. A sufficient condition is that $F_i\left(U\left(y_i^L, t_i^L\right) - U\left(y_i^R, t_i^R\right)\right)$ is concave in y_i^L, t_i^L, and convex in y_i^R, t_i^R. In our setup, in addition to the concavity of u, we also assume that $\gamma''' \geq 0$. This is a sufficient condition for the second order conditions of the candidate's problem in Section 4 to be satisfied.[12] We refer the reader to Lindbeck and Weibull (1987) for details on existence.

Let us order the group indices $i = 1, ..., N$ so that $f_i(0) > f_j(0)$ if and only if $i < j$. Lindbeck and Weibull (1987) show that $f_i(0)$ provides a measure of the responsiveness of group i to monetary

[12] It can be shown that $\gamma''' \geq 0$ corresponds to labor supply (determined by equation (2)) being *concave* in the tax rate t.

promises: the return in terms of vote share of offering one more dollar to voters in group i is high if the group has a relatively high $f_i(0)$. Our ordering assumption means that lower indexed groups are more responsive. This in turn implies that parties make better promises to voters with lower i.

Proposition 3.1 *There exists a group $h > 1$ such that, all groups with $i < h$ receive positive transfers and pay no taxes, while all groups with $i \geq h$ receive no transfers and pay positive taxes.*

Proof. See Appendix. ■

The intuition for this result is the following. As in Lindbeck and Weibull (1987), candidates have the incentive to appeal to voters who are more responsive (as measured by $f_i(0)$). Given the balanced budget constraint, the only way to offer something to highly responsive groups is to tax other voters. Thus, candidates tax groups who are not very responsive.

Remark 1. Note that for any given group, in this single period model, candidates either offer a transfer to a group of voters, or they tax this group; candidates never engage in fiscal churning. The reason is that if a group pays positive taxes and receives positive transfers, it is possible to increase this groups's welfare and therefore the vote share gained by the candidate from this group without affecting any other group. This can be done by reducing transfers and tax revenue from this group by the same amount, i.e., by netting-out the fiscal position of the group. Because taxes are distortionary, the group benefits by this netting out.

Remark 2. An interesting special case of Proposition 3.1 arises when groups are homogeneous: $f_i = f$ for all i. In this case, absent the informational frictions introduced later, the equilibrium strategy for candidates is to be completely inactive: they offer zero taxes and zero transfers to every group. Thus, when gropus are homogenous, all government activity will come from imperfect transparency. In order to see why candidates decide to be inactive, note first that, because voters are ex-ante identical, and because candidates objective functions are concave in transfers, there is no gain to offering different transfers to different voters. Since taxation is distortionary, it is then better for a candidate to set this common level of transfers to zero, i.e. to promise to do nothing.

Remark 3. The equilibrium outcome in a single period election is unaffected by information about offers made to other voters because conditional on the offer received by a voter, this voter's welfare (and hence his voting decision) is independent of what is being offered to others.

3.2 Two elections with perfect transparency

We now move to a two period environment with perfect information. This is a necessary benchmark which sets up intermediate steps that are useful later.

Intertemporal considerations, in particular the possibility of deficit financing, are important for an analysis of the role of transparency. In order to abstract from other potential sources of intertemporal distortions, we assume that there are two identical electoral periods as described in Section 2. We assume that the government finances the debt by borrowing from abroad and we rule out the possibility of default on the debt. From now on we assume that $f_i = f$ for all i, and that f is symmetric around zero so that ideology is symmetrically distributed in the population. For expositional simplicity we assume that there is no discounting, and that voters can borrow and save at a zero interest rate.

The equilibrium of the second period subgame is analogous to the equilibrium of the static game described in Section 2, with the exception that budget balance requires that debt D (if any) accumulated in the first period is repaid:

$$\sum_{i=1}^{N} T_{i2}^{j} = \sum_{i=1}^{N} t_{i2}^{j} l\left(t_{i2}^{j}\right) = D + \sum_{i=1}^{N} y_{i2}^{j} \text{ for } j = L, R.$$

For the same reasons as in the static game (see Remark 2), the extent of information available to voters has no effect in this subgame. As argued in Remark 2, because groups are homogeneous, candidates offer zero transfers in the second period, and the burden of the debt is divided equally among the N homogenous groups. Thus, taxes in the second period are

$$T_{i2}^{j} = t_{i2}^{j} l\left(t_{i2}^{j}\right) = \frac{D}{N} \text{ for } j = L, R \text{ and for all } i. \tag{6}$$

In the first period, the voting decision is not only based on the first period offer, but also on the total debt resulting from all offers. Suppose that a voter in group i receives a first period offer from party j that comprises of transfers y_{i1}^{j}, and of taxes T_{i1}^{j}. Suppose also that the voter expects his second period taxes to be T_{i2}^{j} if party j wins in the first period (because the debt implied by candidate j's first period platform has to be repaid). Given these politically determined variables, this voter chooses savings and labor supply in the two periods to maximize his intertemporal payoff, implying that the voter equalizes utility across the two periods, and that labor supply in the two periods maximizes

$$\max_{l_{i1}, l_{i2}} 2u\left(\frac{1}{2}\left(y_{i1}^{j} + \left(1 - t\left(T_{i1}^{j}\right)\right) l_{i1}^{j} - \gamma\left(l_{i1}^{j}\right) + \left(1 - t\left(T_{2}^{j}\right)\right) l_{i2}^{j} - \gamma\left(l_{i2}^{j}\right)\right)\right).$$

Thus, labor supply $l\left(t_{k}^{j}\right) = l\left(t\left(T_{k}^{j}\right)\right)$ in period k is given by

$$\gamma'\left(l\left(t_{k}^{j}\right)\right) = 1 - t_{k}^{j}. \tag{7}$$

and the indirect utility to a voter over the two periods can be written as

$$U\left(y_{i1}^{j}, t_{i1}^{j}, t_{i2}^{j}\right) = 2u\left(\frac{1}{2}\left(y_{i1}^{j} + \left(1 - t_{i1}^{j}\right) l\left(t_{i1}^{j}\right) - \gamma\left(l\left(t_{i1}^{j}\right)\right) + \left(1 - t_{2}^{j}\right) l\left(t_{2}^{j}\right) - \gamma\left(l\left(t_{2}^{j}\right)\right)\right)\right). \tag{8}$$

Hence, we can write the intertemporal budget constraint as

$$\sum_{i=1}^{N} T_{i1}^{j} + \sum_{i=1}^{N} T_{i2}^{j} = \sum_{i=1}^{N} t_{i1}^{j} l\left(t_{i1}^{j}\right) + \sum_{i=1}^{N} t_{2}^{j} l\left(t_{2}^{j}\right) = \sum_{i=1}^{N} y_{i1}^{j} \text{ for } j = L, R.$$

or, using the fact that second period taxes are the same for all groups in equilibrium,

$$\sum_{i=1}^{N} T_{i1}^{j} + N T_{2}^{j} = \sum_{i=1}^{N} t_{i1}^{j} l\left(t_{i1}^{j}\right) + N t_{2}^{j} l\left(t_{2}^{j}\right) = \sum_{i=1}^{N} y_{i1}^{j} \tag{9}$$

Thus, given promises $\left(y_{i1}^{L}, T_{i1}^{L}\right)$ and $\left(y_{i1}^{R}, T_{i1}^{R}\right)$ a voter in group i votes for candidate L in period 1 whenever

$$U\left(y_{i1}^{L}, t\left(T_{i1}^{L}\right), t\left(T_{2}^{L}\right)\right) - U\left(y_{i1}^{R}, t\left(T_{i1}^{R}\right), t\left(T_{2}^{R}\right)\right) > x \tag{10}$$

where $t = t\left(T_2^j\right)$ is the tax rate that voters expect is necessary in the second period given the promises made by candidate j in the first period.

Candidate L's first period vote share is therefore given by

$$S_{L,1} = \frac{1}{N}\sum_{i=1}^{N} F\left(U\left(y_{i1}^L, t\left(T_{i1}^L\right), t\left(T_2^L\right)\right) - U\left(y_{i1}^R, t\left(T_{i1}^R\right), t\left(T_2^R\right)\right)\right). \tag{11}$$

In the first period, candidate L chooses $\left(\left(y_{i,1}^L, T_{i,1}^L\right)\right)_{i=1}^N$ to maximize his vote share $S_{L,1}$ given by equation (11) subject to the budget constraint (9) and non negativity constraints. Note that the second period election only enters into the candidates problem through the debt. Since debt affects both candidates in the second period, there is nothing candidate L can do in the first period to change his electoral prospects in the second period.

When voters perfectly observe all promises made by the two candidates, and groups are homogeneous, the best thing that a candidate can promise is to do nothing: no transfers and no taxes.

