Affecting Reelection Probability through Tax-price*

(PRELIMINARY VERSION)

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Abstract

The evaluation of voters over candidates that compete for office can be distorted by the political decisions of an incumbent government. In this paper we analyze, from a theoretical viewpoint, how the likelihood of reelection can be influenced by tax reforms affecting the set of swing voters. We consider a two-party system in a two-period model. We find that government persuades voters by modifying the progressive of the tax scheme. We show that when the opponent internalizes this persuasive effects, the party in office reduces the electoral use of tax reforms.

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1. Introduction

The evaluation of voters over candidates that compete for office can be distorted by the political decisions of an incumbent government. It is a common practice of incumbent governments to take political decisions which ultimate objective is achieving more votes. In this paper we analyze, from a theoretical viewpoint, how the likelihood of reelection can be influenced by tax reforms affecting the set of decisive voters.

Recent contributions evaluate how political decisions of incumbent governments force future government decisions in their benefit (see the review of the literature in Persson and Tabellini; 2000; and the contributions of Persson and Svensson; 1989, Alesina and Tabellini; 1990). Those contributions, however, do not analyze the impact of political decisions on the electoral outcome, since they account for an exogenous electoral outcome. Aghion and Bolton (1990) consider an endogenous electoral outcome. In their model, parties' choice of public debt not only affects future spending decisions, but also affects the reelection probability. For that, these authors consider a second dimension in voters' preferences which not only depend on policy but also on the identity of the party holding office. Thus, the party in office, by favouring the group with more swing voters, increases reelection probability.

In this paper, we isolate the effect that public spending and tax-collection has on the reelection probability. In contrast to Aghion and Bolton (1990), we do not introduce an additional dimension in voter's preferences, since we consider that preferences over candidates can be directly derived from their political position. In this way, we analyze the persuasive effect of a tax reform when voters preferences over candidates only depend on their political platforms (reflected in their proposals of government-size)

We consider a two-period model with two-party system. Governments can use tax reforms to enhance their probability of reelection. We find that right-wing government persuade voters by introducing a less progressive tax scheme, whereas left-wing governments persuade voters by introducing a more progressive tax scheme (see also Buchanan (1972), the theory of public choice). We show that increases in progressivity yielding a lower tax price for the middle-class, generates preferences-bias towards greater public spending. However, decreases in progressivity yielding a higher tax price for the middle-class, generates preferences-bias toward less public spending. Therefore, without any other consideration, it is in the benefit of a right-wing party to increase the middle-class tax bill when holding office, while a left-wing government will benefit by reducing the tax-bill of the middle-class. We, additionally, consider that the party in the opposition internalizes these persuasive effects when setting its political platform. As a consequence, we show that when a government uses taxation to persuade voters, then the opponent party sets a political platform that converges to the one of the party in office. We find that this optimal reaction of the opponent imposes a bound on the persuasive power of favoured taxation.

Our contribution is new in two respects: 1) it is the shape of voters' preferences which can be manipulated to affect reelection probability, 2) the opponent party internalizes this manipulation effect when setting its political platform on public expenditure.

The rest of the paper is organized as follows. Section 2 introduces the model. Section 3 provides the results. Section 4 concludes

2. Model

There is a jurisdiction populated by a continuum of citizens. Citizens are differentiated by their earnings. The earnings (or income) of citizen i are denoted by y_i.

The preferences of citizens:

Preferences of citizen i are defined over bundles of private consumption (measured in monetary terms) $x_i \in \mathbb{R}_+$, and units of a publicly provided good $e \in \mathbb{R}_+$. Citizens have identical quasi-linear utility representation

$$U(x_i, e) = u(x_i) + e \tag{1}$$

where function u is increasing, strictly concave and satisfies the standard CARA specification of risk.[1]

The publicly provided good is financed through taxation levied on every citizen. Optimal private consumption of citizen i is given by her disposable income, $x_i = y_i - \tau_i$,

[1] The CARA specificatio of risk implies $u''' > 0$, i.e., citizens are "prudent" according to Kimball (1993) and Eeckhoudt and Schlesinger (2006)

where $\tau_i \geq 0$ stands for citizen i's tax bill (or tax obligation).

