VOTING IN FEDERAL ELECTIONS FOR LOCAL PUBLIC GOODS IN A FISCALLY CENTRALIZED ECONOMY*

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Resumen: Se desarrolla un modelo de votos probabilísticos de transferencias inter-gubernamentales para explicar la distribución y tamaño de los bienes públicos locales, y encontramos que: i) la competencia por votos de los partidos políticos induce al gobierno central a proveer transferencias regionales que conducen a una provisión Pareto eficiente de bienes públicos locales con y sin externalidades inter-regionales; ii) el gobierno central tiene incentivos políticos para producir bienes públicos diferenciados y uniformes. Se hace también un análisis comparativo que ayuda a entender la influencia de la competencia política, las externalidades inter-regionales y la distribución de la población en la economía sobre el tamaño y distribución de los bienes públicos locales.

Abstract: In this paper we develop a probabilistic voting model of inter-governmental transfers to explain the distribution and size of local public goods. We find that: i) The parties political competition for votes induces the central government to provide regional transfers that lead to Pareto efficient local public goods with and without inter-regional spillovers. ii) The central government has political incentives to produce differentiated and uniform local public goods. Moreover, we provide a comparative analysis to study the influence of political competition, the extent of inter-regional spillovers of local public goods, and the distribution of the population in the economy on the size and distribution of local public spending.

1. Introduction

What is the influence of federal elections on the size and distribution of local public goods? Since the central government imposes taxes on households across the country and provides inter-governmental transfers to sub-national governments, we could expect that the fiscal policy of the federal government would have a sizeable influence on the size and distribution of local public goods in a federation. The influence of the central government on local public spending would be more evident in those economies with a high degree of fiscal centralization. Although in the last decades many countries have engaged in reforms intended to move towards fiscal decentralization, there are many developing and developed economies in which fiscal policy is highly centralized (for evidence of this see Ter-Minassian 1997).

The positive theory of public economics has emphasized that the fiscal policy of the central government is influenced by electoral incentives and political institutions. For instance, Downs (1957), Meltzer and Richards (1981), Persson and Tabellini (2002a) and many others argue that economic policy is likely to reflect the fact that policy makers are elected in democracies. Therefore, the parties' political competition for votes in federal elections creates incentives for parties to recognize the relative merits of different economic policies according to the ability of these policies to gain electoral support for parties in federal elections. Hence, the main objective of this paper is to provide a politico-economic analysis of how the parties' electoral competition to win federal elections might determine the policies enacted by the central government in our economy, that is, the size and distribution of local public goods.

To do so, we analyze a voting equilibrium for an economy with heterogeneous preferences and endowments of voters across districts to which the central government provides transfers to finance the provision of local public goods with and without inter-regional spillovers. Our analysis builds on the probabilistic voting model, see Enelow and Hinich (1989) and Coughlin (1992), which emphasizes that parties have imperfect information on the voters' preferences over the fiscal policy of the government. Although there are few applications of the probabilistic voting theory to the analysis of public economics, to the best of our knowledge, there is not any application of the probabilistic voting model to the analysis of the influence of central-government fiscal policy on the size and distribution of local public goods. This paper seeks to contribute towards filling this gap.[1]

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[1]   For analysis of the application of the probabilistic voting model on the theory

In this paper, parties compete in a federal election by announcing binding policies regarding a general income tax on all residents and inter-governmental transfers to the different districts in the country that help to finance the provision of local public goods. Voters observe the candidates' platforms and vote sincerely for the policy that is closer to their own views on local public spending. After the federal election takes place, the candidate with the highest relative plurality of the votes in the federal election is elected, forms the federal government, and implements the policy platform of the party.

The main contributions of this paper are the following: first, we show that the parties' competition for votes in the federal election creates incentives for parties to establish inter-governmental transfers that lead to a Pareto efficient provision of local public goods with and without inter-regional spillovers. This outcome is different from the predictions of the median voter model (see Downs 1957, Lockwood 2002, and Persson and Tabellini 2002b) and partisan models of electoral competition (see Roemer 1997, 2001) because these models predict that the provision of local public goods with and without inter-regional spillover is, in general, Pareto *inefficient*. In contrast, our analysis identifies conditions in which parties have incentives to recognize the benefits and costs of local public goods for all residents in the economy and, consequently, local public goods with and without inter-regional spillovers are Pareto efficient.

Second, in this paper we show that the central government has political incentives to produce differentiated and uniform local public goods. This outcome is different from most normative and positive analysis that consider that the heterogeneity of the households preferences across districts has a strictly positive monotone effect on the distribution of local public goods.[2] We show, under general assumptions, that this is not necessarily the case. In particular, differentiated local public goods arise if the voters' preferences over local public spending are not too heterogeneous across districts and the inter-regional spillovers of local public goods are moderate. Therefore, for this class of equilibria, the heterogeneity in the voters' preferences for

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[2] The heterogeneity of the households' preferences across districts has a strictly positive monotone effect on the inter-regional distribution of local public goods if higher differences in the voters' preferences for local public goods across districts are translated into higher differences in the size of local public goods across districts.

local public spending and the extent of spillovers of local public goods between districts i and $-i$ has a strictly positive monotone effect on the inter-regional distribution of local public goods.

However, the heterogeneity of the voters' preferences for local public goods between districts i and $-i$ does not have a strictly positive monotone effect on the provision of local public goods if the preferences of voters over local public goods are too heterogeneous across districts and the size and asymmetry of spillovers of local public goods is sufficiently high. In this case, the central government has political incentives to provide a uniformly local public good. This outcome can explain why in some countries the central government tends to concentrate resources in certain regions of the country (see Ter-Minassian 1997).

Moreover, the issue of a uniform versus a differentiated provision of local public goods is central for the theory of fiscal federalism. In the analysis of Oates (1972), the celebrated decentralization theorem requires that the central government provide a uniform local public good.[3]

However, as Lockwood (2002) points out, the hypothesis of policy uniformity in the analysis of Oates (1972) is *ad hoc*, since it is not derived from the underlying behavior of the government.[4] Knowing what type of politico-economic conditions might induce the central government to provide uniform versus differentiated local public goods would be useful to make meaningful comparative analyses of the decentralization theorem for representative democracies.[5]

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[3] Oates (1972) identifies a set of conditions that leads to the celebrated Decentralization Theorem in which the decentralized and differentiated provision of Pareto efficient local public goods by a system of sub-national governments is welfare superior to the Pareto efficient but uniform provision of local public goods by the central government.

[4] Clearly, under perfect information and full discretion in policy making, a benevolent central planner could maximize the nationwide social welfare by prescribing sub-national transfers that lead to differentiated local public goods. The consequence of giving full discretion to the central government in the analysis of Oates (1972) is that the fiscally centralized provision of local public goods might be welfare equivalent to the decentralized provision. In this case, fiscal decentralization might not be needed.

[5] The analysis of Oates (1972, 1995) considers that governments are ruled by benevolent social planners. Hence, it is not clear if the decentralization theorem can survive if we relax this assumption and introduce political competition and political institutions that can shape the design of fiscal policies. For this reason it is theoretically relevant to extend the analysis of fiscal federalism considering the political institutions associated with representative democracies. Our paper

Finally, in this paper we provide a comparative analysis to study the influence of political competition, the extent of inter-regional spillovers of local public goods, the distribution of the population in the economy and the size and distribution of local public spending.