Proposition 3.2 *Under perfect information, equilibrium platforms involve zero transfers and zero transfers in both periods, and hence no debt accumulation.*

Because Proposition 3.2 is a special case of Proposition 4.1, we delay the proof of this result until the proof of Proposition 4.1. This result is a useful benchmark because it allows us to show that in our model, any government activity and debt accumulation must be due to information imperfections.[13]

4 Imperfect Transparency

We now assume that each voter observes perfectly the promises made to his own group but only observes imperfect signals of electoral promises to other groups.[14] Specifically, we consider the case of two distinct signals. The first is informative about aggregate spending and the second is informative about aggregate revenues. We model these imperfect signals as follows. The first signal reveals aggregate transfers perfectly with probability p and reveals nothing with probability $1-p$. Similarly, the second signal reveals aggregate revenues perfectly with probability q and reveals nothing with probability $1-q$. Two alternative assumptions on the correlation of these signals across voters are equivalent in terms of the expected vote shares, and therefore these assumption are equivalent in terms of the candidates' equilibrium strategies. In the first case, there is perfect correlation across voters: every voter sees the same realization of signals (e.g., if aggregate transfers are revealed to one voter they are also revealed to every other voter). In the second case, each single voter receives an independent draw of these signals, implying that different voters may observe different signal realizations.[15] The equivalence between these two assumptions is due to the continuum of voters in

[13]With heterogeneous groups, Remark 1 still applies in each of the two periods: if there is perfect information, the one election equilibrium is replicated in both periods; in particular, there is no fiscal churning and no debt.

[14]More generally, we would need that group i voters observe more informative signals of promises made to group i and less informative signals to groups $j \neq i$.

[15]In our model, the probability that a voter is pivotal is zero. We therefore ignore issues related to potential strategic voting decisions tied to asymmetric information across voters.

each group.[16] Note that the only thing that matters to a voter is the aggregate debt resulting from offers to other groups and not the precise composition of those offers.

In the event that voters do not observe all offers, voting decisions depend on beliefs about candidates' offers to other voters (because these determine the deficit). In our simple model, without introducing some refinement, there are few restrictions that can be made on out-of-equilibrium beliefs. Thus, there are multiple equilibria. This problem is common to sequential models with an upstream player and multiple downstream players, where the upstream player makes unobservable offers to the downstream players.[17] In order to eliminate this indeterminacy, our formal analysis in the paper uses a refinement of off-equilibrium beliefs that generalizes one often called *passive beliefs* which is commonly used in the literature on multilateral contracting. In Remark 4 below we discuss the import of this assumption and alternative approaches to resolve the potential indeterminacy. Fix a putative equilibrium platform $\left(\hat{y}_{i,1}^J, \hat{T}_{i,1}^J\right)_{i=1}^N$ in the first period for candidate J, and consider a possible deviation for this candidate that promises a higher transfer or a tax cut $\left(y_{k1}^J, T_{k1}^J\right) = \left(\hat{y}_{i,1}^J + z, \hat{T}_{i,1}^J - w\right)_{i=1}^N$ to group k. Beliefs of voters in group k specify what candidate J is expected to offer to other groups $i \neq k$ following the deviation. Our refinement specifies these beliefs to be that candidate J offers $\left(\hat{y}_{i,1}^J + b_y z, \hat{T}_{i,1}^J - b_T w\right)_{i=1}^N$ to all other groups $i \neq k$ for some real numbers b_y and b_T. The values of b_y and b_T define how *pessimistic* voters are about the offers made to other groups following a deviation. The common assumption in the literature is that $b_y = b_T = 0$, in which case beliefs are said to be *passive* because voters do not change their conjectures about what others receive. We assume that b_y and b_T are both less than 1, i.e., voters are not too pessimistic about promises to other voters. Of course, in equilibrium voters have correct beliefs about promises to all groups. However, the values of b_y and b_T do affect the possible off-equilibrium incentives for candidates and hence the possible equilibrium platforms.[18]

4.1 Equilibrium construction

Denote by U^j the equilibrium utility induced by candidate j's platform. We now describe the payoff to candidate L when he deviates from the putative equilibrium platform $\left(\hat{y}_{i1}^L, \hat{T}_{i1}^L\right)_{i=1}^{i=N}$ by changing offers to group 1.[19]

[16] An alternative specification is that voters within a group receive the same signal realization, but different groups have independent signals. The exact formulation of the candidates' vote share in this case is more elaborate. However, the comparative statics results in Proposition 4.1 still hold (the intuition outlined below Proposition 4.1 is exactly the same).

[17] See for instance the literature on multilateral contracting (McAfee and Schwartz 1994 and Segal 1999)

[18] This assumption can be relaxed by allowing b_y and b_t to display some dependence on the platform, and the identity of the group. However, this would be unwieldy and we will not do so in the interest of exposition. Our assumption is convenient because it delivers a unique equilibrium in a simple way, which is essential given the fact that the focus of the analysis is on the comparative statics of alternative information structures (the role of transparency). An alternative approach would focus on the comparative statics of sets of equilibria. This is in principle feasible but considerably more burdensome.

[19] It is easy to show that, if there is no profitable deviation to a single group, then there is no profitable deviation to multiple groups. Therefore, to characterize equilibrium, it is enough to make sure that there is no profitable single group deviation.

Under our informational assumptions there are four possible events:

A. With probability pq, all voters have full information. The difference in material payoffs to voters in group 1 between the two candidates is

$$\Delta_1^A = U\left(\hat{y}_{11}^L + z, t_{11}^L\left(\hat{T}_{11}^L - w\right), t_2^L\left(\hat{y}_{11}^L - \hat{T}_{11}^L + \frac{z+w}{N}\right)\right) - U^R$$

where $\hat{y}_{11}^L - \hat{T}_{11}^L + \frac{z+w}{N}$ is the group 1 share of the debt associated with the transfers $\hat{y}_{11}^L + z$ and taxes $t_{11}^L\left(\hat{T}_{11}^L - w\right)$, and $t_2^L\left(\hat{y}_{11}^L - \hat{T}_{11}^L + \frac{z+w}{N}\right)$ is the tax rate common to all groups that ensues in the period two subgame. Thus, a voter in group 1 votes for candidate L whenever the difference in material payoffs is larger than their ideological attachment x, namely, if and only if, $U\left(\hat{y}_{11}^L + z, t_{11}^L\left(\hat{T}_{11}^L - w\right), t_2^L\left(\hat{y}_{11}^L - \hat{T}_{11}^L + \frac{z+w}{N}\right)\right) - U^R > x$.

For voters in groups $2, ..., N$, the difference in payoffs between the platforms offered by the two candidates is

$$\Delta_{i\neq 1}^A = U\left(\hat{y}_{i1}^L, \hat{t}_{i1}^L, t_2^L\left(\hat{y}_{i1}^L - \hat{T}_{i1}^L + \frac{z+w}{N}\right)\right) - U^R.$$

B. With probability $p(1-q)$, voters observe transfers but not revenues, so voters in groups $2, ..., N$ are aware of the deviation on transfers but not of the one on revenues. For group 1 the difference in perceived payoffs between the platforms offered by the two candidates is

$$\Delta_1^B = U\left(\hat{y}_{11}^L + z, t_{11}^L\left(\hat{T}_1^L - w\right), t_2^L\left(\hat{y}_{11}^L - \hat{T}_{11}^L + \frac{z + w\left(1 + b_T\left(N-1\right)\right)}{N}\right)\right) - U^R$$

since now group 1 does not observe aggregate revenues and, given our assumption on off-equilibrium beliefs, believes that all groups $2, ..., N$ are paying $\hat{T}_{11}^L - b_T w$ taxes.

For voters in groups $2, ..., N$, the difference in perceived payoffs between the platforms offered by the two candidates is

$$\Delta_{i\neq 1}^B = U\left(\hat{y}_{i1}^L, \hat{t}_{i1}^L, t_2^L\left(\hat{y}_{i1}^L - \hat{T}_{i1}^L + \frac{z}{N}\right)\right) - U^R.$$

C. With probability $(1-p)q$, voters observe revenues but not the transfers. In this case, for group 1 the difference in perceived payoffs between the platforms offered by the two candidates is

$$\Delta_1^C = U\left(\hat{y}_{11}^L + z, t_{11}^L\left(\hat{T}_{11}^L - w\right), t_2^L\left(\hat{y}_{11}^L - \hat{T}_{11}^L + \frac{z\left(1 + b_y\left(N-1\right)\right) + w}{N}\right)\right) - U^R$$

since now group 1 does not observe aggregate transfers and believes that all groups $2, ..., N$ are receiving $\hat{y}_{i1}^L + b_y z$ transfers.