Given an amount of publicly provided good e, the *tax bill* of a citizen with income y_i is given by

$$\tau_i = t(y_i)e \tag{2}$$

and $t(y_i)$ is the *tax-price* of citizen i. This tax-price is the "cost per unit" at which the publicly provide good is available.[2] Normalizing the price of the publicly provided good to be one, the tax-price of each citizen is a fixed proportion of total expenditure in public good $t(y_i) \in (0, 1)$.

A *tax scheme* t describes the tax-price for each citizen. A tax scheme is budget balanced if the sum of $t(y_i)$ over all the citizens is 1. Among others, proportional income taxation corresponds to $t(y_i) = \frac{y_i}{\tilde{y}}$ where $\tilde{y}$ denotes mean income of the overall population.

Substituting private consumption x_i into the preferences of the citizens, we derive the *indirect utility function* over public expenditure

$$V(e, y_i) \equiv u(y_i - t(y_i)e) + e. \tag{3}$$

Given a citizen tax-price $t(y_i)$, we can derive citizen i's most preferred policy (or peak)

[2] We follow Buchanan (1972) who argues that "this assumption allow to examine individual purchases of public goods in a model that is, in some respects, analogous to the ordinary market purchases of private and divisible goods".

denoted by e_i^p, where $e_i^p \in \arg\max_e \; V(e, y_i)$.

The political context:

There are two political parties that compete for office, party L and party H. Elections are solved by majority voting. Each party has an ideology reflected by an ideal size of the public sector (or amount of the publicly provided good), denoted by $L > 0$ and $H > 0$ respectively $L < H$. We refer to the political party holding office as the incumbent. Once in office, this party implements a platform which consists of an amount of public expenditure, e_L and e_H respectively. We impose $e_L \leq e_H$, which implies that parties should keep their respective ideological positions.

Every citizen has a voting right. Given a pair of platforms (e_L, e_H) and a tax scheme t, voter i votes for party L when $V(e_L, y_i) > V(e_H, y_i)$, otherwise, she votes for party H. The *indifferent voter* is the one which preferences satisfy $V(e_L, \hat{y}) = V(e_H, \hat{y})$ and where $\hat{y}$ is her income. The most preferred policy of the indifferent voter is denoted by $\hat{e}$. The location of $\hat{e}$ can be expressed as a function of the platforms of the parties and the current tax scheme, so that $\hat{e} = \hat{e}(e_L, e_H, t)$.

Some restrictions on the tax scheme are needed to guarantee that the ideal policies of the citizens can be ordered according to their income levels. In particular, for each given tax scheme t, we require citizens' preferences to satisfy the single-crossing property.[3] In particular, a sufficient condition is given by a negative cross derivative V''_{ey}. According

[3]See, for instance, Milgrom (1994) and Gans and Smart (1996).

to the utility specification (3),

$$V''_{ey} = -\underset{-}{u''}\frac{\partial x_i}{\partial y}t - \underset{+}{u'}t' \tag{5}$$

where private consumption is a normal good, implying $\frac{\partial x_i}{\partial y} > 0$. To guarantee that $V''_{ey} < 0$ we require $t' > 0$ and $r_A < \frac{t'}{\frac{\partial x_i}{\partial y}t}$ where $r_A = -\frac{u''}{u'}$ is the coefficient of absolute risk aversion. Thus, we impose an increasing marginal tax rate and a sufficiently low coefficient of absolute risk aversion.[4] When such conditions hold and $e_L < e_H$, those voters with income $y > \hat{y}$ strictly prefer party L over party H, whereas those with income $y < \hat{y}$ strictly prefer party H over party L.

The objective of the political parties:

Due, among others, to electoral turnout, political parties are uncertain about the location of the median voter, i.e., the median among those who participate in the elections. For simplicity, we assume that both parties are equally uncertain about the location of the ideal policy of the median, that we denote e_m. This policy is drawn from a common-knowledge distribution function with density g on the support $[\underline{e}, \bar{e}]$ and cumulative log-concave distribution function G. This distribution function is known just before the elections. We interpret the support $[\underline{e}, \bar{e}]$ as the interval containing the ideal

[4] As an example, with proportional income taxation $V''_{ey} < 0$ requires $r_A < \frac{1}{y_i - e\frac{y_i}{\bar{y}_i}}$. Simplifying yields $r_A < \frac{1}{x_i}$, from where $x_i r_A < 1$, i.e., the coefficient of relative risk aversion (RRA) must be below 1. Empirical studies on the coefficient of RRA estimate values below 1, see Mankiw et al. (1985), Hansen and Singleton (1982).

policies of those citizens in the middle-class.