The paper is structured as follows. Section 2 includes the literature review and puts into context the contributions of our paper. Section 3 develops a probabilistic voting model to rationalize the size and distribution of local public goods. Section 4 considers a comparative analysis of the voting equilibrium. Section 5 concludes.

2. Literature Review

There is a large literature on the provision of local public goods. At the core of the normative theory of fiscal federalism, Oates (1972, 1995) considers governments controlled by benevolent social planners and emphasizes the tradeoff between the heterogeneity of preferences across districts and efficiency in the provision of local public goods. An issue of theoretical interest related with this literature is whether providing differentiated versus uniform local public goods is rational for policy makers. The normative theory of federalism assumes that the federal government is constrained to provide a uniform public good. However, Lockwood (2002) points out that the hypothesis of policy uniformity is *ad hoc*, since it is not derived from the underlying government behavior. Clearly, under perfect information and full discretion in policy making, a benevolent central planner could maximize the nationwide social welfare by prescribing sub-national transfers that lead to local public goods that are differentiated according to the heterogeneity of preferences of individuals across regions. In this case, the consequence of allowing full discretion to the central government in the analysis of Oates (1972) is that fiscal decentralization might not be needed.

Our paper relaxes the assumptions that governments are ruled by benevolent planners and that the central government is constrained to provide a uniform local public good. In this paper we show that highly heterogeneous preferences of voters over local public goods across districts and sufficiently high spillovers lead the central government to provide a uniform and Pareto efficient local public good because of strategic political behavior. In this paper, we also characterize a class of equilibria in which a differentiated provision of

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contributes in this direction.

local public goods is compatible with the parties' political objectives
if the inter-regional preferences over local spending and the size and
distribution of spillovers from local public goods are moderate. The
main contribution of these outcomes is to show that the heterogene-
ity across districts of the voters' preferences concerning local public
goods has a non-monotone effect on the distribution of local public
goods (more heterogeneity of the voters' preferences across district
does not necessarily lead to more inter-regional differentiation in the
supply of local public goods).

Another line of research of the normative theory argues that eq-
uity concerns provide a rationale for the central government to provide
inter-governmental transfers since poverty reduction requires national
standards, see Ladd and Doolittle (1982). Moreover, if individuals are
altruistic, see Pauly (1973), then local redistribution could be lower
than the level of redistribution that is socially optimal.[6] Feldstein and
Wrobel (1998) also argue that local governments would not be success-
ful in redistributing income due to inter-regional migration. Lastly,
a divergence between the resources of a locality and the wanted or
needed local public outlays provides another rationale for the central
government to establish inter-governmental transfers, see Boadway
and Flatters (1982b), Boadway (2006) and Bernd-Spahn (2007).

Many others have emphasized that the central government can
establish inter-governmental transfers that might improve the effi-
ciency in the allocation of resources. Boadway and Flatters (1982a),
Smart (1998) y Bucovetsky y Smart (2006) argue that, in a system of
sub-national governments, taxes might lead to excessive deadweight
costs from tax competition among local governments. The central
government could provide a more efficient tax system that avoids
wasteful tax competition. Oates (1995) argues that the decentral-
ized provision of local public goods with inter-regional spillovers will
produce lower than optimal local public goods since sub-national gov-
ernments might not incorporate the spillovers of local public goods in
fiscal policy design. In this case, the central government can provide
Pigouvian taxes-transfers to induce Pareto efficient local spending.

In our paper we are also concerned with efficiency and redistribu-
tion in the provision of local public goods. In our probabilistic voting
model, candidates aggregate the preferences of the whole electorate;

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[6] This is the case because local redistribution could be thought of as a local
public good with inter-regional spillovers and the local provision of this local public
good does not recognize the inter-regional spillovers from local redistribution. It
follows that, at the equilibrium, the amount of redistribution provided by local
governments is lower than the socially efficient provision of redistribution.

and local public goods with and without inter-regional spillovers are Pareto efficient. Our model, however, is different from the normative theory since we relax the assumption that governments are benevolent and introduce the role of the electoral competition as a determinant of fiscal policy design. Our model is also different from deterministic models of political competition, see Meltzer and Richards (1981), Persson and Tabellini (2002b) and Besley and Coate (2003) and for partisan models of electoral competition see Roemer (2001) and Khemani (2003), since these models predict that local public goods are not Pareto efficient while our model identifies conditions under which local public goods are Pareto efficient.[7]

In our political equilibrium parties also recognize the redistributive properties of the provision of local public goods. However, redistribution is not explained by concerns of policy makers over the equitable distribution of gains from fiscal policy (as in the normative theory) but by political incentives to maximize votes by redistributing the gains from the fiscal exchange in favor of influential coalitions of voters. In our model, political influence and redistribution are determined by the expected votes that different coalitions of voters can deliver in the election.

3. Voting in Federal Elections for State Transfers to Finance Local Public Goods

In this section we develop a probabilistic voting model to rationalize the provision of local public goods. Our focus is to develop sufficient conditions to explain the size and distribution of local public goods as a result of a voting equilibrium in a fiscally centralized economy.

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[7] There are other differences between our probabilistic voting model and the median voter model. Here, we mention just one of the differences that have received a great deal of attention in the literature: the median voter model does not have a majoritarian equilibrium for a large economy in which policy is multidimensional and preferences of voters are heterogeneous. However, in the real world policy is multidimensional and empirical evidence suggests, see Borcherding and Holsey (1997) and Mueller (2003), that the heterogeneity of preferences of household is an important determinant of the government's spending and tax policies. Hence, the median voter model seems limited in its application to the analysis of inter-governmental transfers that help to finance the provision of local public goods in a federation. In contrast, in our paper we provide a probabilistic voting model with a political equilibrium for a large economy in which policy is multidimensional and the preferences of voters are heterogeneous.

Conflicts among residents in the same district (and among voters of different districts) over the size of the government arise because of heterogeneous preferences and endowments of voters within the same district and across districts. The collective choice mechanism that resolves the differences of voters over fiscal policy is the delegation of decision-making power to a policy maker elected in a nationwide election who then designs transfers to the different districts in the economy that finance the provision of local public goods.

In a two party system, with parties $Z = \{L, R\}$, candidates compete in a federal election by proposing a fiscal platform constituted by an income tax on residents that finances a transfer from the federal government to each district in the economy to provide local public goods.[8],[9] For simplicity, we dont model the choice of taxation and spending of local authorities since our main interest is to develop a model of fiscal centralization that explain the influence of political competition in federal elections on the size and distribution of inter-governmental transfers that help to finance the provision of local public goods.[10] For this reason, we just assume that local spending is financed by the federal transfers to districts i and $-i$.[11]

The timing of the model is as follows: in the first stage, candidates announce binding policies regarding the size of a federal income

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[8] It is important to highlight the relevance of providing a model with fiscal centralization. First, this model would provide a benchmark to compare with more complex models in which we consider strategic considerations between the central and sub-national governments. Second, the literature concerning fiscal policy in a centralized economy is well established (see Oates 1972, 1995 among many others). Hence our paper would complement this literature since we are not aware of an application of the probabilistic voting theory to the analysis of local public goods in a fiscally centralized economy. Our paper contributes to fill this gap.