For voters in groups $2, ..., N$, the difference in perceived payoffs between the platforms offered by the two candidates is

$$\Delta_{i\neq 1}^C = U\left(\hat{y}_{i1}^L, \hat{t}_{i1}^L, t_2^L\left(\hat{y}_{i1}^L - \hat{T}_{i1}^L + \frac{w}{N}\right)\right) - U^R.$$

D. With probability $(1-p)(1-q)$ voters do not observe any aggregate information. For voters in group 1 the difference in perceived payoffs between the platforms offered by the two candidates is

$$\Delta_1^D = U\left(\hat{y}_{11}^L + z, t_{11}^L\left(\hat{T}_{11}^L - w\right), t_2^L\left(\hat{y}_{11}^L - \hat{T}_{11}^L + \frac{z\left(1 + b_y\left(N-1\right)\right) + w\left(1 + b_T\left(N-1\right)\right)}{N}\right)\right) - U^R$$

since now group 1 believes that all groups $2, ..., N$ receive $\hat{y}_{i1}^L + b_y z$ transfers and pay $\hat{T}_{i1}^L - b_T w$ taxes.

For voters in groups $2, ..., N$, the difference in their perceived payoffs are just the equilibrium payoff

$$\Delta_{i\neq1}^{D} = U^{L} - U^{R}.$$

In each of these events candidate L's vote share following the deviation is given by the fraction of voters whose ideology x is lower than the difference in material payoffs. We can therefore now write the vote share for candidate L following this deviation:

$$\begin{aligned} S_L(z,w) \quad = \quad & pq\left(F\left(\Delta_1^A\right)+(N-1)\,F\left(\Delta_{i\neq1}^A\right)\right)+p\,(1-q)\left(F\left(\Delta_1^B\right)+(N-1)\,F\left(\Delta_{i\neq1}^B\right)\right)+ \\ & (1-p)\,q\left(F\left(\Delta_1^C\right)+(N-1)\,F\left(\Delta_{i\neq1}^C\right)\right)+(1-p)\,(1-q)\left(F\left(\Delta_1^D\right)+(N-1)\,F\left(\Delta_{i\neq1}^D\right)\right) \end{aligned} \tag{12}$$

In each event, the first term is the vote share obtained from group 1: the group that receives the deviations. The second term is the vote share from the remaining $N-1$ groups in the four events described above.

Equation (12) emphasizes the key force operating in our model: the candidate obtains the full benefit of improved offers to group 1 but is only held partially accountable by the other $N-1$ groups because these only observe any deviation with probability less than 1.

Candidate L chooses taxes and transfers in period 1 to maximize his expected vote share $S_L(z,w)$ subject to non-negativity constraints for taxes and transfers. If candidate L cannot increase his vote share with any deviation on transfers z or on taxes w to group 1, then the platform $\left(\hat{y}_{i1}^L, \hat{T}_{i1}^L\right)_{i=1}^{i=N}$ is an equilibrium. Hence, when the first order conditions of equation (12) with respect to the deviations z and w hold at $z=0$ and $w=0$, then, given the symmetry of groups and candidates, such conditions describe the equilibrium policies.

Proposition 4.1 *When voters observe spending with probability p and revenues with probability q, in equilibrium,*

(i) Debt and first period transfers are positive if and only if transparency of expenditures is imperfect ($p<1$). Debt and first period transfers are decreasing in p, and social welfare is increasing in p.

(ii) If $p<1$, then there is a $q(p)<1$ such that, for $q>q(p)$ first period taxes are positive, and there is fiscal churning. If revenues are perfectly transparent ($q=1$), then taxes are perfectly smoothed across periods: $T_1=T_2$. If revenues are not perfectly transparent ($q<1$), then taxes are imperfectly smoothed across periods: $T_1<T_2$. First period taxes and transfers are increasing in revenue transparency q, whereas social welfare is decreasing in q.

Proof. See Appendix. ■

Several phenomena highlighted by Proposition 4.1 are particularly worthy of elaboration. First, the fact that budget deficits emerge in equilibrium; second, the possibility of fiscal churning; third, the fact that social welfare is decreasing in the transparency of revenues.

To build an intuition for the emergence of budget deficits, let us first argue that, when $p<1$, zero transfers cannot be part of an equilibrium. If transfers were zero for all groups, then each candidate would have the incentive to give a small positive transfer to one group, gaining an increase in vote share of, say, s_1 from this group. This deviation is only detected with probability $p<1$ by the other groups, implying a decrease in vote share in this event of s_2. For any deviation, s_1 is lower than s_2 because of the distortions arising from future taxes. However, at zero transfers, and for a small deviation, $s_1 \approx s_2$ because the distortions are of second order when taxes are small. Furthermore, the vote loss s_2 ensues with probability $p < 1$ while the vote gain s_1 occurs with probability 1, implying that transfers have to be positive in equilibrium. This reasoning lies behind the fact that in equilibrium there are positive transfers. This effect captures the idea that candidates are only held partially accountable for the losses from transfers that are not perfectly observable to voters, and therefore candidates do not fully internalize such losses. This leads to an incentive for candidates to "overpromise". Equilibrium transfers have to be sufficiently high that distortions from an additional transfer balance this incentive to overpromise. It is then clear that less transparent systems lead to larger transfers and distortions.

Fiscal churning arises because of a combination of wasteful transfers and efficient tax smoothing. Consider for simplicity the case in which $q = 1$, i.e., the case of perfect observability of revenues. As long as $p < 1$, wasteful transfers arise in equilibrium for the reasons just discussed: candidates do not fully internalize the future cost of transfers since deviations are only detected with probability p. Given that voters understand that candidates offer positive transfers, it cannot be the case that first period taxes are zero: for any given level of aggregate transfers, candidates have an incentive to raise first period taxes to reduce the deficit and smooth the distortions from taxation across the two periods. This is because distortions from taxation in each period are convex in the tax rate. When $q = 1$, tax smoothing is complete, so that taxes are the same in the two periods. When $q < 1$, smoothing is imperfect because first period taxes are lower than second period taxes.

When revenues are perfectly observable, transfers are efficiently financed by smoothing distortions across periods. However, voters would clearly be better off if first period taxes could be reduced to zero and the transfers reduced accordingly. Despite this, part (ii) of Proposition 4.1 says that first period taxes are increasing in q. This may be counterintuitive but there is a simple force behind this phenomenon. For any given p the equilibrium size of debt is determined by the necessity of sufficiently large marginal second period distortions to balance the marginal incentive for candidates to overpromise because of imperfect transparency of transfers. When revenues are observable, the possibility of smoothing taxes reduces the marginal distortion associated with any given level of aggregate transfers. Thus, to maintain equilibrium, aggregate transfers must rise to restore a sufficiently high marginal distortion.

Remark 3. There are additional interesting and convenient features of our model that emerge from the proof presented in the Appendix but were not emphasized in Proposition 4.1. Debt and second period taxes are independent of revenue transparency q, and first period taxes are independent of p.[20] The intuition for these results is as follows. Since the probability of observing aggregate transfers and aggregate taxes are independent of each other, the partial observability of transfers only affects the second period distortions, while the partial observability of taxes only affects the first period distortions.

[20]This result is sensitive to the way we have specified off-equilibrium beliefs and to the independence of signals on spending and revenues.

The result that debt is higher in less transparent political systems has recently emerged in the literature. Milesi-Ferretti (2004), Shi and Svensson (2006) and Alt and Lassen (2006) also provide models in which higher transparency reduces incentives to accumulate debt. However, the main policy conclusion of Proposition 4.1 is that, while transparency of spending is beneficial, transparency of revenues may end up being counterproductive because it reduces the marginal political cost of offering wasteful transfers. This may sound perverse: after all, the transparency of revenues leads to efficient intertemporal financing of any given pattern of expenditures. However, as we have shown in Proposition 4.1, this leads to even larger wasteful transfers, and hence an increase in current taxation without any corresponding benefit of reduction in future taxation.

Proposition 4.1 may also be useful for empirical analyses of transparency. Shi and Svensson, Alt and Lassen, and Alesina et al. (1999) also provide an empirical analysis of transparency. They look at cross-sections of countries and show that indices of transparency help predict fiscal outcomes: lower deficits are associated with better transparency. The logic of Proposition 4.1 suggests that it would be useful to decompose the indices into sub-indices of revenue transparency and spending transparency because aggregate transparency indices may lead to weaker results due to the aggregation of opposite effects from revenue and spending transparency. Indeed, as predicted by our model, Alt et al. (2006b) find some evidence from a cross-section of US states suggesting that transparency has different effects depending on whether it concerns spending or revenues.

Remark 4 In Appendix B we provide sufficient conditions for existence of an equilibrium.