We consider $\hat{e} \in [\underline{e}, \bar{e}]$, i.e., the indifferent voter is a citizen of the middle-class. Because $e_L \leq e_H$, the winning probability for party L is given by the probability of the median located below the indifferent voter

$$Pr(e_m < \hat{e}) = \int_{\underline{e}}^{\widehat{e}} g(e)de = G(\widehat{e}), \tag{6}$$

and therefore, the winning probability of party H is given by $1 - G(\widehat{e})$.

The objective of the parties consists of maximizing a weighted average of the "closeness" to the ideology of the party and the probability of winning (or reelection probability). We denote by W_L and W_H the objective functions of party L and party H respectively and we represent them as a function of the parties' political platform and the current tax-scheme

$$\begin{aligned} W_L(e_L, e_H, t) &= \alpha\left[-(e_L - L)^2\right] + (1-\alpha)\ln G(\hat{e}) \qquad (7) \\ W_H(e_L, e_H, t) &= \beta\left[-(e_H - H)^2\right] + (1-\beta)\left[-\ln G(\widehat{e})\right] \end{aligned}$$

where $\alpha, \beta \in [0, 1]$ are the weights that each party assigns to their ideology.[5] We take

[5] The utility derived from the "closeness" to the ideology has a *quadratic* form. In this way, greater deviations with respect to the party's ideology generate proportionally more disutility. The explanation for this fact is that greater deviations create more tensions between the party's factions (opportunists versus ideologists).

$\ln G$ as a monotonic transformation of the winning probability.

The electoral game:

We take party H as the incumbent and party L as the challenger (a symmetric analysis can be derived if party L is the incumbent). We consider a model with two periods, each of which coincides with a legislature and where elections take place at the beginning of period 2. Events in the model unfold as follows:

Stage one: party H holds office in period 1 and implements its political platform e_H.

Stage two: in the mid-term of period 1, party H sets a tax scheme.

Stage three: at the end of period 1, party L decides its political platform e_L, and elections are held.

Stage four: the elected party holds office for the rest of period 2 and implements its political platform.

We consider that the party holding office in period 1 cannot credibly commit to an amount of public expenditure different from the one implemented during the legislature (this is why no decision on its platform is needed). This is in the mid-term of period 1, that the party in office implements a tax reform. In this way, the tax reform has an electoral purpose.

To facilitate our analysis, we consider a piece-wise linear tax-price, with three different marginal tax-prices $(\underline{t}, t, \overline{t})$ targeted at each income group: $\underline{t}$ to those which income is below $\underline{y}$; the marginal tax-price t to those citizens which income is in the interval

$[\underline{y}, \overline{y}]$; and $\bar{t}$ those which income is above $\overline{y}$. Thus, a tax scheme is defined by a triple $(\underline{t}, t, \bar{t})$ where the corresponding tax bill is

$$\tau_i = \begin{cases} \underline{t} y_i e \text{ if } y_i < \underline{y} \\ t y_i e \text{ if } y_i \in [\underline{y}, \overline{y}] \\ \bar{t} y_i e \text{ if } y_i < \overline{y}. \end{cases}$$

Figure 1 illustrates two different piece-wise linear tax schemes. Consider that the doted line is a tax reform over the thick one, because the middle class reduces its marginal tax-price, we say that such reforms yields *more progressivity.* On the contrary, if the thick line is a tax reform over the doted line, we say that such reform yields *less progressivity.* We impose balanced-budget tax schemes, in this way, every tax reform reducing the marginal tax-price to certain income subgroup has to increase the marginal tax-price to another income subgroup (this is the case in Figure 1).

In order to satisfy the single-crossing condition, every implemented tax scheme must be strictly increasing in income and the marginal tax-bills (given by the respective slopes $(\underline{t}, t, \bar{t})$) must be below one. Note that the single-crossing property is the key for the citizens in the middle class to always contain the median voter.[6]

[6] In contrast, when the interests of the extremes are aligned (what is called "the ends againgst the middle"), the median may not be in the middle-class, see for instance Epple and Romano (1996).