[9] In this paper we analyze a model for an economy with a majoritarian electoral system with a two party system. However, Ponce (2010) identifies conditions for which our results would also be valid for economies with a proportional representation electoral system and multi-party electoral competition.

[10] In another paper Kochi and Ponce (2011) relax the assumption of a fiscally centralized economy by considering explicitly the strategic interaction between the central and sub-national governments in providing local public goods.

[11] An alternative to avoid strategic considerations between the federal and sub-national governments is to consider exogenously given sub-national taxes and spending. However, this extension does not change the qualitative interpretations of our model. For this reason, we simply normalize sub-national taxes and spending to zero.

tax and the distribution of transfers from the central government to the different districts (regions) of the economy that finance the provision of local public goods. Parties design fiscal policy to maximize their share of the vote in the federal election. In the second stage, voters observe the candidates' platforms and vote sincerely for the policy that is closer to their own views on local public spending. All voters vote and voters are not mobile. At the end of the second stage, the elected candidate with the highest relative plurality of the votes in the federal election is elected, forms the federal government, and implements the policy platform of his party.

In this setting, the competition of parties for votes leads to a process of preference aggregation in which parties aggregate the preferences of voters over local public goods according to the marginal propensity of different voters to vote for some party in the federal election. This means that the distribution of the ideal policies of voters over local spending is one of the fundamental determinants of fiscal policy design.[12] We can characterize the distribution of the voters' ideal policy positions over local spending by considering the ideal provision of the local public good of citizen type e^i in district i which is given by $g^{*i}(e^i) \in \text{argmax } v(g^i, g^{-i}, e^i)$, where $v(g^i, g^{-i}, e^i)$ is the indirect utility function over feasible local public goods financed by the federal government in district i such that

$$v(g^i, g^{-i}, e^i) =$$

$$Max \begin{Bmatrix} \mu(x^i, l^i, g^i + k^{-i}g^{-i}) \\ s.t: a)\ x^i = e^i l^i (1 - \tau)\ \forall\ e^i \in \left[\underline{e}^i, \bar{e}^i\right] \\ b)\ g^i + g^{-i} = \sum_{\forall i, -i} \int_{\forall e^i} h^i(e^i)\tau e^i l^{*i}(e^i) de^i \end{Bmatrix} \quad (1)$$

Preferences of a resident of district i are given by $\mu(x^i, l^i, g^i + k^{-i}g^{-i}) = ln(x^i) + ln(1 - l^i) + ln(g^i + k^{-i}g^{-i})$ where x^i is a private good, $1 - l^i$ is the households leisure, and $l^i \in [0, 1]$ is the household's labor supply.[13] Moreover, $G^i = g^i + k^{-i}g^{-i}$ where g^i and g^{-i} are

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[12] The differences among the voters preferences and income explain the voters' differences over the ideal size of local public goods. For instance, if local public goods are normal goods then we should expect that voters with high income prefer an ideal size of local public goods that is higher than the ideal size of local public spending of low income voters.

[13] By assuming $l^i \in [0,1]$ we have normalized the maximum time that a worker can offer labor services to one.

local public goods provided in districts i and $-i$, and $k^{-i} \in [0, 1]$ is a parameter measuring the extent of inter-regional spillovers of g^{-i} which represents the benefits to residents of district i of the local public good provided in district $-i$.[14] The individual's budget is $x^i = e^i l^i (1 - \tau)$ where e^i is the consumer's earning ability (or wage), $e^i l^i$ is the income from labor services, τ is an income tax on labor income, and

$$g^i + g^{-i} = \sum_{\forall i, -i} \int_{\forall e^i} h^i(e^i) \tau e^i l^{*i}(e^i) de^i$$

is the budget constraint of the federal government in which local public goods are financed by a linear income tax system.[15]

The distribution of ideal policies over local public goods of the voters in district i, $g^{*i}(e^i)$, is indexed by the distribution of the voter's types in the district which density is given by

$$h^i(e^i) > 0 \ \forall \ e^i \in \left[\underline{e}^i, \bar{e}^i\right] \ : \ H^i(e^i) = \int_{\underline{e}^i}^{\bar{e}^i} h^i(e^i) de^i = N^i / N^T \ \forall \ i,$$

and

$$\sum_{\forall i, -i} \int_{\underline{e}^i}^{\bar{e}^i} h^i(e^i) de^i = 1,$$

where N^i is the population in district i and $N^T = N^i + N^{-i}$.

For the analysis that follows we make the following assumptions.

$$\textbf{A1} \qquad H^i(e^i) > H^{-i}(e^{-i})$$

$$\textbf{A2} \qquad \int_{\forall e^i} h^i(e^i) e^i de^i > \int_{\forall e^{-i}} h^{-i}(e^{-i}) e^{-i} de^{-i}$$

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[14] The local public goods provided by some district might benefit residents of other districts due to the properties of non exclusivity and non rivalry of local public goods, see Oates (1972, 1999).

[15] The budget constraint of the government reflects the optimal labor supply of all residents in the economy hence $l^{*i}(e^i) \in$ argmax $\mu(x^i, l^i, g^i + k^{-i} g^{-i})$ subject to $x^i = e^i l^i (1-\tau) \ \forall \ e^i \in \left[\underline{e}^i, \bar{e}^i\right]$.

Assumption **A1** characterizes the heterogeneity in the distribution of the population between districts i and $-i$. Assumption **A2** means that the average income in district i is higher than the average income in district $-i$. Without loss of generality, assumptions **A1** and **A2** say that the average preferences for local public goods from voters of district i is higher than that of residents of district $-i$.

Under the fiscal platforms of parties $Z = \{L, R\}$, the utilities of a voter type e^i under the administrations of parties L and R are, respectively, $v^{Li}(g^{Li}, g^{L-i}, e^i)$ and $v^{Ri}(g^{Ri}, g^{R-i}, e^i)$. Sincere voting implies that a voter type e^i votes for party L if

$$\chi^{Li} = v^{Li}(g^{Li}, g^{L-i}, e^i) - v^{Ri}(g^{Ri}, g^{R-i}, e^i) > 0;$$

if $\chi^{Li} < 0$ he votes for party R, and the voter flips a coin if $\chi^{Li} = 0$.