Remark 5 We now comment on the importance of our assumption that voter's off-equilibrium beliefs are not too pessimistic. If this assumption does not hold, then it is easy to show that the equilibrium of no government activity obtained in the case of perfect transparency (Proposition 3.2) can be sustained for any level of transparency. If voters believed that any positive transfer meant that other voters receive even higher transfers, then such a deviation would not be beneficial for a candidate. In order to interpret our assumptions, it may be useful to think of a model in which voters have incomplete information about the candidates' characteristics. There are many alternative specifications of what incomplete information may be about. One scenario is that voters are uncertain about the degree to which candidates 'like' a particular group, or how important this group is in the candidate's electoral calculations.[21] Such a model would display beliefs that are similar to our non-pessimistic beliefs: a high transfer is evidence of the candidate liking a group more, so it is predictive of good things for this group in the future too. More generally, the key force driving our analysis is that a high transfer to a voter is typically 'good news' for the voter.[22] We believe that this feature is quite reasonable and resembles candidate behavior in real elections: candidates try to convince groups that they are particularly attached to them or that good things can come from

[21] See Drazen and Eslava (2006) for a model of the budget cycle that displays this feature.

[22] In Gavazza and Lizzeri (2008) we present a model of the behavior of an incumbent with unknown ability. In that model we do not need to make any assumption about off-equilibrium beliefs. We have also explored a model where candidates' platforms are communicated to voters with noise. Under a full support assumption, all relevant offers by candidates are on the equilibrium path, and therefore no refinements are necessary. In both these models a high transfer is good news for a voter and it makes more likely to vote for the deviating candidate.

electing them. Another scenario is one in which voters are uncertain about the overall fiscal discipline that a candidate is capable of exerting. In this case, a relatively high transfer may be evidence of poor fiscal discipline. More broadly (and more abstractly), it is clear that one can construct models where the set of possible information states is sufficiently rich that there may be equilibria where voters' suspicions of the candidate unmonitored activity are allowed to dominate, preventing much activity by all candidates in the first place. We do not believe that it is possible to provide a definitive and universal theory of government transparency that delivers uniform predictions regardless of the underlying information environment. However, this should not prevent an analysis that explores some plausible scenarios in which transparency plays a particular role, as in our model. Of course, this cannot exclude the possibility that there are other scenarios that would be relevant in different settings.

4.2 Heterogenous transparency across groups

We now assume that groups are characterized by different degrees of transparency. Offers to some groups are observed with a higher probability than offers to other groups. For simplicity, assume that there are two types of groups: group $i = 1, ..., N_A$ is of type A, and group $j = N_A + 1, ..., N$ is of type B. Further assume that aggregate transfers to *the collection* of type k groups are observed with probability p_k; that aggregate transfers to type B groups are observed with higher probability, i.e. $p_B > p_A$; and that all groups observe taxes perfectly, i.e. $q_A = q_B = 1$. Candidates now have an incentive to offer higher transfers to type A groups. These transfers are observed with lower probability, and therefore candidates are less likely to be held accountable for the costs of such transfers.

Proposition 4.2 *In the first period type A groups receive larger transfers $y_{i1}(p_A) > y_{j1}(p_B)$. There is more fiscal churning for type A groups.*

Proof. See Appendix. ■

This result provides an interesting interpretation of a puzzling phenomenon discussed in Palda (1997). Palda finds that in Canada fiscal churning rises with income deciles: higher income individuals face more churning. Palda argues that this phenomenon is puzzling because it is reasonable to expect that higher income individuals are more informed about fiscal policy and the political process, and that therefore they should be faced with less distortionary policies. Proposition 4.2 says that there is more churning for groups whose transfers are observed with lower probability. Since higher income individuals are better informed, lower income individuals have worse information about transfers offered to high income people. Therefore, Proposition 4.2 suggests that an explanation of higher churning for higher income individuals is that, precisely because these individuals have better information, transfers offered to them are relatively hard to observe by the rest of the population, leading candidates to favor offering higher transfers to these voters.[23]

[23] A related result holds when groups are heterogeneous with respect to the probability of observing taxes q_i. Candidates tax more heavily groups that are observed with a higher probability q_i.

Another interesting implication of Proposition 4.2 involves a comparison of two societies with the same level of average aggregate transparency that differ in the extent of heterogeneity of transparency across groups. For instance, assume that one society has the same level of transparency p for all N groups, whereas in the second society transfers to N_A groups are observed with probability p_A, and transfers to $N_B = N - N_A$ groups are observed with probability p_B, with $\frac{p_A N_A + p_B N_B}{N} = p$. A corollary of Proposition 4.2 is that the size of government, taxes, transfers, and deficits are larger in the second, more heterogeneous society. The intuition is that what determines the size of government is the marginal incentive to offer transfers to a group. In the heterogenous society this incentive is determined by the least transparent group. Thus total future distortions have to be sufficiently high to deter sneaky transfers to such a group. This emerges very starkly if u is linear: in this case, all that matters for determining the size of the deficit is the transparency of the least transparent group: all other groups receive nothing.

4.3 Public Goods: Transparency and the Composition of Government Spending

In all of our previous analysis the only type of government spending was wasteful transfers. This has colored some of our discussion of the welfare effects of transparency. We now introduce spending on beneficial public goods. The analysis of this extension has two purposes. First, we want to examine the robustness of our results to the introduction of socially useful government spending. Second, we want to discuss the consequences of transparency for the composition of public spending between socially useful public projects and socially wasteful transfers. We find that underprovision of public goods may be a consequence of imperfect transparency of transfers, and that more transparent fiscal systems devote more resources to public goods as opposed to transfers.

We assume that, spending on the public good is observable, and, if G is spent on the public good, a voter who receives a transfer y and works l has utility given by $u\left(v\left(G\right) + y - \gamma\left(l\right)\right)$ where v is concave, and u and γ satisfy the assumptions stated in section 2. Denote by G^{eff} the efficient level of provision of G. Because spending on the public good is financed via distortionary taxes, it must be the case that $v'\left(G^{eff}\right) > 1$.

Our conclusion that transparency of revenues is harmful has to be qualified: as discussed below, when there is positive spending on the public good, and no spending on transfers, transparency of revenues can be beneficial. However, our prior analysis is robust and empirically relevant: as long as there are positive transfers in equilibrium, full revenue transparency is not optimal. We proceed in two stages. First, in Proposition 4.3 we assume that there is an exogenous value G of spending on public goods in both periods which is known by all voters. We later allow for endogenous spending on the public good.

Proposition 4.3 *Assume that aggregate transfers are observed with probability p and aggregate revenues with probability q. There is a $\overline{G}$ such that, for any G in $\left(0, \overline{G}\right)$,*

(i) There exists $p\left(G, q\right)$ such that, for $p < p\left(G, q\right)$, in equilibrium there are positive transfers and positive deficits.

(ii) For any $p < p\left(G, 1\right)$, the socially optimal level of revenue transparency is lower than 1.

Proof. See Appendix. ■

In order to gain an intuition for this result, note first that distortionary taxes are positive even when transfers are zero because they must at least finance the level of spending G. The exact distribution of these taxes across the two periods depends on the level of revenue transparency q. The existence of spending on the public good implies that we need to qualifiy our previous analysis of the effects of revenue transparency. When there are no transfers in equilibrium (when p is particularly high), then, generally, a marginal increase in q no longer leads to an increase in transfers (in contrast with Proposition 4.1). In this case, it is beneficial to smooth taxation to finance the public good so that reducing q may be inefficient because it leads to imperfect tax smoothing without a corresponding reduction in transfers. The fact that taxes are positive even absent transfers implies that the marginal distortion due to transfers is first order even for very small transfers. This means that $p < 1$ is no longer sufficient for guaranteeing positive first period transfers. However, the idea behind part (i) of the proposition is that, when spending on the public good is not too high, then distortions due to spending on the public good are not sufficiently large to deter positive transfers when these are highly non-transparent. The intuition for part (ii) is that the existence of positive transfers restores the problems associated with revenue transparency emphasized in part (ii) of Proposition 4.1: reducing q does not change the equilibrium level of second period taxes but reduces the equilibrium level transfers and first period taxes.

We now allow for endogenous spending on the public good to consider how transparency affects the equilibrium composition of spending between socially useful spending on public goods and socially wasteful spending on transfers. For the rest of this analysis we fix $q = 1$ and focus on the effects of p. Let $G(p)$ denote the equilibrium value of spending on the public good.

Proposition 4.4 *There are two regions defining the equilibrium behavior of transfers, deficits, and spending on the public good.*

(i) If $p \geq \widehat{p} = p\left(G^{eff}, 1\right)$, then transfers are zero, there is no deficit, and spending on the public good is efficient: $G(p) = G^{eff}$.

(ii) If $p < \widehat{p}$, then, transfers and deficits are positive, there is fiscal churning, and underprovision of the public good $G(p) < G^{eff}$. Furthermore, in this region, $G(p)$ is increasing in p, and transfers and deficits are decreasing in p.

Proof. See Appendix. ■

Part (i) of Proposition 4.4 says that when transparency of transfers is sufficiently high, then government activity is efficient. This has a simple intuition. Second period taxes (and marginal distortions) are positive in this environment even absent a first period deficit because of second period spending on the public good. This means that the effect in favor of positive transfers outlined in the intuitive discussion following Proposition 4.1 no longer holds because distortions are now first order even with zero transfers. This implies that, if transparency is so high that the small distortions suffice to deter transfers, then when there is spending on the public good, candidates will not offer transfers in the first period. Absent transfers, given that spending on the public good is observable, candidates have the incentive to choose an efficient level of spending on the public good.