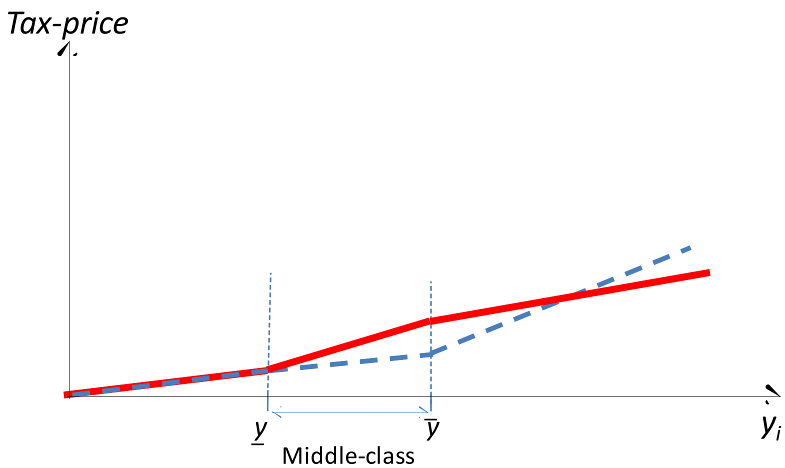

Figure 2.1: Piece-wise linear tax schemes

3. Results

In this section we solve, by backward induction, the proposed electoral game. First, we analyze the shape of the preferences of the voters over policies and how a tax reform affects the valuation over the two competing parties. Then, we analyze the optimal decisions of party H and party L regarding the tax scheme and political platforms respectively.

3.1. On how a tax reform affects preferences

Risk aversion in private consumption yields a strictly concave u, and therefore V is strictly concave. Thus, each citizen has a most preferred policy (or peak), e_i^p, and her preferences over e are single-peaked (as e moves above or below e_i^p the citizen is worse-off). The shape of the single-peaked preferences may not be symmetric around the peak since preferences over e also depend on the particular tax bill which indirectly affects private consumption.

Definition: We say that single-peaked preferences are *biased towards underprovision* when for each value of the parameter $d \in [0, e^p]$, there is a function $\delta(d) > 0$ satisfying $V(e^p - d) = V(e^p + \delta(d))$ such that $d > \delta(d)$ for all d.

This definition implies that underprovision over the peak is preferred to an equivalent overprovision over the peak. As we show next, the proposed shape of preferences can be implicitly derived from our primitive modeling assumptions.

Lemma 1: *The preferences of the voters over public good are single-peaked and biased towards underprovision.*

Proof. Marginal utility over public expenditure is given by $V' = -u't+1$. We show that V' is a concave function. Solving for V''' we have $V''' = -u'''t^3$. The CARA specification of risk implies prudence, defined by $u''' > 0$. Thus $V''' < 0$, and so, preferences are biased towards underprovion. ■

Two modeling assumptions facilitate this result, the quasi-linnear utility specification and the CARA specification of risk which implies $u''' > 0$, with the later assumption known as "prudence".[7] In our setting, "prudence" in private consumption is translated

[7] It is important to observe that the CARA specification of risk is a sufficient but not a necessary condition for $u''' > 0$. The DARA or CRRA specification of risk also imply $u''' > 0$.

into an asymmetry of voters' preferences around their most preferred policy, with marginal utility falling faster at higher level of publicly provided good over the peak and slower at lower levels of publicly provided good over the peak. In fact, lower levels of public good correspond to higher levels of private consumption, and by the interpretation of prudence (according to Eeckhoudt and Schlesinger, 2006), the agent prefers to accept an extra risk when consumption is higher, rather than when consumption is lower. Therefore, our voters are indifferent between $e^p - d$ and $e^p + \delta(d)$ where $d > \delta(d)$.

We compare different degrees of preferences-bias according to the following definition.[8]

Definition: Let V_1 and V_2 be two different specification of preferences over the publicly provided good with e_1^p, e_2^p denoting their respective peaks, and such that the functions $\delta_1(d)$ and $\delta_2(d)$ are defined by

$$\begin{aligned} V_1(e_1^p - d) &= V_1(e_1^p + \delta_1(d)) \\ V_2(e_2^p - d) &= V_2(e_2^p + \delta_2(d)), \end{aligned} \tag{9}$$

we say that V_2 is *less biased than* V_1 when for every $d \leq \min\{e_1^p, e_2^p\}$, we have $\delta_1(d) < \delta_2(d)$.

The less biased preferences are, the smaller the difference $d - \delta(d)$, i.e., preferences become less asymmetric (or closer to symmetry).