Parties have imperfect knowledge on the distribution of the voters' preferences over local public goods. Hence, the probability that a voter type e^i votes for party L evaluated at some feasible value $\tilde{\chi}^{Li}$ is

$$F^{Li}(\tilde{\chi}^{Li}) = \int_{-\infty}^{\tilde{\chi}^{Li}} f^{Li}(\tilde{\chi}^{Li}) d\chi^{Li}$$

where $F^{Li}(\tilde{\chi}^{Li})$ is the cumulative distribution over $\tilde{\chi}^{Li}$ and

$$f^{Li}(\tilde{\chi}^{Li}) = dF^{Li}(\tilde{\chi}^{Li})/d\chi^{Li}.$$

The share of the expected votes in the federal election for parties $Z = \{L, R\}$ is

$$s^Z = \sum_{\forall i} \int_{\forall e^i} h^i(e^i) F^{Zi}(\tilde{\chi}^{Zi}) de^i.$$

It follows that the problem of policy design for parties $Z = \{L, R\}$ is given by

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\begin{aligned}
Max \quad s^Z &= \sum_{\forall i} \int_{\forall e^i} h^i(e^i) F^{Zi}(\tilde{\chi}^{Zi}) de^i \\
s.t : \text{ a) } & T^{Zi} = g^{Zi} \; \forall \; i, \; \forall \; Z = \{L, R\} \\
\text{b) } & g^i + g^{-i} = \sum_{\forall i, -i} \int_{\forall e^i} h^i(e^i) \tau^Z e^i l^{*i}(e^i) de^i
\end{aligned}
\tag{2}
$$

Where T^{Zi} is the level of the transfer from the central government to district i that finances the provision of the local public good

$g^{Zi} \forall i, \forall Z = \{L, R\}$. Condition ($a$) says that all transfers to district i are used to provide a local public good in the district and condition (b) is the government's budget constraint.[16, 17]

DEFINITION. *The electoral equilibrium for our economy is character-ized by policy choices* τ^{*Z}, T^{*Zi} *and* $T^{*Z-i} \forall Z = \{L, R\}$ *and voting choices for voters type* e^i *in districts* i *and* $-i$ *such that*

I) In the first stage parties select $T^{*Zi} = g^{*Zi} \forall i, \forall Z = \{L, R\}$ *such that*

$$\tau^{*Z}, g^{*Zi} \in \operatorname{argmax} s^Z = \sum_{\forall i} \int_{\forall e^i} h^i(e^i) F^{Zi}\left(\tilde{\chi}^{Zi}\right) de^i$$

$$\text{s.t} : g^{*Zi} + g^{*Z-i} = \sum_{\forall i,-i} \int_{\forall e^i} h^i(e^i) \tau^{*Z} e^i l^{*i}\left(e^i\right) de^i$$

II) In the second stage, voters type e^i *in districts* i *and* $-i$ *observe the parties' policies and vote for:*

Party L if

$$\chi^{Li} = v^{Li}(g^{*Li}, g^{*L-i}, e^i) - v^{Ri}(g^{*Ri}, g^{*R-i}, e^i) > 0$$

Party R if

$$\chi^{Li} < 0$$

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[16]   In our model parties seek to maximize the expected share of the votes while in the Downs' model parties maximize the probability of winning the election. As Aranson, Hinich and Ordeshook (1974) show, if all voters vote in the election then the candidates policy strategies at the political equilibrium are equivalent for candidates that maximize the expected share of the vote with those candidates that select policy to win elections. Since we have assumed that all voters vote, our findings do not change if we assume that the parties' objective is to maximize the expected share of the votes or maximize their probability of winning the election (although our results are not the same as the predictions of the median voter model). However, if voters can abstain, then this is not longer the case and the parties optimal policies will depend on the objective that parties seek to maximize. It is not obvious to us how the results of our model would be modified if we allow abstentions. We leave this for future work.

[17]   We thank an anonymous reviewer for pointing out the issue discussed in our previous note.

We proceed to develop the main result of this section. In theorem 1 we characterize the optimal design of inter-governmental transfers that finance the provision of local public goods.

THEOREM 1. *Under* **A1**, **A2**, *probabilistic voting in federal elections, office seeking candidates of parties* $Z = \{L, R\}$ *converge in selecting a Pareto efficient distribution of local public goods in each district. The size of the local public good in district i,* $\forall$ *i is given by*

$$g^{*i} = \left\{ \frac{\sum_{\forall i} E\left[e^i l^{*i}\right] + \sum_{\forall i} E\left[\eta^i_{l^{*i}-\tau}\right]}{\sum_{\forall i} E\left[\alpha^i e^i l^{*i}\right]} \right\} \tag{3}$$

$$\left\{ \frac{H^i\left(e^i\right)}{1-k^i} - \frac{k^{-i}H^{-i}\left(e^{-i}\right)}{1-k^{-i}} \right\} \forall \ i$$

PROOF. The problem of fiscal policy design for parties seeking to maximize votes in the federal election is:

$$Max \ \delta^{Zc} = \sum_{\forall i} \int_{\forall e^i} h^i(e^i) F^{Zi}\left(\tilde{\chi}^{Zi}\right) de^i$$

$$+ \lambda^{Zc} \left\{ \sum_{\forall i,-i} \int_{\forall e^i} h^i(e^i)\tau^Z e^i l^{*i}\left(e^i\right) de^i - g^{Zi} - g^{Z-i} \right\} \tag{4}$$

The first order conditions for the parties' policy problem are given by:

$$\frac{\partial \delta^{Zc}}{\partial \tau^Z} = \sum_{\forall i} \int_{\forall e^i} h^i(e^i) f^{Zi}(\tilde{\chi}^{Zi}) \frac{\partial v^{Zi}}{\partial \tau^Z} de^i$$

$$+ \lambda^{*Zc} \left\{ \sum_{\forall i,-i} \int_{\forall e^i} h^i(e^i) e^i l^{*i}(e^i) de^i \right. \tag{5}$$

$$+ \sum_{\forall i,-i} \int_{\forall e^i} h^i(e^i)\tau^{*Z} e^i \frac{\partial l^{*i}}{\partial \tau^Z}(e^i) \ de^i \right\} = 0$$

And

$$\frac{\partial \delta^{Zc}}{\partial g^{Zi}} = \sum\nolimits_{\forall i} \int\limits_{\forall e^i} h^i(e^i) f^{Zi}\left(\tilde{\chi}^{Zi}\right) \frac{\partial \upsilon^{Zi}}{\partial g^{Zi}} de^i - \lambda^{*Zc} \qquad (6)$$

$$= 0 \ \forall \ g^{*Zi} > 0, \ \forall \ i$$

And $\frac{\partial \delta^{Zc}}{\partial \lambda^{*Zc}} = 0 : \lambda^{*Zc}\left\{\sum\nolimits_{\forall i,-i} \int\limits_{\forall e^i} h^i(e^i) \tau^{*Z} e^i l^{*i}(e^i) de^i - g^{*Zi}\right.$

