

THREE ESSAYS ON FISCAL FEDERALISM

by

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Abstract

This dissertation consists of three essays on fiscal federalism.

The first essay takes a political economy approach to fiscal centralization, through federation formation. I analyze a simple two region model of federalism with interregional policy spillovers. Departing from a state of independence with decentralized provision of public policy we analyze the proposed formation of a federation to internalize the spillovers. A federation forms when the centralized outcomes satisfy participation constraints. With this restriction to *rational federalism* we then consider equilibrium allocations under alternative institutional environments involving; simple majority voting, restriction of uniform taxation, and regional bargaining through a bicameral legislature. The analysis illustrates the importance of these institutions on the allocation of policy authority in federations that form. The model produces clear results with regards to the feasible set of equilibrium centralization and the allocations of publicly provided goods therein.

In the second essay local governments compete over a mobile business property tax base by adjusting their tax rates. This paper estimates the effect of neighboring tax rates on a local government's tax rate. This tax setting best response function is estimated with a difference-in-differences model. Endogeneity of neighboring tax rates is avoided by using election outcomes as an instrumental variable. The model is estimated using data from the municipalities of British Columbia, Canada. The findings indicate that tax competition is a determining factor of tax setting behavior. The results are discussed with reference to the local government institutions and the rising property values.

The third essay studies intergovernmental transfers. Many intergovernmental transfers are said to serve political purposes. I augment a standard model of political career concerns allowing for multilevel governance, to investigate this assertion. When elections are staggered, an equilibrium exists with positive transfers. These transfers are motivated by two

factors; sabotaging challengers and rent smoothing. These transfers are non-partisan and an artifact of the electoral dynamics as prescribed by an electoral calendar and politicians' career concerns. These results are discussed with reference to the growing literature on the partisan basis of intergovernmental transfers.

Keywords: Fiscal Federalism; Public Economics; Political Economy; Bicameralism; Tax Competition; Intergovernmental Transfers

Subject Terms: Economic Policy; Tax Competition; Intergovernmental Fiscal Relations

*To my love, Gillian Royle, the world's most precious human being.
And to David, Karen, Mikiki, and Kate.
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Chapter 1

Introduction

This dissertation answers three questions in fiscal federalism. These three questions are: i) When will regions centralize/decentralize authority over fiscal instruments? ii) How large is the effect of tax competition over business property? and iii) Why do self-interested politicians engage in intergovernmental transfers of resources?

The first essay takes a political economy approach to fiscal centralization, through federation formation. I analyze a simple two region model of federalism with interregional policy spillovers. Departing from a state of independence with decentralized provision of public policy we analyze the proposed formation of a federation to internalize the spillovers. A federation forms when the centralized outcomes satisfy participation constraints. With this restriction to *rational federalism* we then consider equilibrium allocations under alternative institutional environments involving; simple majority voting, restriction of uniform taxation, and regional bargaining through a bicameral legislature. The analysis illustrates the importance of these institutions on the allocation of policy authority in federations that form. The model produces clear results with regards to the feasible set of parameters for which centralization takes place in equilibrium, and the allocations of publicly provided goods therein.

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election outcomes as an instrumental variable. The model is estimated using data from the municipalities of British Columbia, Canada. The findings indicate that tax competition is a determining factor of tax setting behavior. The results are discussed with reference to the local government institutions and the rising property values.