[8] See Martínez-Mora and Puy (2010) for an analysis on the comparison of preference-bias.

Each individual tax-price generates an optimal demand of the publicly provided good. The demand function of each citizen $e_i^p(t)$ is defined by the peak evaluated at each tax-price (to simplify notation, and when the context be clear, we omit the subindex referring to a generic citizen i). A reduction in the citizen's tax-price has an effect on both, her demand for the publicly provided good, and her preference-bias. The following proposition analyzes the impact of a variation of the tax price over the preferences of the citizens.

Proposition 1. *As the tax-price of a voter decreases, her preferences over the publicly provided good modifies in the following way:*

- the peak increases

- preferences become less biased.[9]

Proof. Let us first show that the peak increases. The demand for the publicly provided good is implicitly defined by the first order condition to the problem $\underset{e}{Max}\ V(e, y)$ that is given by $-u't + 1 = 0$. According to the implicit function theorem, $\frac{\partial e^p}{\partial t} = -\frac{u'' e^p u' - u'}{u'' t^2}$ where by concavity of u, we have $\frac{\partial e^p}{\partial t} < 0$. This implies that the lower t, the greater the demand for the publicly provided good.

Let us second show that preferences become less bias. Let t_1, t_2 (where $t_1 > t_2$) be two different tax prices for a representative citizen. Let preferences of such citizen over e under t_1 and t_2 be denoted by $V_1 \equiv u(y_i - t_1 e) + e$ and $V_2 \equiv u(y_i - t_2 e) + e$ respectively.

[9] *Likewise, when the tax-price increases, the peak decreases and preferences become more biased.*

We prove that V_1' is more concave than V_2' by showing that, normalizing the peaks of the voters, the value of $\frac{V_1'''(e-\Delta)}{V_1''(e-\Delta)}$ is greater than the value of $\frac{V_2'''(e)}{V_2''(e)}$ for all e and where $\Delta = (e_2^p - e_1^p)$.[10] Solving for the derivatives, $\frac{V'''}{V''} = -\frac{u'''}{u''}t$. According to (**??**), $u''' = \frac{(u'')^2}{u'}$, from where $\frac{V'''}{V''} = -\frac{u''}{u'}t = r_A t$. The CARA specification of risk implies that r_A is constant and therefore, $t_1 > t_2$ implies $\frac{V_1'''(e-\Delta)}{V_1''(e-\Delta)} > \frac{V_2'''(e)}{V_2''(e)}$ for all e. Thus, V_1' is more concave than V_2' at every equivalent distance out of peak, which implies that V_1 is more biased than V_2. ■

We have first shown that the demand for the publicly provided good is decreasing in the tax-price. In addition, we analyze the effect on preference-bias. As we have shown, a reduction in the unitary price of the publicly provided good makes citizens less opposed to overprovision with respect to underprovision of the publicly provided good, i.e., preferences become less biased towards underprovision.

According to the model assumptions, preferences over parties generate a segmentation of the population into two groups: those that prefer party H over L (the "poor") and those that prefer party L over H (the "rich"). The indifferent voter locates in-between these two groups. A tax reform modifies this segmentation in the following

[10] We normalize the functions around their peak so that when $e = e_2^p, V_1'(e-\Delta) = V_2'(e) = 0$. We then apply the technics of the Theory on risk aversion (see Pratt,1964). In our context, if $\frac{V_1'''(e-\Delta)}{V_1''(e-\Delta)}$ is greater than $\frac{V_2'''(e)}{V_2''(e)}$, then V_1' can be obtained as a strictly concave transformation of V_2'. This implies that below the normalized peak V_1 falls slower towards the peak than V_2, and above the normalized peak, V_1 falls faster out of the peak than V_2. Thus, V_1 is more biased towards underprovision (or more asymmetric) than V_2 (see our companion paper Martínez-Mora and Puy; 20010, for a more detailed proof of this point).

way.