$\left. -g^{*Z-i}\right\} = 0.$ Since parties share a common system of beliefs over

voting behavior, that is since $f^{Li}\left(\tilde{\chi}^{Li}\right) = f^{Ri}\left(\tilde{\chi}^{Ri}\right)$ for $\tilde{\chi}^{Li} = \tilde{\chi}^{Ri}$ the strategy set is the same for both parties, and candidates are not otherwise differentiated; then parties converge in their fiscal platforms toward $g^{*Li} = g^{*Ri} = g^{*i} \ \forall \ i$ (for formal proofs on the property of the convergence of the parties policies in probabilistic voting models with homogeneous parties, see Coughlin 1992). It follows that $g^{*Li} = g^{*Ri} = g^{*i} \ \forall \ i$ implies $\tilde{\chi}^{Li} = \tilde{\chi}^{Ri} = 0$ and $f^{Li}(0) = f^{Ri}(0) = c$ where $c > 0$ is a non-negative constant. Therefore, the optimality conditions for $\tau^{*L} = \tau^{*R} = \tau^*$ are characterized by

$$\frac{\partial \delta^{Zc}}{\partial \tau^Z} = \sum\nolimits_{\forall i} \int\limits_{\forall e^i} h^i(e^i) \frac{\partial \upsilon^{Zi}}{\partial \tau^Z} de^i$$

$$+ \lambda^{*Zc}\left\{\sum\nolimits_{\forall i,-i} \int\limits_{\forall e^i} h^i(e^i) e^i l^{*i}(e^i) de^i \qquad (7)\right.$$

$$\left. + \sum\nolimits_{\forall \ i,-i} \int\limits_{\forall e^i} h^i(e^i) \tau^{*Z} e^i \frac{\partial l^{*i}(e^i)}{\partial \tau^Z} de^i\right\} = 0.$$

And

$$\frac{\partial \delta^{Zc}}{\partial g^{Zi}} = \sum\nolimits_{\forall i} \int\limits_{\forall e^i} h^i(e^i) \frac{\partial \upsilon^{Zi}}{\partial g^{Zi}} de^i - \lambda^{*Zc} = 0 \ \forall \ g^{*i} > 0, \ \forall \ i \quad (8)$$

Use $E\left[\alpha^i e^i l^{*i}\right] = \displaystyle\int\limits_{\forall e^i} h^i(e^i)\frac{\partial v^{Zi}}{\partial \tau^Z}de^i = -\int\limits_{\forall e^i} h^i(e^i)\alpha^i e^i l^{*i}\left(e^i\right)de^i$

where α^i is the marginal utility of income of voter type e^i,

$$E\left[e^i l^{*i}\right] = \int\limits_{\forall e^i} h^i(e^i)e^i l^{*i}\left(e^i\right)de^i,$$

and

$$E\left[\eta^i_{l^{*i}-\tau}\right] = \int\limits_{\forall e^i} h^i(e^i)e^i l^{*i}\left(e^i\right)\eta^i_{l^{*i}-\tau}de^i < 0$$

where $\eta^i_{l^{*i}-\tau} = \left(\partial l^{*i}/\partial \tau^*\right)/\left(\tau^*/l^{*i}\right)$ is the elasticity of the labor supply with respect to the income tax for individual type e^i, and $E\left[\eta^i_{l^{*i}-\tau}\right]$ is a weighted average elasticity of labor services-income tax for residents of district i. Using these terms, condition (7) is equivalent to:

$$\lambda^{*c} = \frac{\sum_{\forall i} E\left[\alpha^i e^i l^{*i}\right]}{\sum_{\forall i} E\left[e^i l^{*i}\right] + \sum_{\forall i} E\left[\eta^i_{l^{*i}-\tau}\right]} \qquad (9)$$

Moreover, $\partial v^i/\partial g^i = 1/\left(g^i + k^{-i}g^{-i}\right)$. Re-arranging the terms in condition (8) and using

$$H^i(e^i) = \int_{\underline{e^i}}^{\overline{e^i}} h^i(e^i)de^i = N^i/N^T \ \forall \ i$$

we obtain

$$\frac{H^i(e^i)}{g^{*i} + k^{-i}g^{*-i}} + k^i\left(\frac{H^{-i}(e^{-i})}{g^{*-i} + k^i g^{*i}}\right) - \lambda^{*c} = 0 \qquad (10)$$

A similar condition to that in (10) is obtained for the local public good provided by district $-i$. This is given by:

$$\frac{H^{-i}(e^{-i})}{g^{*-i} + k^i g^{*i}} + k^{-i}\left(\frac{H^i(e^i)}{g^{*i} + k^{-i}g^{*-i}}\right) - \lambda^{*c} = 0 \qquad (11)$$

Use (9) and solve the system of linear equations to obtain

$$g^{*i} = \frac{1}{\lambda^{*c}}\left\{\frac{H^i(e^i)\left(1 - k^i k^{-i}\right)}{\left(1 - k^i\right)}\right\} - k^{-i}g^{-i} \qquad (12)$$

A similar condition to that in (12) is given by

$$g^{*-i} = \frac{1}{\lambda^{*c}}\left\{\frac{H^{-i}(e^{-i})\left(1 - k^i k^{-i}\right)}{\left(1 - k^{-i}\right)}\right\} - k^i g^i$$

At the Nash equilibrium

$$g^{*i} = \left\{\frac{\sum_{\forall i} E\left[e^i l^{*i}\right] + \sum_{\forall i} E\left[\eta^i_{l^{*i}-\tau}\right]}{\sum_{\forall i} E\left[\alpha^i e^i l^{*i}\right]}\right\} \qquad (13)$$

$$\left\{\frac{H^i\left(e^i\right)}{1 - k^i} - \frac{k^{-i}H^{-i}\left(e^{-i}\right)}{1 - k^{-i}}\right\} \; \forall \; i$$

∎

Theorem 1 identifies conditions in which the electoral competition induces parties to converge in designing moderate policies on local public spending.[18] However, Ponce (2007) provides a probabilistic voting model in which the Downsian electoral competition in a bi-party system (and multi-party systems) can lead to polarized policies (in this last equilibrium the parties' policies do not converge

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[18] In the theory of elections, a moderate policy is a policy that reflects the preferences of voters at the center of the distribution of the preferences for fiscal policy of the whole electorate. In contrast, polarized policies might reflect extreme preferences of a minority of voters in the electorate.

and might not be moderate).[19] Moreover, the parties' political competition for votes in a federal election creates incentives for parties to aggregate the benefits and costs across districts of the provision of local public goods. Hence, the provision of local public goods with and without inter-regional spillovers is Pareto efficient.

This outcome is different from the predictions of the median voter model (see Downs, 1957; Meltzer and Richards, 1981; and Persson and Tabellini, 2002a) and from partisan models of electoral competition (see Roemer, 2001), because these models predict that policy maximizes, respectively, the preferences of the median voter and the preferences of a minority coalition of voters controlling the party on power. In the median voter and partisan models, the parties' design of local public spending does not recognize the intensities of preferences of the whole electorate and as a result local spending with and without inter-regional spillover is, in general, Pareto *inefficient*.[20]

Theorem 1 also shows that parties incorporate a tradeoff between political inter-regional redistribution and efficiency in the design of local public spending.[21] Efficiency concerns take two different forms: the first form of efficiency is the extent of inter-regional spillovers in the provision of local public goods. At the political equilibrium g^{*i} is provided where the aggregate marginal benefits for residents of districts i and $-i$ from the provision of g^{*i} are equal to the marginal costs associated with the taxes needed to be imposed by the government to finance g^{*i}.[22] The second concern related with efficiency is

[19] In another paper we have relaxed the assumptions that voting behavior is only policy oriented. In this extension, voting behavior is explained by policy and partisan preferences (voters have a partisan identification). The main difference of this extension with our paper is that the parties policies do not converge in a two party system.