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These three essays build on a large literature on fiscal federalism. This literature stems from the early work in welfare economics, and the economics of externalities by Pigou (1928) in particular. Each essay addresses an externality that arises in a situation where there are multiple governing decision makers. In the first essay the externality is positive as regions enjoy the benefits of publicly provided goods that are funded through a tax whose burden does not fall directly upon them. The externality addressed in the second essay can be argued as either positive or negative. The externality arises through the reaction of a mobile tax to relative tax rates among competing jurisdictions. If one believes that uncoordinated taxation in the presence of a mobile tax base provides a restraint on an otherwise excessive tax authority this externality is positive as competitive pressure prevents excessive taxation allowing for an equilibrium allocation of the tax base that is closer to the efficient allocation. However, if one believes that the motives of government are benevolent or benign, then the competition that ensues from uncoordinated taxation presents a negative externality as competitive pressure drives the tax rates too low, leading to tax revenues that are too low to provide public goods efficiently. The third essay addresses an externality that is not of direct application to citizens of a federation, but rather their elected representatives. Modeling elected officials as rational self-interested agents we see that discretionary transfers from a higher to lower level of government can have an effect on the equilibrium re-election rates of politicians, and also distort their rent appropriation while in office.

What makes these essays more than an afterthought of the work by Pigou on externalities

or the work of Tiebout(1956), Oates (1999) and others in the existing literature on fiscal federalism is that here we gain understanding by making use of those aspects of reality that are sometimes viewed to be a complication in economic analysis: institutions and politics. Research on institutions has become of growing importance in economics. While the distinction between an institution and a policy can be philosophically difficult to assess in this work we consider the constitution to be an institution; a set of policies coordinated upon (either formally or informally) whose abandonment in favor of a different set of policies is costly. From this point of view both the constitutional structures considered in the first chapter, and the election calendar of the second chapter can be viewed as institutions. By studying these institutions directly we are able to gain insight on the allocation of resources in the economy.

Politics is a theme throughout these three essays, and it's presence is explicit. In the first chapter a formal model of legislative bargaining is employed to assess the allocations of public goods and taxation in the economy. The second chapter employs the turnover of elected councillors as a source of exogenous variation to identify strategic interaction in municipal tax setting. Finally in the third chapter we focus on the elected representatives themselves as the unit of analysis for much of the chapter, and their actions in a game of electoral competition.

The work amassed in this document is heavily influenced by the ideas of Buchanan and Tullock (1962), and Stigler (1971) each viewing government actions as resulting from a rational decision making process on behalf of both voters and those who operate on their behalf. This line of research has been extended in recent years by Persson and Tabellini (2000) and Besley (2006), incorporating much of what has been learned from agency theory in economics from authors such as Holmstrom (1982), and others to models of the allocation government resources.

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Chapter 2

Bicameral Bargaining and Federation Formation

2.1 Introduction

“The Legislative body [is] composed of two parts, one checks the other, by the mutual privilege of refusing”

-Montesquieu, *The Spirit of The Laws*

This paper presents a model of federalism under alternative constitutional structures demonstrating the link between the decision to form a federation to centralize the policy space and the constitutional structure. The constitutional rules explored in this paper are uniform taxation, unicameralism, and bicameralism. Bicameralism is the partitioning of the legislative assembly into two chambers. Once this partition is in place policy requires the approval of each chamber in order to become legislated. As alluded to in the quote from Montesquieu, this legislative structure influences outcomes from the “mutual privilege of refusing”; the essence of a bargaining scenario. The incidence of refusal is a function of the apportionment, or assignment of seats, in each chamber. Thus, different apportionment to each chamber is critical to achieve a different outcome under bicameralism than under unicameralism¹. Through the use of a simple model, the role of bicameralism in federations

¹Using the nomenclature of Lijphart(1984) we will focus on *incongruent* and *symmetric* bicameralism. *Congruence* refers to the composition of the represented interests; if the same interests are represented by each chamber it is said to be congruent². *Symmetry* refers to the allocation of authority that each chamber possesses; if they are equal it is said to be symmetric.

becomes clear; bicameralism is an institution that fosters federation formation. Given a chamber with proportional representation, the question I address is whether the presence of a second chamber can affect policy.