Corollary 1: *Suppose that the political platforms are fixed at* (e_L, e_H). *A tax-price reduction to the citizens in the middle-class moves the identity of the indifferent voter to another with higher earnings.*[11]

Proof. Because the indifferent voter always belongs to the middle class, she is affected by the tax-price reduction. The indifference between e_L and e_H implies that there is a fixed value $\bar{d}$ and its corresponding $\delta_0(\bar{d})$ such that $V(e_0^p - \bar{d}) = V(e_0^p + \delta_0(\bar{d}))$ where $e_L = e_0^p - \bar{d}$ and $e_H = e_0^p + \delta_0(\bar{d})$. When the tax price decreases, according to Proposition 1, her peak (or ideal policy) increases $e_1^p > e_0^p$ and preferences become less biased, i.e., there is a new value $\delta_1(\bar{d})$ such that according to the modified utility representation $\tilde{V}$

$$\tilde{V}(e_1^p - \bar{d}) = \tilde{V}(e_1^p + \delta_1(\bar{d})) \tag{3.1}$$

where $\delta_1(\bar{d}) > \delta_0(\bar{d})$. This implies that $e_H < e_1^p + \delta_1(\bar{d})$ whereas $e_L < e_1^p - \bar{d}$. There are two possible cases, either $e_H \geq e_1^p$ or $e_H < e_1^p$. In the first case, e_H is closer to e_1^p than $e_1^p + \delta_1(\bar{d})$ which implies that $V(e_1^p + \delta_1(\bar{d})) < V(e_H)$. And given that $e_1^p - \bar{d}$ is closer to e_1^p than e_L, $\tilde{V}(e_L) < \tilde{V}(e_1^p - \bar{d})$. Thus, according to the modified preferences and Equation (3.1), party H is strictly more preferred than party L. In the second case, i.e., when $e_H < e_1^p$, e_H is closer to e_1^p than e_L. This implies that, according to the modified

[11] *Likewise, increasing the tax-price of the middle-class moves the indifferent voter towards another with lower earnings.*

preferences, party H is strictly more preferred than party L. The model assumptions guarantee that all the citizens which earnings are below this citizen also prefer party H over party L, and thus, the "new" indifferent voter must be one with higher earnings. ■

This result proves that a lower unitary price of the publicly provided good increases the segment $\left[\underline{y}, \hat{y}\right]$ that contains the level of earnings of those citizens that prefer party H over party L. Observe that the proof of this statement requires information on both, the peak effect (the peak increases) and the preference-bias effect (preferences become less bias).

3.2. Solving the electoral game

We solve the two-period model by backward induction. The optimal decision of the party in office is chose in Stage 2and that of the opponent is chosen in Stage 3.

The challenger chooses its platform as to maximize its utility given the preferences of the voters. If the preferences of an indifferent voter were symmetric, then the location of $\hat{e}$ would be the midpoint between the parties platform, $\hat{e} = \frac{e_L + e_H}{2}$. When preferences are biased towards underprovision, however, there is a deviation from this midpoint. Given a tax scheme t, there is always a value $b > 0$ such that $\hat{e}$ is given by the linear function $\hat{e} = \frac{e_L + e_H}{2} + b\left[e_H - e_L\right]$ where $b \geq 0$ represents the asymmetry of preferences towards underprovision. Given that $\hat{e} < e_H$, we have that $b < \frac{1}{2}$. Note that the smaller b, the less biased preferences are.

Given the tax scheme proposed by the party in office, and its political platform e_H, the challenger maximizes the following problem

$$\begin{array}{ll} \underset{e_L}{Max} & \alpha\left[-(e_L-L)^2\right]+(1-\alpha)\ln G(\hat{e}^c) \\ \text{s.t.} & \hat{e}=\frac{e_L+e_H}{2}+b\left[e_H-e_L\right] \end{array} \tag{10}$$

where b identifies the location of the indifferent voter, given the already observed decision of the incumbent on t. Recall that $\alpha \in [0,1]$ is the weight assigned to the ideology of the party. On the one hand, when $\alpha = 1$ the optimal policy is given by the ideology of the party, i.e., $e_L^* = L$. On the other hand, when $\alpha = 0$, the only aim of the party is maximizing votes and $e_L^* = e_H$. In order to avoid these two cases, we just account for those values of α such that $e_L^* \in (L, e_H)$. The following proposition analyzes the location of e_L^* as a function of the asymmetry of preferences

Proposition 2. *(The optimal decision of the challenger) The lower the preferences-bias around the peak, the more convergence between the equilibrium platforms, i.e.,* $\frac{\partial e_L^*}{\partial b} < 0$.