This spending is financed by efficiently smoothing taxes across periods, so that there is no deficit in equilibrium.

The intuition for part (ii) is the following. Suppose that transfers are zero, and that spending on the public good is G^{eff}. Then, second period spending on the public good would also be G^{eff}. When transparency is low enough, by Proposition 4.3, this profile cannot be an equilibrium because distortions are not large enough to prevent candidates from offering positive transfers in the first period. The presence of transfers increases the marginal distortions of taxes that finance spending on the public good. Since spending on the public good is observable, candidates internalize this cost by reducing spending on the public good below G^{eff}. This is the force behind underprovision.

Proposition 4.4 thus highlights the fact that the lack of transparency of transfers is an electoral force that may push toward the underprovision of public goods. Recent literature (e.g., Lizzeri and Persico 2001, 2005) has suggested other reasons why elections may lead to underprovision of public goods. Specifically, this literature emphasizes the idea that transfers may be favored by candidates because they are more targetable to subgroups of the population leading to excessive use of transfers relative to non targetable public goods. These effects are complementary to the effect highlighted here.

5 Appendix A

Proof of Proposition 3.1. It is clear that, for each group i, either $t_i = 0$ or $y_i = 0$. Otherwise, the candidate can reduce both taxes and transfers to group i by the same amount, without affecting any other group. This increases the utility of group i because taxes are distortionary. Furthermore, a straightforward adaptation of the arguments in Lindbeck-Weibull show that, in equilibrium,

$$\begin{aligned} f_i(0)\frac{\partial U}{\partial y_i} &= f_j(0)\frac{\partial U}{\partial y_j} && \text{if } y_i > 0, y_j > 0, \\ f_i(0)\frac{\partial U}{\partial y_i} &= f_j(0)\frac{\partial U}{\partial t_j}\frac{\partial t_j}{\partial T_j} && \text{if } y_i > 0, t_j > 0, \\ f_i(0)\frac{\partial U}{\partial t_i}\frac{\partial t_i}{\partial T_i} &= f_j(0)\frac{\partial U}{\partial t_j}\frac{\partial t_j}{\partial T_j} && \text{if } t_i > 0, t_j > 0. \end{aligned}$$

where $T_j(t_j) = t_j l(t_j)$ is the tax revenue obtained from tax rate t_j. Suppose that $i < j$. Recall that we have ordered indices so that $f_i(0) > f_j(0)$. These equations imply that if group j receives positive transfers (and therefore pays no taxes), group i must also receive transfers, and pay no taxes. Analogously, if group i pays positive taxes (and therefore receives no transfers) then group j must pay positive taxes as well. Note also that $(y_i^L, t_i^L) = (y_i^R, t_i^R) = (0,0)$ to all $i = 1,..,N$ cannot be an equilibrium, since

$$f_1(0)\frac{\partial U(0,0)}{\partial y_1} > f_2(0)\frac{\partial U(0,0)}{\partial t_2}\frac{\partial t_2}{\partial y_1}$$

because $\frac{\partial U(0,0)}{\partial y_1} \approx \frac{\partial U(0,0)}{\partial t_2}\frac{\partial t_2}{\partial y_1}$. This implies that each candidate can increase his vote share by offering an small transfer to group 1 financed with a small tax to group 2. Hence, the only possibility is that there exists an $h > 1$ such that groups $i < h$ receive positive transfers and pay no taxes, while all groups with $i \geq h$ receive no transfers and pay positive taxes. ■

Proof of Proposition 4.1. Throughout this and subsequent proofs, we drop the index L on the deviating candidate. Whenever a variable appears without an index it refers to candidate L. Also, we simply denote by U the function $U(y_1, t(T_1), t(T_2))$ evaluated at the equilibrium platform.

(i) We first prove that debt and first period transfers are positive when $p < 1$. As in the static model, in equilibrium, candidates make the same offers to all groups in the population. Denote period 1 per capita tax revenues by T_1 and consider a deviation consisting of an additional transfer z to group 1 and an additional tax revenue w to group 1. The vote share of a candidate making such a deviation is equal to equation (12). Differentiating equation (12) with respect to z and w and imposing the equilibrium condition $z = w = 0$ we obtain the following Kuhn-Tucker conditions (recall that transfers and taxes are constrained to be non negative):

$$\begin{aligned}
\left(\frac{\partial U}{\partial y} + p\frac{\partial U}{\partial t_2}\frac{\partial t_2}{\partial y} + \frac{(1-p)(1+b_y(N-1))}{N}\frac{\partial U}{\partial t_2}\frac{\partial t_2}{\partial y}\right) f(0) &\leq 0, \\
y\left(\frac{\partial U}{\partial y} + p\frac{\partial U}{\partial t_2}\frac{\partial t_2}{\partial y} + \frac{(1-p)(1+b_y(N-1))}{N}\frac{\partial U}{\partial t_2}\frac{\partial t_2}{\partial y}\right) f(0) &= 0, \\
\left(\frac{\partial U}{\partial t_1}\frac{\partial t_1}{\partial T_1} + q\frac{\partial U}{\partial t_2}\frac{\partial t_2}{\partial T_1} + \frac{(1-q)(1+b_T(N-1))}{N}\frac{\partial U}{\partial t_2}\frac{\partial t_2}{\partial T_1}\right) f(0) &\leq 0, \\
T_1\left(\frac{\partial U}{\partial t_1}\frac{\partial t_1}{\partial T_1} + q\frac{\partial U}{\partial t_2}\frac{\partial t_2}{\partial T_1} + \frac{(1-q)(1+b_T(N-1))}{N}\frac{\partial U}{\partial t_2}\frac{\partial t_2}{\partial T_1}\right) f(0) &= 0
\end{aligned}$$

where $U = U(y, t_1(T_1), t_2(y - T_1))$ is the indirect utility evaluated at the equilibrium platform.

Rearranging, we can rewrite the first and the third equilibrium conditions above as follows:

$$\frac{\partial U(y, t_1(T_1), t_2(y-T_1))}{\partial y} \leq -\frac{(1-p)(1+b_y(N-1))+pN}{N}\frac{\partial U(y, t_1(T_1), t_2(y-T_1))}{\partial t_2}\frac{\partial t_2}{\partial y}, \tag{13}$$

$$\frac{\partial U(y, t_1(T_1), t_2(y-T_1))}{\partial t_1}\frac{\partial t_1}{\partial T_1} \leq -\frac{(1-q)(1+b_T(N-1))+qN}{N}\frac{\partial U(y, t_1(T_1), t_2(y-T_1))}{\partial t_2}\frac{\partial t_2}{\partial T_1}. \tag{14}$$

From equation (8), we obtain

$$\frac{\partial U(y, t_1(T_1), t_2(y-T_1))}{\partial y} = u' \tag{15}$$

$$\frac{\partial U(y, t_1(T_1), t_2(y-T_1))}{\partial t_i} = \left(-l_i + \frac{\partial l_i}{\partial t_i}(1 - t_i - \gamma')\right)u' = -l_i u' \tag{16}$$

where the second equality holds because of the optimality of labor supply. In addition, from $t_i l_i(t_i) = T_i$ we have that

$$\frac{\partial t_i}{\partial T_i} = \frac{1}{l_i + \frac{\partial l_i}{\partial t_i}t_i} \tag{17}$$

Differentiating implicitly equation (7) with respect to t_i we obtain $\frac{\partial l_i}{\partial t_i} = -\frac{1}{\gamma''(l_i(t_i))}$. Thus,

$$\frac{\partial U(y, t_1(T_1), t_2(y-T_1))}{\partial t_2}\frac{\partial t_2}{\partial y} = -\frac{l_2 u'}{l_2 + \frac{\partial l_2}{\partial t_2}t_2}. \tag{18}$$

Substituting equations (15) and (18) into equation (13) and simplifying we obtain:

$$t_2(y - T_1) \geq \frac{(N-1)(1-b_y)(1-p)}{N}\gamma''(l_2(t_2(y-T_1)))\, l_2(t_2(y-T_1)). \tag{19}$$

For $p < 1$, the right-hand side of inequality (19) is positive. Hence $t_2 > 0$. This shows that the deficit and first period transfers are positive. Moreover, it implies that for $p < 1$ equation (19) holds with equality.