The Database of Political Institutions lists 58 bicameral legislatures, and 27 with regional representation in the upper chamber (Beck et. al (2001)). Bicameralism and federalism often appear together. Of the world's 27 federations, 15 (55%) have a bicameral legislature with regional representation in the upper chamber. Examples of federations with regional representation in a bicameral legislature are the United States, Switzerland, Australia, Germany, Austria, Italy, Spain, Canada, India, and France. This paper presents a simple model that incorporates the choice of constitutional structure into the decision to adopt a federal structure. The assignment of authority occurs at a constitutional stage, when a union becomes possible given a pre-determined (exogenous) constitutional structure. This constitutional stage is akin to an entry stage in a model of duopoly in that a decision at such a stage must be sequentially rational. In the paper the term *rational federalism* is used repeatedly. Rational federalism requires that regions must be made no worse off under the federal constitution than they would be in its absence.

This paper integrates two strands of literature. First the study of bicameralism by political scientists. Bicameralism has been viewed as virtuous since classical political thought³. Modern political theory has returned to this issue in recent times. Perhaps the attention to bicameralism as a desirable institution is related to the casual observation that it is more common among successful countries (in terms of GDP). Prominent contributions on bicameralism are Lijphart (1979), and Riker (1992). In Riker (1992) multi-cameralism is seen as virtuous as it reduces the presence of policy cycles which occur in the absence of a Condorcet winner. Lijphart (1979) describes the relationship between federalism and the deviation from Westminster style majority rule to be often necessary for the union of differing interests under a single national government⁴. Cremer and Palfrey (1999) explore in a very abstract setting the relationship between the "degree of centralization and the mode of representation", when voters have preferences over these features. Tsebelis and Money (1997) presents an in depth analytical description of bicameral bargaining, making little

³For early references on the virtues of bicameralism see Montesquieu's "The Spirit of the Laws" and Jefferson, Hamilton and Madison in "The Federalist Papers".

⁴Consociation, which has elements of grand coalition, mutual veto, proportionality, and segmental autonomy are the elements of this deviation from simple plurality considered by Lijphart.

formal reference to the link with federalism.

Only recently have economists begun to discover the influence of bicameralism in environments of economic analysis. Diermeier and Myerson (1999) develop a vote buying model of legislative activity finding that bicameral separation induces legislative chambers to create internal veto players (committees, etc.) or super-majority rules, a feature not present in unicameral legislatures. This takes place because bicameralism introduces a veto making legislation more costly to pass. Facchini and Testa (2005) study analytically the role of bicameralism in the accountability of government, while Testa (2003) studies empirically the role of bicameralism and government corruption. The latter two papers indicate that bicameralism is not always virtuous. Bradbury and Crain (2002), in an empirical study of US states, argue that the bicameralism has a role in determining state fiscal policy. They find that “increasing the bicameral difference in terms of redistributive coalitions between chambers reduces government expenditures” (p658). While their paper highlights one fiscal effect of bicameralism, it is silent on role of bicameralism in a fiscal federation.

Second this paper brings bicameralism into the literature on fiscal federalism. Fiscal federalism addresses the issues that emerge when multiple levels of government are involved (vertically and horizontally) in decisions over fiscal instruments⁵. Recent work in fiscal federalism has explored the role of politics in the decision to centralize or decentralize a policy space. Of the first in this vein is Seabright (1996), who considers fiscal centralization and decentralization on accountability grounds, stressing that the implications for welfare could go either way depending on inter and intra regional heterogeneity⁶. Etro and Giarda (2007) study a model of fiscal federalism concentrating on redistribution under decentralization and centralization. One central allocation they consider is a house of regional representatives, however their results arise from the timing of decisions under the central regime where the set of fiscal instruments is constrained *ex ante*. A prominent example of the political economy approach is Besley and Coate (2003). In their paper they identify three problems of centralization that arise as a result of incorporating politics into the model. The first is misallocation, that with centralization public spending is skewed to the regions that comprise the minimum winning coalition. The second is uncertainty, that with centralization there is uncertainty over the public allocation arising from uncertainty of the identity of the

⁵For an excellent review of the literature on fiscal federalism see Oates (1999).