Proof. Log-concavity of G requires concavity of $\ln G$, from where, the objective function of party L is the sum of two concave functions and it is, therefore, concave. Thus, the optimal policy of party L can be derived as an interior solution to problem (10). Solving for the first order condition

$$-2\left(e_L^*-L\right)\alpha+(1-\alpha)\left(\frac{1}{2}-b\right)\frac{g(\hat{e}(e_L^*))}{G(\hat{e}(e_L^*))}=0. \tag{11}$$

By the implicit function theorem,

$$\frac{\partial e_L^*}{\partial b} = -\frac{(1-\alpha)\left[(\frac{1}{2}-b)(e_H-e_L)\left(\frac{g(\hat{e}(e_L^*))}{G(\hat{e}(e_L^*))}\right)' - (\frac{g(\hat{e}(e_L^*))}{G(\hat{e}(e_L^*))})\right]}{-2\alpha+(1-\alpha)(\frac{1}{2}-b)^2\left(\frac{g(\hat{e}^c(e_L^*))}{G(\hat{e}^c(e_L^*))}\right)'}. \tag{12}$$

Since $(\ln G)'' = (\frac{g}{G})'$, and log-concavity of G implies that $(\ln G)'' < 0$, we have $(\frac{g}{G})' < 0$. In addition, $b < \frac{1}{2}$ implies $\frac{1}{2} - b > 0$. Then, $\frac{\partial e_L^*}{\partial b}$ is negative. ■

Our result implies that the optimal platform of party L becomes closer to the one of the incumbent as preferences are less bias. In other words, less asymmetry in the preferences of the indifferent voter leads to more convergence of the challenger towards the incumbent, i.e., the distant between the parties' platforms narrows.

By the end of period 1, the government chooses a tax scheme maximizing the utility of its political party. In doing so, the incumbent conjectures the optimal response of the challenger to the proposed tax reform.

Given that preferences are biased towards underprovision, there is a value of $b > 0$ measuring the preferences-bias of the indifferent voter such that $\hat{e} = \frac{e_L+e_H}{2} + b\left[e_H - e_L\right].$ Since according to Proposition 1, the higher the tax t the more bias preferences are around the corresponding peak, we consider that the incumbent can deduce the preferences-bias of an indifferent voter as a strictly increasing function of t, so that $b = f(t)$ where $f' > 0$. The conjecture on the location of the challenger is described by a linear function of b that we denote $e_L^c(b)$. Observe that, according to Proposition 2, $\frac{\partial e_L^c}{\partial b} < 0$. Thus, the maximization problem of the incumbent is

$$\begin{aligned} &\underset{t}{Max} && W_H(e_L, e_H, t) \\ &\text{s.t.} && \widehat{e} = \tfrac{e_L^c(b)+e_H}{2} + b\left[e_H - e_L^c(b)\right] \\ & && b = f(t). \end{aligned} \tag{13}$$

Since the political platform of party H is fixed, the proposed optimization problem only requires maximizing the probability of reelection, which is equivalent to minimizing the location of the indifferent voter. Observe that the location of the indifferent voter depends on the degree of preferences-bias that is represented by b. Hence, once selected the optimal value of asymmetry in preferences b^*, the inverse function $f^{-1}(b^*)$ indicates the tax policy that must be applied to the middle class in order to induce such degree of preference-bias. The optimal tax reform (the complete specification of the function $t(y)$) will consist of an increasing function of income such that the tax bill of the indifferent voter correspond to that derived in problem (13).

The optimization problem of the incumbent can be reduced to

$$\underset{b \in \left[0, \frac{1}{2}\right]}{Min} \ \widehat{e} \tag{14}$$

where the minimum and a maximum degree of preferences-bias correspond to $b = 0$ and $b = \frac{1}{2}$ respectively.

If the political platform of the opponent were fixed (or independent of the implemented tax reform), then the solution to (13) would be $b^* = 0$. We consider, however, that the opponent sets a political platform according to the optimal response to the incumbent's tax reform. In particular, by Proposition 2, the platform of party L converges to that of party H as b reduces. Observe then that, on the one hand, party H benefits from reducing b since it implies less preference biased towards underprovision of the indifferent voter, but, on the other hand, party H becomes worse off reducing b because the platform of the opponent converges towards the policy of the incumbent. Whereas the first effect increases the probability of reelection, the later effect reduces such probability. As a consequence, when solving (14), we find that the minimum degree of preference-bias cannot be an optimal solution.