We now use that equation (19) holds with equality to prove that debt and first period transfers are decreasing in p, and social welfare is increasing in p. From equation (13), we define

$$\lambda(y, p) = \frac{\partial U(y, t_1(T_1), t_2(y-T_1))}{\partial y} + \frac{(1-p)(1+b_y(N-1))+pN}{N}\frac{\partial U(y, t_1(T_1), t_2(y-T_1))}{\partial t_2}\frac{\partial t_2}{\partial y} = 0.$$

From the implicit function theorem

$$\frac{\partial y}{\partial p} = -\frac{\frac{\partial \lambda(p,y)}{\partial p}}{\frac{\partial \lambda(p,y)}{\partial y}}.$$

From the second order conditions we know that the denominator of the right-hand side of the above equation is negative, i.e. $\frac{\partial \lambda(p,y)}{\partial y} < 0$. Moreover

$$\frac{\partial \lambda(p, y)}{\partial p} = \left(\frac{N - (1 + b_y(N-1))}{N}\right)\frac{\partial U(y, t_1(T_1), t_2(y-T_1))}{\partial t_2}\frac{\partial t_2}{\partial y} < 0$$

which implies $\frac{\partial y}{\partial p} < 0$.

Moreover, by monotonicity and continuity, at $p = 1$, equation (19) implies $t_2 = 0$ and $y - T_1 = 0$, which means zero deficit and proves Proposition 3.2.

(ii) The proof proceeds as follows. We first show that $T_1 > 0$ if $q = 1$ and $p < 1$. We then show that T_1 and y are non-decreasing in q. Monotonicity and continuity allow us to conclude that there is a $q(p) < 1$ such that, for $q \geq q(p)$ first period taxes are positive, and there is fiscal churning.

Let us start by proving that $T_1 > 0$ if $q = 1$ and $p < 1$. Suppose not, i.e. $T_1 = t_1 = 0$. Substitute equations (15)-(17) into the first order condition (14) to obtain

$$\frac{l_1}{l_1 + \frac{\partial l_1}{\partial t_1} t_1} = 1 \geq \frac{l_2}{l_2 + \frac{\partial l_2}{\partial t_2} t_2}$$

which is impossible since $\frac{\partial l_2}{\partial t_2} < 0$ and $t_2 > 0$. Hence $T_1 > 0$ if $q = 1$ and $p < 1$. Moreover, when $q = 1$ it must be the case that

$$\frac{l_1}{l_1 + \frac{\partial l_1}{\partial t_1} t_1} = \frac{l_2}{l_2 + \frac{\partial l_2}{\partial t_2} t_2}$$

which holds if and only if $t_1 = t_2$, which implies $T_1 = T_2$.

We now show that T_1 and y are non-decreasing in q. We proved in part (i) that transfers and deficits are positive, which implies that $T_2 > 0$. We have also just shown that for $q = 1$, $T_1 > 0$. Thus, for q close to 1, the first order condition (14) holds as an equality. We now define

$$h(T_1, q) = \frac{\partial U(y, t_1(T_1), t_2(y - T_1))}{\partial t_1} \frac{\partial t_1}{\partial T_1} + \frac{(1-q)(1 + b_T(N-1)) + qN}{N} \frac{\partial U(y, t_1(T_1), t_2(y - T_1))}{\partial t_2} \frac{\partial t_2}{\partial T_1} = 0. \quad (20)$$

From equation (20) and the implicit function theorem, we obtain

$$\frac{\partial T_1}{\partial q} = -\frac{\frac{\partial h(T_1, q)}{\partial q}}{\frac{\partial h(T_1, q)}{\partial T_1}}$$

and from the second order conditions we know that the denominator of the right-hand side of the above equation is negative, i.e. $\frac{\partial h(T_1,q)}{\partial T_1} < 0$. Moreover,

$$\frac{\partial h(T_1, q)}{\partial q} = \frac{-(1 + b_T(N-1)) + N}{N} \frac{\partial U}{\partial t_2} \frac{\partial t_2}{\partial T_1} > 0$$

which implies $\frac{\partial T_1}{\partial q} > 0$. This proves that first period taxes are increasing in q. Moreover, note that the first order condition (13) does not depend on q. Since this condition determines second period taxes, these taxes are independent of q. We can conclude that first period transfers are increasing in q.

We now show that $T_1 < T_2$ for $q < 1$. Since T_1 is increasing in q, it achieves a maximum at $q = 1$. But at $q = 1$ we know that $T_1 = T_2$. Hence, $T_1 < T_2$ for all $q < 1$.

We now prove Remark 3. Substituting equations (15)-(17) in equation (13), we note that T_1 only enters in the equilibrium condition through the budget deficit $y - T_1$. Since taxation is distortionary, equation (13) alone implies that any candidate can always increase his vote share by decreasing y and T_1 by the same amount. Hence, only $y - T_1$ depends on p, and not T_1. Moreover, we have already shown above that T_2 is independent of q. This proves the Remark.

■

Proof of Proposition 4.2. Assume without loss of generality that $p_A < p_B$. Note first that these differences in transparency cannot lead to different treatment across groups in the second period: as in the previous analysis, since the second period is the final period, voters only care about transfers to their own group, not about aggregate expenditures and revenues. Thus, as above, in the second period both platforms will involve zero transfers and all groups paying taxes that involve equal shares of repayment of the debt.

Denote by $\hat{y}_A$ and $\hat{y}_B$ the equilibrium first period transfers to groups N_A and $N_B = N - N_A$, respectively, and by $\hat{T}^L$ the tax revenues, equal for all groups. Since $q = 1$ we know $\frac{\hat{y}_A N_A + \hat{y}_B N_B}{N} = 2\hat{T}^L$ in equilibrium.

The proof proceeds adapting the construction preceding equation (12). Let $i \in \{1, ..., N_A\}$ and $j \in \{N_A + 1, ..., N\}$ and consider a deviation to a type A group, let us call it group 1. We can construct four events:

A. With probability $p_A p_B$, all voters have full information. The difference in material payoffs to voters in the type A group receiving the deviation between the two candidates is:

$$\Delta_{1A}^A = U\left(\hat{y}_{1A}^L + z_A, t^L\left(\hat{T}^L\right), t_2^L\left(\hat{y}_{1A}^L - \hat{T}^L + \frac{z_A}{N}\right)\right) - U^R$$

where $\hat{y}_{1A}^L - \hat{T}^L + \frac{z_A}{N}$ is the debt associated with additional transfers z_A, and $t_2^L\left(\hat{y}_{1A}^L - \hat{T}^L + \frac{z_A}{N}\right)$ is the tax rate common to all groups that ensues in the period two subgame. Thus, a voter in group 1 votes for candidate L whenever the difference in material payoffs is larger than their ideological attachment x, namely, if and only if, $U\left(\hat{y}_{1A}^L + z_A, t^L\left(\hat{T}^L\right), t_2^L\left(\hat{y}_{1A}^L - \hat{T}^L + \frac{z_A}{N}\right)\right) - U^R > x$.

For voters in groups $2, ..., N_A$, the difference in payoffs between the platforms offered by the two candidates is

$$\Delta_{i\neq 1,A}^A = U\left(\hat{y}_{iA}^L, t^L\left(\hat{T}^L\right), t_2^L\left(\hat{y}_{iA}^L - \hat{T}^L + \frac{z_A}{N}\right)\right) - U^R.$$

Similarly, we can construct the differences $\Delta_{j,B}^A$ to type B groups:

$$\Delta_{j,B}^A = U\left(\hat{y}_{jB}^L, t^L\left(\hat{T}^L\right), t_2^L\left(\hat{y}_{jB}^L - \hat{T}^L + \frac{z_B}{N}\right)\right) - U^R.$$

B. With probability $p_A(1 - p_B)$, voters observe transfers to type A groups but not to type B. For group 1 – the type A group that receives the deviation – the difference in perceived payoffs between the platforms offered by the two candidates is equal to

$$\Delta_{1A}^B = \Delta_{1A}^A.$$

Similarly, for voters in groups $2, ..., N$ the differences in perceived payoffs are equal to

$$\Delta_{i\neq 1,A}^B = \Delta_{i\neq 1,A}^A \text{ and } \Delta_{j,B}^B = \Delta_{j,B}^A.$$