⁶Lockwood (2005) presents a survey of the literature on the political economy approach to fiscal decentralization, highlighting the preference-matching and accountability arguments in favor of decentralization.

minimum winning coalition. Finally centralization induces strategic delegation, as regions have incentives to elect representatives with high demands for public goods. In a similar environment, Redoano and Scharf (2004) discuss the decision to centralize under direct referendum and representative democracy, showing that centralization is more likely under representative democracy.

A shortcoming of the existing political economy approach to fiscal federalism is the failure to incorporate what is arguably the most prominent political feature of federalism, namely, a bicameral legislature. This paper does just that. If centralization is desirable, one would expect institutions to be of use to insure that the desirable outcome is obtained. Using an environment similar in spirit to that adopted by Besley and Coate (2003), we formally explore the relationship between a bicameral legislative structure and the gains to centralize policy instruments.

The approach taken in this paper is also similar to that of Gradstein (2004). Gradstein studies the formation of a federation under different secession rules when a federation forms to internalize public good spillovers. When fiscal policies are determined by a unicameral central legislature strategic delegation occurs, reducing efficiency when secession is free. Foreseeing this, federation formation is hampered. If the secession requirement is met through regional referenda it is costly and does not reduce efficiency, hence facilitating federation formation. The essence of the argument of Gradstein (2004) depends on which branch holds the option to secede; the legislature or the regions. All of the efficiency loss and hampering of federation formation arises through strategic delegation. In contrast, I focus on the decision to form the federation when secession is not an option as it is not an element of the federal constitution, and a secession clause is absent in many federal constitutions. Additionally the model presented here is more general, allowing for spillovers arising from the majority, or minority regions.

A glance at a few of the historical cases of federation formation provides examples of how the framers of constitutions wrestled with the consequences of constitutional rules on participation in the federation. Money and Tsebelis (1997) document that European federation formation in the era prior to the introduction of democracy were dominated by unicameral assemblies. Some examples of these are the Swiss Confederation of 1291-1798 and the German confederation of 1815-1866⁷. In each case there was one chamber, with

⁷Money, Jeannette and George Tsebelis (1997) p.31

regionally balanced geographic representation. Switzerland did not introduce bicameralism until after the creation of the most prominent example of a bicameral federation, the United States of America. This introduction of a second chamber was a compromise for the smaller cantons who wished to retain equal geographic representation and the more populous cantons who sought to have a form of popular representation⁸. The formation of the constitution of United States of America can be viewed as the result of a debate that took place largely through The Federalist Papers. These essays published anonymously by Hamilton, Madison, and Jay depict a concern for the protection of individual citizens through popular representation while also protecting the individual states who agree to form the union. While the senate is argued to serve many roles in the United States constitution, that it is regionally balanced does not appear to be a historical accident⁹.

The model in this paper studies two regions, differing in preferences, incomes, and population. Each region has full authority over its policies under decentralization. The policies produce spill-overs, creating a rationale to centralize the authority over the policy space. The centralization of the policy space will only occur when regions are made no worse off by this arrangement; thus, they perfectly foresee the allocative consequences of federalism (the centralization of the policy space) and decide whether to participate or not. Under centralized provision I consider alternative authoritative structures. In particular I consider unicameralism and bicameralism each with the presence and absence of uniformity requirements. Considering a situation in which ex ante the policy space is decentralized but policy coordination at a central level would be beneficial (because of spillovers) we then explore how the structure of authority within the central objective influences a rational decision to centralize the policy space¹⁰.

The model's results concern the decision to centralize under the constitutional structures analyzed as well as statements in terms of the efficiency and equity of the resulting allocation. Unicameral legislatures are efficient but insufficient to induce federalism. With the additional requirement of uniform taxation unicameralism can induce a federal outcome; however, this restriction leads to an allocation that is inefficient. With unicameralism the

⁸ibid. p.32

⁹see Hamilton, Alexander, John Jay, and James Madison (1961)

¹⁰The simplicity and exclusivity of the constitutional features explored does capture some realism as constitutions are *incomplete contracts*. Likewise what the restriction to regional representation in the presence of proportional representation lacks in generality it compensates with realism

less populated region would require uniformity to prevent ex post exploitation in the federation. Bicameral legislatures produce efficient rational federalism for the largest set of parameter values. The additional requirement of uniformity shrinks the set of parameter values consistent with rational federalism and yields an inefficient federal outcome. Here bicameralism induces bargaining, leading to efficiency while the distribution of bargaining power in the legislature insures against ex post exploitation. Intuitively the restriction of uniformity in a bicameral legislature constrains the very feature of bicameralism that induces efficiency, bargaining.