[20] In the median voter and partisan models, the provision of local public goods without inter-regional spillovers could be Pareto efficient if the preferences of the median voter and the preferences of the minority coalition of voters controlling the partisan government coincide with the preferences of the average voter in the district. However, this can be considered as a peculiar outcome. Hence, in general, the local public spending of the median voter and partisan models is not Pareto efficient.

[21] Parties also recognize the redistributive consequences of the provision of local public goods and income taxation for residents of each district. However, in this paper we emphasize the role of inter-regional redistribution in the provision of local public goods.

[22] Conditions (10) and (11) are the expressions that capture the parties' political calculus in the provision of $g^{*i} \forall i$ in which marginal aggregate benefits of

the dead weight costs from income taxation. These inefficiency costs are related with the negative behavioral response of residents to income taxation (voters tend to reduce the supply of labor when the income tax increases) which in turn reduces both the well being of all residents in the economy and the political support of voters for parties in the federal election.

For this reason, parties seek to minimize the inefficiency costs from taxation. In condition (3) the dead weight costs from income taxes are characterized by the weighted average elasticity of labor supply to income taxation of all residents in the economy, $\sum_{\forall i} E\left[\eta^i_{l^{*i}-\tau}\right]$ < 0. Hence, the larger $\sum_{\forall i} E\left[\eta^i_{l^{*i}-\tau}\right]$ < 0 the larger the inefficiency costs from income taxes and the lower the provision of g^{*i} and g^{*-i} when the spillovers of local public goods are moderate (we will explain in more detail this point in Theorem 2 below). If the spillovers of local public goods of the high demand district (district i) are high enough then the larger $\sum_{\forall i} E\left[\eta^i_{l^{*i}-\tau}\right]$ < 0 the larger the inefficiency costs from income taxes and the lower the provision of g^{*i} while the provision of the local public good in the low demand district (district $-i$) would be zero (this point will be evident once we introduce theorem 2, see below).

Parties also have political incentives to incorporate inter-regional redistribution in the design of local public goods because parties can redistribute the burden of the tax system to maximize the parties' political support from voters in the federal election. To see this, we just need to acknowledge that an increase in the provision of local public goods entails a net positive (negative) transfer to the low (high) income district since the low (high) income district pays lower (higher) than average taxes. In our economy the larger the ratio between the average income of all residents $\sum_{\forall i} E\left[e^i l^{*i}\right]$ and the weighted average income of all residents in the economy $\sum_{\forall i} E\left[\alpha^i e^i l^{*i}\right]$, the larger the political incentives for parties to engage in inter-regional redistribution that provides net positive transfers from the high income district (district i) to the low income district (district $-i$).

As shown by condition (3), the larger the ratio $\sum_{\forall i} E\left[e^i l^{*i}\right] /$ $\sum_{\forall i} E\left[\alpha^i e^i l^{*i}\right]$ the larger the provision of g^{*i} and g^{*-i} when the spillovers of local public goods is moderate (this point will be evident once we introduce theorem 2 below). If the spillovers of local public goods of the high demand jurisdiction (the district i) are high enough

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all residents in the economy are equalized with the marginal aggregate costs from g^{*i} for all residents of this economy.

then the larger $\sum_{\forall i} E\left[e^i l^{*i}\right] / \sum_{\forall i} E\left[\alpha^i e^i l^{*i}\right]$ the larger the provision of g^{*i} while the provision of the local public good in the low demand district (district $-i$) would be zero.

3.1. *Size and Distribution of Local Public Goods*

There is a renewed interest in the role of the heterogeneity of preferences and the inter-regional provision of local public goods in the theory of the political economy of fiscal policy design. Oates (1972, 1995) is the first to consider that inter-regional heterogeneity in the preferences of households for local public goods is an important factor in determining the optimal structure of government to serve citizens.[23] In the analysis of Oates, the heterogeneity of preferences of households for local public goods has a strictly positive monotone effect on the inter-regional distribution of local public goods.[24] Moreover, his analysis ignores the role of political competition and political institutions.

Besley and Coate (2003) re-consider the role of the voters' preferences for local public goods for an economy in which political competition determines fiscal policy since in this economy local public spending is determined by the legislature. Their analysis also suggests that the heterogeneity of preferences of households for local public goods has a strictly positive monotone effect on the inter-regional distribution of local public goods. However, in our paper we show, under

[23] The celebrated Decentralization Theorem of Oates (1972,1995) depends heavily on the role of the heterogeneity of preferences of households for local public goods. In this theorem, a fiscally Pareto efficient and differentiated decentralized provision of local public goods might be welfare superior to the Pareto efficient but uniform centralized provision of local public goods if local public goods do not have inter-regional spillovers, the central government does not have economies of scale in the provision of local public goods, and there is significant heterogeneity of the households' preferences for local public goods across districts. A sub-national system of governments can be welfare superior to the centralized provision since the former structure of governments can deliver a differentiated provision of local public goods that match the heterogeneity of the households' preferences for local public goods across districts.

[24] The heterogeneity of the households' preferences across districts has a strictly positive monotone effect on the inter-regional distribution of local public goods if greater differences among the voters' preferences for local public goods across districts are translated into greater differences in the size of local public goods across districts.

general assumptions, that the cross district heterogeneity of the preferences of voters over local public spending has a non-monotone effect on the distribution of local public goods. We proceed to show this outcome in theorem 2.

THEOREM 2. *The distribution and size of local public goods in districts i and -i for our economy is given by:*

$$2.i) \ For \ \ \lambda^{*c} = \frac{\sum_{\forall i} E\left[\alpha^i e^i l^{*i}\right]}{\sum_{\forall i} E\left[e^i l^{*i}\right] + \sum_{\forall i} E\left[\eta^i_{l^{*i}-\tau}\right]} : \lambda^{*c} > 0$$

and $k^i = k^{-i} = 0$ *then* $g^{*i} > 0$ *and* $g^{*-i} > 0 : g^{*i} \neq g^{*-i}$ *satisfying*
$g^{*i} = H^i\left(e^i\right)/\lambda^{*c} \ \forall \ i.$

$$2.ii) \ For \ \ \lambda^{*c} > 0, \ \Theta^i = H^{-i}\left(e^{-i}\right)/\left(1 - k^{-i}H^i\left(e^i\right)\right) \ \forall \ i \ and$$

$0 < k^i < \Theta^i \ \forall \ i$ *then* $g^{*i} > 0$ *and* $g^{*-i} > 0 : g^{*i} \neq g^{*-i}$ *satisfying*

$$g^{*i} = \left\{\frac{1}{\lambda^{*c}}\right\} \left\{\frac{H^i(e^i)}{1 - k^i} - \frac{k^{-i}H^{-i}(e^{-i})}{1 - k^{-i}}\right\} \ \forall \ i.$$

$$2.iii) \ For \ \ \lambda^{*i} > 0, \ \Theta^i < 1 \ \forall \ i, 0 \leq k^{-i} < \Theta^{-i}, \ and \ 0 < \Theta^i \leq k^i$$

then $g^{*-i} = 0$ *and* $g^{*i} = H^i\left(e^i\right)/\left\{\lambda^{*c}\left(1 - k^i\right)\right\} > 0.$ *In this last case the provision of local public goods is uniform for districts* i *and* $-i$.