C. With probability $(1 - p_A) p_B$, voters observe transfers to type B groups but not to type A. For group 1 – the type A group that receives the deviation – the difference in perceived payoffs between the platforms offered by the two candidates is equal to

$$\Delta_{1A}^C = U\left(\hat{y}_{1A}^L + z_A, \hat{t}^L, t_2^L\left(\hat{y}_{1A}^L - \hat{T}^L + \frac{z_A(1 + b_y(N-1))}{N}\right)\right) - U^R$$

since now group 1 believes that all groups $2, ..., N$ receive $\hat{y}_{iA}^L + b_y z_A$ transfers. For voters in groups $2, ..., N$ the difference in their perceived payoffs are just the equilibrium payoff. Hence

$$\Delta_{i\neq 1,A}^C = \Delta_{j,B}^C = U^L - U^R.$$

D. With probability $(1 - p_A)(1 - p_B)$ voters do not observe any aggregate information. For voters in group 1 the difference in perceived payoffs between the platforms offered by the two candidates is

$$\Delta_{1A}^D = \Delta_{1A}^C.$$

For voters in groups $2, ..., N$ the differences in their perceived payoffs are just the equilibrium payoff

$$\Delta_{i\neq 1,A}^D = \Delta_{j,B}^D = U^L - U^R.$$

In each of these events candidate L's vote share following the deviation is given by the fraction of voters whose ideology x is lower than the difference in the material payoffs. We can therefore now write the vote share for candidate L

following the deviation as:

$$\begin{aligned}S_L(z_A) = \quad & p_A p_B \left(F\left(\Delta_{1A}^A\right) + (N_A - 1) F\left(\Delta_{i\neq 1,A}^A\right) + N_B F\left(\Delta_{j,B}^A\right)\right) + \\ & p_A(1-p_B)\left(F\left(\Delta_{1A}^B\right) + (N_A - 1) F\left(\Delta_{i\neq 1,A}^B\right) + N_B F\left(\Delta_{j,B}^B\right)\right) + \\ & (1-p_A) p_B \left(F\left(\Delta_{1A}^C\right) + (N_A - 1) F\left(\Delta_{i\neq 1,A}^C\right) + N_B F\left(\Delta_{j,B}^C\right)\right) + \\ & (1-p_A)(1-p_B)\left(F\left(\Delta_{1A}^D\right) + (N_A - 1) F\left(\Delta_{i\neq 1,A}^D\right) + N_B F\left(\Delta_{j,B}^D\right)\right).\end{aligned}$$

Adding common terms, we obtain

$$S_L(z_A) = p_A\left(F\left(\Delta_{1A}^A\right) + (N_A - 1) F\left(\Delta_{i\neq 1,A}^A\right) + N_B F\left(\Delta_{j,B}^A\right)\right) + (1-p_A)\left(F\left(\Delta_{1A}^C\right) + (N-1) F\left(\Delta_{i\neq 1,A}^C\right)\right).$$

We can construct in the symmetric way $S_L(z_B)$, the vote share after the deviation to one type B group.

The proof now proceeds by way of contradiction. Let us assume that $y_B \geq y_A$. The optimal y_B must be such that candidate L has no incentive to increase the transfer to any of the N_B groups. From the vote share $S_L(z_B)$, we can obtain the first order condition for optimality and evaluate it at the equilibrium, i.e. $z_B = 0$

$$\begin{aligned}&\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial y_B} + \frac{p_B + (1-p_B)(1 + b_y(N-1))}{N}\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} \\ &+ p_B\frac{N_B - 1}{N}\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} + \frac{p_B N_A}{N}\frac{\partial U(y_A, t_1(T), t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} = 0\end{aligned}$$

Since $y_B \geq y_A$, the first order condition for the N_B groups implies that

$$\begin{aligned}0 = & \frac{\partial U(y_B, t_1(T), t_2(T))}{\partial y_B} + \frac{p_B + (1-p_B)(1 + b_y(N-1))}{N}\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} + \\ & p_B\frac{N_B - 1}{N}\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} + \frac{p_B N_A}{N}\frac{\partial U(y_A, t_1(T), t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} \\ \leq & \frac{\partial U(y_B, t_1(T), t_2(T))}{\partial y_B} + \frac{p_B + (1-p_B)(1 + b_y(N-1))}{N}\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} + \\ & p_B\frac{N_B - 1}{N}\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} + \frac{p_B N_A}{N}\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T}\end{aligned}$$

since $y_B \geq y_A$ implies that $\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial t_2} \geq \frac{\partial U(y_A, t_1(T), t_2(T))}{\partial t_2}$.

Rewriting the last equation, using the fact that $p_A < p_B$, and substituting the expressions for $\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial y_B}$ and $\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T}$, we obtain

$$\begin{aligned}0 \quad \leq \quad & \frac{\partial U(y_B, t_1(T), t_2(T))}{\partial y_B} + \frac{p_B N + (1-p_B)(1 + b_y(N-1))}{N}\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} \\ < \quad & \frac{\partial U(y_B, t_1(T), t_2(T))}{\partial y_B} + \frac{p_A N + (1-p_A)(1 + b_y(N-1))}{N}\frac{\partial U(y_B, t_1(T), t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} \\ = \quad & u'(y_B)\left(1 - \frac{p_A N + (1-p_A)(1 + b_y(N-1))}{N}\frac{l_2}{l_2 - \frac{t_2}{\gamma''}}\right)\end{aligned}$$

which implies that $\left(1 - \frac{p_A N + (1-p_A)\left(1 + b_y(N-1)\right)}{N}\frac{l_2}{l_2 - \frac{t_2}{\gamma''}}\right) > 0$ since $u'(y_B) > 0$. Moreover, since $y_B \geq y_A$ we have

$$\begin{aligned}0 \quad < \quad & u'(y_B)\left(1 - \frac{p_A N + (1-p_A)(1 + b_y(N-1))}{N}\frac{l_2}{l_2 - \frac{t_2}{\gamma''}}\right) \\ \leq \quad & u'(y_A)\left(1 - \frac{p_A N + (1-p_A)(1 + b_y(N-1))}{N}\frac{l_2}{l_2 - \frac{t_2}{\gamma''}}\right). \qquad (21)\end{aligned}$$

However, the optimality condition for the N_A groups and $\frac{\partial U(y_B,t_1(T),t_2(T))}{\partial t_2} \geq \frac{\partial U(y_A,t_1(T),t_2(T))}{\partial t_2}$ imply

$$\begin{aligned}
0 &= \frac{\partial U(y_A,t_1(T),t_2(T))}{\partial y_A} + \frac{p_A+(1-p_A)(1+b_y(N-1))}{N}\frac{\partial U(y_A,t_1(T),t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} \\
&+ p_A\frac{N_A-1}{N}\frac{\partial U(y_A,t_1(T),t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} + p_A\frac{N_B}{N}\frac{\partial U(y_B,t_1(T),t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} \\
&\geq \frac{\partial U(y_A,t_1(T),t_2(T))}{\partial y_A} + \frac{p_A+(1-p_A)(1+b_y(N-1))}{N}\frac{\partial U(y_A,t_1(T),t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} \\
&+ p_A\frac{N_A-1}{N}\frac{\partial U(y_A,t_1(T),t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} + p_A\frac{N_B}{N}\frac{\partial U(y_A,t_1(T),t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T}.
\end{aligned}$$

But the last equation is equivalent to

$$\begin{aligned}
0 &\geq \frac{\partial U(y_A,t_1(T),t_2(T))}{\partial y_A} + \frac{p_A+(1-p_A)(1+b_y(N-1))}{N}\frac{\partial U(y_A,t_1(T),t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} \\
&+ p_A\frac{N_A-1}{N}\frac{\partial U(y_A,t_1(T),t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} + p_A\frac{N_B}{N}\frac{\partial U(y_A,t_1(T),t_2(T))}{\partial t_2}\frac{\partial t_2}{\partial T} \\
&= u'(y_A)\left(1 - \frac{p_AN+(1-p_A)(1+b_y(N-1))}{N}\frac{l_2}{l_2-\frac{t_2}{\gamma''}}\right)
\end{aligned}$$

which contradicts equation (21). We thus conclude that $y_B < y_A$. Since taxes are equal for all groups, this also implies that there is more churning for type A groups. ■

Proof of Proposition 4.3. Assume first that $q=1$. Given that spending on the public good is fixed, as before, in the second period, all voters are treated identically and second period taxes are such as to finance spending on the public good G as well as repayment of the debt. Thus, the only difference relative to the environment of Proposition (4.1), is that there is a minimal level of spending G in both periods.

We can adapt the equilibrium condition (19) derived in Proposition (4.1) as

$$t_2\left(G+\frac{D}{N}\right) = t_2(2G+y(p)-T_1) = \max\left\{\frac{(N-1)(1-b_y)(1-p)}{N}\gamma''\left(l_2\left(t_2\left(G+\frac{D}{N}\right)\right)\right)l_2\left(t_2\left(G+\frac{D}{N}\right)\right), t_2(G)\right\} \tag{22}$$

where the first term in curly brackets on the right-hand side is relevant when debt is positive.

Assume that transfers are zero. If $q=1$, then, as in Proposition 4.1, in equilibrium taxes are perfectly smoothed across periods. Thus, $t_1(G) = t_2(G)$, and there is no debt. Now, for zero transfers to be an equilibrium, it must be the case that

$$\frac{(N-1)(1-b_y)(1-p)}{N}\gamma''(l_2(t_2(G)))\,l_2(t_2(G)) \leq t_2(G).$$

For p close to 1, this inequality clearly holds. However, the left-hand side of this expression is decreasing in p and its maximal value is

$$\frac{(N-1)(1-b_y)}{N}\gamma''(l_2(t_2(G)))\,l_2(t_2(G)) > t_2(G).$$

for G not too large. Thus, there is a $\overline{G}$, such that, for every $G < \overline{G}$, we can always find a $p(G)$ such that for every $p < p(G)$, debt is positive. Since $q=1$, then there is perfect tax smoothing in equilibrium so positive deficit implies positive transfers. It is now straightforward to extend this logic for $q<1$: for any q, there is a $\overline{G}(q)$, such that, for every $G < \overline{G}(q)$, we can find a $p(G,q)$ such that for every $p < p(G,q)$, debt and transfers are positive.