Proposition 3. *(The optimal decision of the incumbent) The optimal policy of the party in office does not consist on reducing up to the maximum the voter's preferences-bias around the peak .*

Proof. First, we show that the objective function is convex in b. Solving for the first and the second derivatives

$$\frac{\partial \widehat{e}}{\partial b} = (e_L^c)' \left(\tfrac{1}{2} - b\right) + e_H - e_L^c \tag{15}$$

$$\frac{\partial^2 \widehat{e}}{\partial b^2} = \frac{(e_L^c)''}{2} \left(\tfrac{1}{2} - b\right) - 2\,(e_L^c)' \tag{16}$$

where by linearity of e_L^c and the fact that $(e_L^c)' < 0$, we can guarantee convexity of the function $\widehat{e}$ in b. Second, we show that $\frac{\partial \widehat{e}}{\partial b}$ is positive when $b \simeq \frac{1}{2}$ and negative when $b = 0$. Suppose that $b = \frac{1}{2}$, then $\frac{\partial \widehat{e}}{\partial b} = e_H - e_L^c > 0$. Suppose now that $b = 0$ and that $e_L^c = a - kb$ where $a, k > 0$, substituting $\frac{\partial \widehat{e}}{\partial b} = -\frac{k}{2} + e_H - a$, since $e_L^c < e_H$ then $e_H - a > 0$ and so, $k > 2(e_H - a)$ guarantees that $\frac{\partial \widehat{e}}{\partial b} < 0$. We have to show that the conjecture e_L^c where $k > 2(e_H - a)$ is compatible with every possible equilibrium value e_L^*. In every equilibrium $e_L^* < e_H$, this requires $e_L^c = a - kb < e_H$, substituting $k = 2(e_H - a) + \varepsilon$ where $\varepsilon > 0$, we have $a - 2b(e_H - a) + \varepsilon b < e_H$ from where $a < \frac{e_H(1+2b) - \varepsilon b}{2}$, and ε sufficiently close to 0 guarantees $a > 0$. Finally, the fact that $\frac{\partial \widehat{e}}{\partial b}$ is continuous and increasing implies that the optimal value b^*satisfies $\frac{\partial \widehat{e}^c(b^*)}{\partial b} = 0$ and so, $b^* \in \left(0, \frac{1}{2}\right)$. Thus, there is always a conjecture $e_L^c = a - kb$ where $a > 0$ and $k > 2(e_H - a)$ such that $e_L^c = e_L^*$. ■

This result indicates that when the opponent internalizes the persuasive effect derived from favoured taxation, the party in office reduces the electoral use of tax reforms. Lower taxation to the citizens in the middle-class implies that the platform of the opponent moves closer to the platform of the incumbent party, encompassing therefore, a reduction in the probability of reelection. To avoid this convergence in platforms, the incumbent party may not distort up to the maximum the preferences of the citizens in the middle-class.

4. Discussion

4.1. Incumbency advantage

We have shown that a left-wing government can persuade voters with a more progressive tax scheme. In this way, the middle-class is less opposed to overprovision. The possibility of implementing a tax-reform provides an incumbency advantage. We find however, that such advantage has some limits imposed by the platform selected by the challenger. Voters not only react to the incumbent's implemented policy, but also to the policy announced in the political campaign by the opponent party.

4.2. Opportunistic and policy motivated governments

Our result can be also interpreted in the light of the theory on political factions (see, for instance, Roemer 2001). In our model, the objective functions of the parties is composed by a convex combination of the incentives of two different political factions. On the one hand the partisan faction, which objective consists of the ideology of the party, and on the other hand the opportunistic faction, which just seek holding office. Our results suggest that the ideological faction cannot deter the electoral use of tax reforms, whereas their partners, the opportunists, avoid it to some extent by modifying the location of their platform accordingly. Thus, it is the opportunistic faction in the opposition that prevents from a too progressive tax scheme.

From a pure ideological viewpoint, the party seeks certain government size (which can be concreted in a number of public programs). The tax collection schemes, however, are mere electoral tools over which no ideological position is set. Even though, it is the case that more progressivity persuades the middle-class towards more public expenditure, whereas less progressivity persuades the middle-class towards less public expenditure. Thus, even though the party's ideology does not specify a concrete tax-collection scheme, our model predicts that more progressivity is supported by left-wing governments, and less progressivity is supported by right-win governments, which is coherent with Buchanan and Tollison(1972).

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