PROOF. From theorem 1, the politically optimal size of the local public good in district i is given by

$$g^{*i} = \left\{\frac{1}{\lambda^{*c}}\right\} \left\{\frac{H^i(e^i)}{1 - k^i} - \frac{k^{-i}H^{-i}(e^{-i})}{1 - k^{-i}}\right\} \ \forall \ i \ \ (\text{see equation 13}).$$

Hence, $\lambda^{*c} > 0$ and $k^i = k^{-i} = 0$ implies $g^{*i} > 0$ and $g^{*-i} > 0 : g^{*i} \neq g^{*-i}$ satisfying $g^{*i} = H^i\left(e^i\right)/\lambda^{*c} \ \forall \ i$.[25]

Moreover, define $\gamma^i = \left\{ \dfrac{H^i(e^i)}{1 - k^i} - \dfrac{k^{-i}H^{-i}(e^{-i})}{1 - k^{-i}} \right\} \forall i,$

$\Theta^i = H^{-i}(e^{-i})/(1 - k^{-i}H^i(e^i)) \ \forall i$ if $0 < k^i < \Theta^i \ \forall \ i$ then $\gamma^i > 0 \ \forall \ i$.

Since $\lambda^{*c} > 0$ and $\gamma^i > 0$ implies $g^{*i} > 0 \ \forall \ i$ with $g^{*i} \neq g^{*-i}$. Therefore, the politico-economic Nash equilibrium in theorem 1, see condition (3), is given by

$$g^{*i} = \left\{ \frac{1}{\lambda^{*c}} \right\} \left\{ \frac{H^i(e^i)}{1 - k^i} - \frac{k^{-i}H^{-i}(e^{-i})}{1 - k^{-i}} \right\} \ \forall \ i.$$

Finally, for $\lambda^{*c} > 0, \Theta^i < 1 \ \forall \ i, 0 \leq k^{-i} < \Theta^{-i}$ and $0 < \Theta^i \leq k^i$ then $\gamma^i > 0$ but $\gamma^{-i} \leq 0$ hence $g^{*i} = H^i\left(e^i\right)/\lambda^{*c}\left(1 - k^i\right) > 0$ and $g^{*-i} = 0$. In this last case the provision of local public goods is uniform for districts i and $-i$.

■

Theorem 2 shows that the heterogeneity of the voters' preferences for local public goods of districts i and $-i$ does not have a monotone effect on the inter-regional provision of local public goods for all values of $k^i \in [0, 1)$. In particular, if local public goods do not show spillovers (for $k^i = k^{-i} = 0$) and for local public goods with moderate spillovers, for spillovers on the range $k^i \in (0, \ 1) : 0 < k^i < \Theta^i$ where $\Theta^i = H^{-i}\left(e^{-i}\right)/\left(1 - k^{-i}H^i\left(e^i\right)\right) \ \forall \ i$, then the more heterogeneous the shares of the population between districts i and $-i$ and the higher the difference between the extent of spillovers of local public goods between districts i and $-i$, then the larger the difference between the sizes of $g^{*i} > 0$ and $g^{*-i} > 0$. Therefore, for this class of equilibria, the heterogeneity in the densities of population and the extent of spillovers of local public goods between districts i and $-i$ has a strictly positive monotone effect on the inter-regional distribution of local public goods.

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[25] The condition $\lambda^{*c} > 0$ corresponds to the set of equilibria for income taxation in which $\tau^* > 0$ and $T^{*Zi} > 0 \ \forall \ Z, \ \forall \ i$. Although $\tau^* < 0$ and $T^{*Zi} < 0 \ \forall \ Z, \ \forall \ i$ is theoretically possible, this tax structure does not have empirical support. For this reason we focus in the former equilibrium.

However, the heterogeneity of the voters' preferences for local public goods between districts i and $-i$ does not have a monotone effect on the provision of local public goods if spillovers of local public goods are sufficiently small in district $-i$ and sufficiently large in district i, that is for $0 \leq k^{-i} < \Theta^{-i} < 1$ and $0 < \Theta^i \leq k^i$, then in this case the central government has electoral incentives to set $g^{*i} = H^i \left(e^i \right) / \lambda^{*c} \left(1 - k^i \right) > 0$ and $g^{*-i} = 0$. Hence, the provision of local public goods in districts i and $-i$ is uniform since the central government provides a local public good only in district i.[26]

This last outcome is explained as follows: if differences in the ideal size of voters over local public goods between districts i and $-i$ are *too* heterogeneous then the provision of the local public good by the high demand jurisdiction (by district i) might drive to zero the net marginal benefit of providing a local public good in district i (the district with the low demand for local public goods). In this case, the best response of the elected central government is to provide a positive local public good only in the high demand district. For this class of equilibria, a differentiated provision of local public goods with $g^{*i} > 0$ and $g^{*-i} > 0 : g^{*i} \neq g^{*-i}$ is restored if the interregional heterogeneity of preferences of voters over local public goods (equivalently if the heterogeneity in the size of the populations across districts and the difference in the extent of spillovers of local public goods between districts i and $-i$) is moderate.

In theorem 2 the decision to provide uniform or differentiated local public goods is endogenous while in the normative (see Oates 1972, 1995) and positive (see Besley and Coate, 2003; Persson and Tabellini, 2002b; Lockwood, 2002) theories the central government is constrained to provide a uniform local public good. Theorem 2 shows that the central government has political incentives to produce uniform and differentiated local public goods. These outcomes are relevant for making meaningful comparative analysis of the decentralization theorem for economies in which the parties political competition is an important determinant of fiscal policy design.

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[26] Note that in this case the ideal size of local public goods for voters in the district with low demand for local public spending might fall (or increase), perhaps because of a widespread negative (or positive) income shock in that district, and still the supply might be $g^{*-i}=0$. In this case, the differences of the voters' preferences for local public goods between districts i and $-i$ has increased (fallen) but the differences in the sizes between $g^{*i}>0$ and $g^{*-i}>0$ remains the same. Hence, the heterogeneity of the voters' preferences for local public goods between districts i and $-i$ does not have a monotone effect on the provision of local public goods.

3.2. *Comparative Static Analysis on the Size and Distribution of Local Public Goods*

In what follows we develop some comparative analysis on the role of political competition, the distribution of population in the economy, and the size and extent of inter-regional spillovers over the size and distribution of local public goods for a representative democracy in which fiscal policy is centralized.