The model also provides insight into the decision to decentralize an ex ante centralized policy space. In an instance where preference matching would yield an efficient decentralized allocation, it is often necessary to make regional transfers to induce the change in the vertical assignment of authority. The size of these transfers would differ under alternative federal constitutions, illustrating again that the decision to assign policy instruments is often of redistributive character.

The next section presents the economic environment in the absence of institutions and describes Pareto optimal allocations. The decentralized allocations are studied in section three. Section four presents the equilibria to the centralization game under alternative institutional structures. Section five introduces heterogeneity. Section six presents a discussion of extending to many regions and of institutions to induce efficiency. The last section concludes.

2.2 An Analytic Framework

Consider two regions, labeled $i \in \{1, 2\}$. Each region is populated by a continuum of agents. The mass of agents in region one is normalized to 1, and let $n < 1$ denote the mass of agents in region 2. There is a representative agent in each region. The population is immobile.

An agent in region $i = 1, 2$ has preferences defined over $\{c_i, g_i, g_j\}$; where c_i is consumption, g_i denotes the consumption of a publicly provided good in region $i \neq j$. Publicly provided goods are locally rival (they are not pure public goods)¹¹. Some examples include health care, day care, and education. I assume that preferences are additively separable and

¹¹Individuals often care for the provision of policies in regions other than that within which they are currently residing.

linear in private consumption; i.e.,

$$U_i(c_i, g_i, g_j) = v(g_i) + \alpha_i v(g_j) + c_i$$

where α_i is a parameter that indexes the degree to which the benefits of a public good in the non-local region spills over into the local region. Assume that v is strictly increasing and concave.

Agents are endowed with a given level of real income $0 < y_i < \infty$. The publicly provided good is produced with a linear technology; that is one unit of the private good can be transformed one-for-one into one unit of the public good. In what follows we restrict attention to taxes on income. Thus citizens of region i face the following individual budget constraint;

$$c_i = (1 - t_i)y_i \tag{2.1}$$

The government has not been fully characterized as of yet. However we can state the binding government budget constraints. If the government is centralized over the $\{g_i, g_j, t_i, t_j\}$ policy space then the following federal budget constraint (*FBC*) is in effect;

$$g_1 + ng_2 = t_1y_1 + nt_2y_2 \tag{2.2}$$

Of course, if the government has decentralized the $\{g_1, g_2, t_1, t_2\}$ policy space then the independent regions must satisfy the regional budget constraint (*RBC*);

$$g_i = t_i y_i \quad \text{for } i = \{1, 2\} \tag{2.3}$$

2.2.1 Independence: Decentralized Allocations

Here we present the allocations of the public goods under a regime of decentralized decision making. Each region has full authority over their respective policy instruments. Regional policies are determined through majority voting.

Definition: Majority Voting in region (i) assigns a feasible policy bundle, $\{g_i, t_i\}$, as *the equilibrium allocation* iff it is preferred by more than half the regional population to any other feasible allocation.