To prove part (ii), note that, for any such G, as in the proof of Proposition (4.1), the value of q does not affect the deficit because it does not affect t_2 in equation (22). However, as in Proposition (4.1), reducing q reduces first period transfers and revenues by the same amount. Thus, when G, p, and q are such that in equilibrium candidates offer transfers, voters' welfare is decreasing in q. ■

Proof of Proposition 4.4. With an endogenous public good, we must obtain the optimal value of public good provision in the second period for every value of the deficit D. Denote by $U_2\left(G_2, y, t_2\left(\frac{D}{N}+G_2\right)\right)$ the second period indirect utility. It is clear that in the second period the candidates offer zero transfers and treat all groups identically. All that remains to be determined is provision of the public good. Given candidate R's equilibrium platform, leading to utility U_2^R, candidate L's vote share is

$$NF\left(U_2^L\left(G_2, y, t_2\left(\frac{D}{N}+G_2\right)\right)-U_2^R\right)$$

From now on we suppress the L index to refer to a generic candidate. The first order condition for public good provision is

$$\frac{\partial U_2}{\partial G_2}+\frac{\partial U_2}{\partial t_2}\frac{\partial t_2}{\partial G_2}=0 \tag{23}$$

Since $\frac{\partial U_2}{\partial t_2}\frac{\partial t_2}{\partial D}=\frac{\partial U_2}{\partial t_2}\frac{\partial t_2}{\partial G_2}$ and $\frac{\partial U_2}{\partial G_2}=u'(\cdot)\,v'(G)$, by using conditions obtained in the proof of Proposition (4.1), equation (23) can be rewritten as

$$v'(G_2)=\frac{l_2(t_2)}{l_2(t_2)+\frac{\partial l_2}{\partial t_2}t_2}=\frac{l_2(t_2)}{l_2(t_2)-\frac{t_2}{\gamma''(l_2(t_2))}}>1. \tag{24}$$

Let us now consider period 1. Denote by $U(G_1, G_2, y, t_1, t_2)$ the sum of a voter's indirect utility from the two periods. Consider candidate L's deviation from the equilibrium platform in the first period increasing the putative equilibrium transfer by an amount z. Candidate L's vote share is

$$\begin{aligned}
&pF\left(U\left(G_1, G_2, y+z, t_1\left(y+G_1-\frac{D}{N}\right), t_2\left(\frac{D}{N}+G_2+\frac{z}{N}\right)\right)-U^R\right)+\\
&(1-p)\,F\left(U\left(G_1, G_2, y+z, t_1\left(y+G_1-\frac{D}{N}\right), t_2\left(\frac{D}{N}+G_2+\frac{z\,(1+b_y\,(N-1))}{N}\right)\right)-U^R\right)+\\
&(N-1)\left(pF\left(U\left(G_1, G_2, y, t_1\left(y+G_1-\frac{D}{N}\right), t_2\left(\frac{D}{N}+\frac{z}{N}+G_2\right)\right)-U^R\right)+(1-p)\,F\left(U^L-U^R\right)\right).
\end{aligned}$$

Maximizing with respect to z and imposing the equilibrium condition $z=0$ it can be shown that we obtain that, in an equilibrium with positive transfers, the following condition must be satisfied:

$$\frac{\partial U}{\partial y}+\left(\frac{Np+(1-p)\,(1+b_y\,(N-1))}{N}\right)\frac{\partial U}{\partial t_2}\frac{\partial t_2}{\partial\left(\frac{D}{N}\right)}=0. \tag{25}$$

Since $\frac{\partial U}{\partial y}=u'$, $\frac{\partial U}{\partial t_2}\frac{\partial t_2}{\partial\left(\frac{D}{N}\right)}=\frac{\partial U_2}{\partial t_2}\frac{\partial t_2}{\partial G_2}$ and $\frac{\partial U_2}{\partial G_2}=u'(\cdot)\,v'(G_2)$, we can combine equations (25) and (23) to obtain

$$v'(G_2)=\frac{N}{Np+(1-p)\,(1+b_y\,(N-1))}. \tag{26}$$

Equations (24) and (26) provide two equilibrium conditions on G_2. Therefore, in an equilibrium with positive transfers, we must have

$$\frac{l_2}{l_2-\frac{t_2}{\gamma''}}=\frac{N}{Np+(1-p)\,(1+b_y\,(N-1))}.$$

The left-hand side is bounded away from one (because $\frac{t_2}{\gamma''}$ is bounded away from zero due to spending on public goods), whereas, the right-hand side is monotonically decreasing to 1 as p increases. Thus, there is a $\widehat{p}$ such that, for $p\geq\widehat{p}$ it is not possible to have positive transfers in equilibrium. In this region, there is no incentive to run a deficit since a candidate would be better off smoothing taxes across periods. Since there is no deficit, and no transfers, provision of the public good is efficient. This proves (i).

We now prove part (ii). Consider the level of transparency $\widehat{p}$ that is at the boundary of the region with no transfers. For $p=\widehat{p}$, public good provision is efficient but it is characterized by equation (26). For any $p<\widehat{p}$, there are positive transfers and, by equation (26), G_2 is decreasing in p. Thus, for any such p, G_2 is provided inefficiently. Analogously, since tax distortions are the same in both periods, G_1 is provided inefficiently as well. By the same argument as in the proof of Proposition 4.1, transfers and the deficit decrease in p. To prove that there is fiscal churning, since voters receive transfers in the first period for $p<\widehat{p}$, and since there are positive taxes in both periods, for such values of p, there is fiscal churning. ■

6 Appendix B

In this Appendix we provide a set of sufficient conditions that guarantee existence of an equilibrium.

For the moment assume that F is uniform with sufficiently large support (so that the objective function is always continuous). We discuss below how to generalize later to conditions on relative concavity or U and F.

Fix equilibrium platform for candidate R. Note first that, (given a strategy by the other candidate) an optimum exists because the objective function is continuous, and the strategy space is compact: it is clearly closed and bounded below, taxes are obviously bounded; so an upper bound on transfers to a given group exists because there is an upper bound to the revenues that can be raised ($2N$ times the maximum of the Laffer curve).

We now show that there exists a unique solution to the first order conditions. When equation (19) holds with equality (as proved in the Appendix), we note that the left-hand side is increasing in t_2 while the right-hand side is decreasing in t_2 since l_2 is decreasing in t_2, γ'' is increasing (since $\gamma''' > 0$) and both l_2 and γ'' are positive. Hence, if a solution to equation (19) exists, it is unique. To prove that a solution exists, note that the left-hand side is bounded between 0 and 1, while the right-hand side is always non-negative and equal to 0 when $t_2 = 1$. This proves existence and uniqueness of a solution in t_2, or in T_2. We now prove that there exist unique y and T_1 such that $T_2 = y - T_1$.

Substituting equations (15) and (18) into equation (14) and simplifying we obtain:

$$\frac{l_1}{l_1 + \frac{\partial l_1}{\partial t_1} t_1} \geq \frac{(1-q)\left(1 + b_T\left(N-1\right)\right) + qN}{N} \frac{l_2}{l_2 + \frac{\partial l_2}{\partial t_2} t_2}$$

Moreover, we have already proved that for q close to 1, the first order condition (14) holds as an equality. Hence,

$$\frac{l_1}{l_1 + \frac{\partial l_1}{\partial t_1} t_1} = \frac{(1-q)\left(1 + b_T\left(N-1\right)\right) + qN}{N} \frac{l_2}{l_2 + \frac{\partial l_2}{\partial t_2} t_2}.$$

Note that the right-hand side is a function of $T_2 = y - T_1$, while the left-hand side is a function of T_1. Hence, there exist unique y and T_1.

We now show that nothing except the one satisfying the first order conditions obtained in Appendix A can be an optimum.

Concavity of u implies that $y_i + (1-t_i)l(t_i) - \gamma(l(t_i))$ is equal across groups. Concavity of $(1-t_i)l(t_i) - \gamma(l(t_i))$ ($l\left(t\right)$ is concave because $\gamma''' \geq 0$) implies t_i is equal across groups, implying that y_i is also equal across groups. This implies that an optimal platform must be symmetric.

We have shown in Appendix A that for any $p < 1$ cannot have boundary optimum with zero transfers so that optimum must have interior transfers, i.e. satisfy the first order conditions.

If F is not uniform, then one must make assumptions to ensure that the concavity of U is sufficient to overcome the convexity of either F (for candidate L) or $1 - F$ for candidate R.

When there is a public good, the argument is very similar.

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