THEOREM 3. *At the political equilibrium the following is satisfied:*

3.i) If $\lambda^{*c} > 0$, $\Theta^i = H^{-i}\left(e^{-i}\right) / \left(1 - k^{-i}H^i\left(e^i\right)\right)$ $\forall$ i *and* $0 < \Theta^i < k^i$ $\forall$ i *then a reduction in the parties' marginal expected loss in votes in the election due to raising the last dollar of public revenue through taxation (a fall of* λ^{*c}*) leads to an increase in both* g^{*i} *and* g^{*-i}. *If* $\lambda^{*c} > 0$, $0 \leq k^{-i} < \Theta^{-i} < 1$ *and* $0 < \Theta^i \leq k^i$ *then a fall of* λ^{*c} *leads to an increase only in* g^{*i} *while* $g^{*-i} = 0$ *remains unchanged.*

3.ii) If $\lambda^{*c} > 0$, $\Theta^i = H^{-i}\left(e^{-i}\right) / \left(1 - k^{-i}H^i\left(e^i\right)\right)$ $\forall$ i *and* $0 < \Theta^i < k^i$ $\forall$ i *then an increase in the population of district i leads to an increase in* g^{*i} *but to a fall in* g^{*-i}. *If* $\lambda^{*c} > 0$, $0 \leq k^{-i} < \Theta^{-i} < 1$ *and* $0 < \Theta^i \leq k^i$ *then only the size of* g^{*i} *increases as a result of an increase in the population in district i while* $g^{*-i} = 0$ *remains unchanged.*

3.iii) If $\lambda^{*c} > 0$, $\Theta^i = H^{-i}\left(e^{-i}\right) / \left(1 - k^{-i}H^i\left(e^i\right)\right)$ $\forall$ i *and* $0 < \Theta^i < k^i$ $\forall$ i *then an increase in the spillovers of the local public good in district i leads to an increase in* g^{*i} *but* g^{*-i} *falls. If* $\lambda^{*c} > 0$, $0 \leq k^{-i} < \Theta^{-i} < 1$ *and* $0 < \Theta^i \leq k^i$ *then only the size of* g^{*i} *increases as a result of an increase in the extent of spillovers the local public good in district i while* $g^{*-i} = 0$ *remains unchanged.*

PROOF. From condition (13) in theorem 1 the conditions

$$g^{*i} = \left\{\frac{1}{\lambda^{*c}}\right\}\left\{\frac{H^i(e^i)}{1 - k^i} - \frac{k^{-i}H^{-i}(e^{-i})}{1 - k^{-i}}\right\} \ \forall \ i$$

are satisfied. By theorem (2), if $\lambda^{*c} > 0$, $0 < k^i < \Theta^i < 1$ $\forall$ i, where $\Theta^i = H^{-i}\left(e^{-i}\right) / \left(1 - k^{-i}H^i\left(e^i\right)\right)\forall i$ then $g^{*i} > 0$ and $g^{*-i} > 0$. The first part of the outcomes in (*3.i*), (*3.ii*) and (*3.iii*) follow directly by obtaining $\partial g^{*i}/\partial\lambda^{*c} < 0$ $\forall$ i, $\partial g^{*i}/\partial H^i\left(e^i\right) > 0$ and

$\partial g^{*-i}/\partial H^i\left(e^i\right) < 0$. Finally, it is also simple to show that $\partial g^{*i}/\partial k^i >$ 0 and $\partial g^{*-i}/\partial k^i < 0$.

The second part of the outcomes in $(3.i)$, $(3.ii)$ and $(3.iii)$ follows if $\lambda^{*c} > 0$, $0 \leq k^{-i} < \Theta^{-i} < 1$ and $0 < \Theta^i \leq k^i$ then $g^{*i} = H^i\left(e^i\right)/\lambda^{*c}\left(1 - k^i\right) > 0$ and $g^{*-i} = 0$. Hence $\partial g^{*i}/\partial\lambda^{*c} < 0$, $\partial g^{*i}/\partial H^i\left(e^i\right) > 0$ and $\partial g^{*i}/\partial k^i > 0$.

∎

Theorem 3 provides a comparative static analysis of the size and distribution of local public goods for changes in the political costs associated with income taxation (the source of funding of public spending), the distribution of the population in each district of the economy, and the size and distribution of the inter-regional spillovers of local public goods in districts i and $-i$. Intuitively, voters want local public goods at the lowest tax possible. Hence, a reduction in the parties' marginal expected loss in votes in the election due to raising the last dollar in public revenue to finance local spending through taxation (a fall of λ^{*c}) leads to an increase in both g^{*i} and g^{*-i}.[27]

A change in the distribution of the population in the economy, for instance an increase in the share of the population in district i, increases the marginal benefits of providing a local public good in district i for residents of that district which tends to increase the electoral gains for parties of an increase in g^{*i}. Moreover higher g^{*i} implies higher external benefits of g^{*i} on residents of district $-i$ (due to the spillovers of g^{*i} on residents of district $-i$) which increases the net marginal gain of providing a local public good in district i and reduces the net marginal gain of providing a local public good in district $-i$. As a result, an increase in the share of the population in district i leads to an increase of g^{*i} and to a fall of g^{*-i}.

Finally an increase in the extent of spillovers of the local public good provided by district i increases the net marginal political benefits of providing g^{*i} but this also reduces the political gains associated with the provision of the local public good in district $-i$ (again due to the spillovers of g^{*i} on residents of district $-i$) which tends to reduce g^{*-i} at the political equilibrium.

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[27] A fall in λ^{*c} can be explained by a larger tax base (a larger value of labor earnings in the economy which could be promoted by a positive shock to labor income), a more inelastic average elasticity of labor earnings to income taxation (a lower value of $\sum_{\forall i} E\left[\eta^i_{l^{*i}-\tau}\right] < 0$), or a lower weighted average income in the economy, a lower value of $\sum_{\forall i} E\left[\alpha^i e^i l^{*i}\right]$, which is a measure of the welfare and political costs from taxation.

4. Concluding Remarks

The main objective of this paper is to provide a politico-economic analysis of how electoral competition among political parties to win federal elections might determine both the tax policy and the inter-governmental transfers enacted by the central government and the size and distribution of local public goods. In particular, our paper examines the influence of political competition, the role of the inter-regional spillovers of public goods, and the heterogeneity across districts of the voters' preferences for local public spending in the provision of local public goods throughout a model of probabilistic electoral competition.

In this paper we show that the parties' political competition for votes in a federal election creates incentives for parties to aggregate the benefits and costs across districts in the provision of local public goods. Hence, the provision of local public goods with and without inter-regional spillovers is Pareto efficient. This outcome is different from the predictions of the median voter model (see Downs, 1957; Lockwood, 2002; Persson and Tabellini, 2002b) and partisan models of electoral competition (see Roemer, 2001) in which the provision of local public goods with and without inter-regional spillover is, in general, Pareto *inefficient*.

Moreover, our paper is also different from normative and positive models of inter-governmental transfers since in this paper we show that the heterogeneity of preferences of voter across districts does not have a monotone effect on the provision of local public goods for all values of the spillovers of public spending. In particular, highly heterogeneous preferences of voters over local public goods across districts and/or sufficiently high spillovers of local public spending lead the central government to provide a uniform and Pareto efficient local public good because of strategic political behavior. In this paper, we also characterize a class of equilibria in which a differentiated provision of local public goods, with positive local public spending in all districts, is compatible with the parties' political objectives if the inter-regional heterogeneity of preferences of voters over local public goods and/or the spillovers of local public spending are moderate.

Finally, in this paper we provide a comparative analysis for studying the influence of political competition, the extent of inter-regional spillovers of local public goods, the distribution of the population in the economy, and the size and distribution of local public spending. Therefore, our paper also contributes by providing hypotheses that can be verified empirically and that seek to explain the size and

inter-regional distribution of local public goods in economies with representative democracies.

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