Since regions are composed of identical citizens¹², *the policy* under independence maximizes the preferences of the *representative citizen*. With homogeneous populations within

¹²This is employed for simplicity. In general one could work with heterogeneous agents then easily applying the median voter theorem so long as the heterogeneity enters in a multiplicative fashion on preferences, or incomes.

regions the median voter for region one will maximize the policy induced preferences:

$$V(g_2) = \max_{g_1, t_1} v(g_1) + \alpha_1 v(g_2) + y_1 - t_1 y_1$$

Subject to the regional budget constraint. Let a superscript d_1 denote the independent allocation. Substituting in the regional budget constraint yields the following FOC:

$$v'(g_1^d) \geq 1$$

The above inequality accounts for the possibility that $v'(g_1^d) > 1$ when $c_1 = 0$. For region 2:

$$V(g_1) = \max_{g_2, t_2} v(g_2) + \alpha_2 v(g_1) + y_2 - t_2 y_2$$

Subject to the regional budget constraint. Let a superscript d_2 denote the independent allocation. Substituting in the regional budget constraint yields the following FOC:

$$v'(g_2^d) \geq 1$$

Let the superscript F denote the federal allocation. The arguments that maximize the above regional objectives yield participation constraints:

$$v(g_1^F) + \alpha_1 v(g_2^F) + y_1 - t_1^F y_1 \geq V(g_1^d) = U_1^d \quad (2.4)$$

$$v(g_2^F) + \alpha_2 v(g_1^F) + y_2 - t_2^F y_2 \geq V(g_2^d) = U_2^d \quad (2.5)$$

These participation constraints must be satisfied in any *rational federation*. In other words any federation that forms must provide members of each region with at least as much utility as they would receive under independence. Since federation formation involves the reassignment of authority, the constitution must insure the members of each region that these constraints will be satisfied ex post. As we will see below, a simple majority rule is not sufficient to insure rational federation formation for any arbitrary parameterized setting.

Inspection of the above decentralized allocations indicates that decentralization will produce inefficient allocations of the public goods.

Lemma 1. *For non-zero $\{\alpha_1, \alpha_2\}$ the allocation $\{g_1^d, g_2^d\}$ is Pareto inefficient.*

Proof. To prove the inefficiency of $\{g_1^d, g_2^d\}$, we show that a Pareto improvement is possible. Let \bar{U}_2^d denote the utility of the representative from region 2:

$$\bar{U}_2^d = v(g_2^d) + \alpha_2 v(g_1^d) + y_2 - t_2 y_2$$

Taking the total differential of the above yields:

$$dt_2 = v'(g_2^d)dg_2 + \alpha_2 v(g_1^d)dg_1 \equiv \Delta$$

where Δ is the tax levied in region 2 to finance increases in g_1, g_2 that leave the representative from region 2 with utility \bar{U}_2^d . What remains is to show that such a reallocation will make the representative from region 1 strictly better off. This gives the representative from region 1:

$$v(g_1^d + \alpha_2 v(g_1^d)) + \alpha_1 v(g_2^d + v'(g_2^d)) + y_1 - t_1 = \hat{U}_1 > \bar{U}_1^d = v(g_1^d) + \alpha_1 v(g_2^d) + y_1 - t_1$$

□

With spillovers present, a reallocation that increases both g_1 and g_2 can be implemented by having region 2 finance the entirety of the additional expenditure. This leaves region 2 no worse off by definition and makes region 1 strictly better off.

As has been alluded to above, one way to achieve an efficient allocation is to assign authority to a central legislature. We consider this in the following section under alternative structures of the central authority.

2.3 Centralized Allocations: Unicameralism

Here we present a centralization game. The game has two stages and is described as follows. In the first stage each region makes a decision to centralize the policy space or not given a constitutional assignment of authority. If centralization is rejected by one or both regions each region continues with the decentralized allocation, payoffs are realized and the game ends. If centralization is accepted the central authority maximizes its objective function, payoffs are realized and the game ends. This structure is important to the results that follow. It captures two important features of centralization and the political environment; first that the constitutional assignment of authority is costly to change (secession is not a credible threat point), and second that commitments that are not fully characterized at the constitutional stage are not credible. The last feature captures the incompleteness of the constitutional contract.

This environment is the appropriate framework for discussing the centralization or decentralization of a policy space at the point of forming a federation or once a federation has already formed. The thought experiment studies a moment at which the decision over the distribution of authority is considered. For other discussions of federation formation see Burbridge et. al (1997), Aghion, Alesina and Etro (2001).

In what follows we assume that the unicameral legislature is apportioned on the basis of population. The timing that we consider is the following: at time 0 a constitutional moment arises bringing with it an exogenous constitutional structure, at time 1 regions accept or reject the proposal on the basis of majority rule (trivially), at time 2 the legislature selects policy variables as determined through the constitution, and finally at time 3 payoffs are realized and the game ends. There is no secession once a constitution is adopted (however this is irrelevant as regions foresee ex post exploitation). The decision to join the federation is made at time one, given the constitutional structure. Thus each region simply considers their payoffs under this constitution and accepts or rejects accordingly.

We now consider two constitutional structures under unicameralism, simple majority rule (SM) and simple majority rule with a restriction of uniform tax rates (SMU).

2.3.1 Simple Majority

If the central legislature is apportioned according to proportional representation with a simple majority rule it is controlled by region 1. Thus their problem is

$$\max_{g_1, g_2, t_1, t_2} v(g_1) + \alpha_1 v(g_2) + (1 - t_1)y_1 \quad (2.6)$$

subject to

$$t_2 \leq 1 \quad (2.7)$$

$$t_1 y_1 + n t_2 y_2 \geq g_1 + n g_2 \quad (2.8)$$

Where the first constraint follows from the fact that region 1 can only expropriate what private good exists in region 2, and the second is the feasibility of the policy. It is easy to see that both constraints bind in equilibrium. We therefore have the following lemma.

Lemma 2. *For non-zero $\{\alpha_1, \alpha_2\}$, and non-uniform taxation the allocation $\{g_1, g_2, t_1, t_2\}$ involves $t_2 = 1$.*

With this unrestricted framework there is nothing preventing region 1 from fully expropriating resources from region 2. This will not satisfy the participation constraints as we assume no commitment technology exists to prevent full expropriation once the assignment of authority has been authorized.

Proposition 1. *Without restrictions on taxes, region 1 always wants to join the federation. Region 2 will never join when $y_2 > 1$ and $\alpha_1 < n$.*

Proof. It is clear that assigning authority over the fiscal instruments of region 2 can make region 1 no worse off, hence region 1 always joins. What remains to be shown is that region 2 is made no better off by the federal allocation in the scenario defined above. In the federation with $y_2 > 1$ and $\alpha_1 < n$, region 2 now consumes $c_2 = 0$ and $g_1^{SM} = g_1^d$ and $g_2^{SM} < g_2^d$. The participation constraint is slack from two ways: if $c_2^d = 0$ which occurs only if $y_2 < 1$, and if $\alpha_1 \geq n$. \square

It will always be the case that region 2 is made worse off by participating whenever $c_2^d > 0$ and $g_2^d > g_2^{SM}$. This corresponds to the case above, where $y_2 > 1$ and $\alpha_1 < n$. If the decentralized provision of g_2^d is under-provided (less than that preferred by region 2) when region 2 is resource constrained ($c_2^d = 0$) there will be some parameters for which region 2 will receive more g_2 under centralization than decentralization. In order for this to occur $g_2^{SM} = v'(\frac{n}{\alpha_1})^{-1} > y_2 = g_2^d$. It is difficult to say something more substantial in terms of parameters of the model without a restriction on the function $v(\cdot)$.

While this constitutional structure may seem trivially simplistic, simple majority voting is very common. Moreover, we learn that the federation does form when regions are unable to achieve their optimal public policies under independence. In this case the federation forms because the participation constraints are not applicable. The federation does not form for non trivial parameter values, ie when endowments are sufficiently large. Nevertheless given the attention that simple majority rule has received in the literature (see Besley and Coate (2003)) we note that it can be consistent with rational centralization, even more so when there is an additional restriction on taxation to be uniform. Below we present the allocation when there are uniform taxes on income.

2.3.2 Simple Majority Uniform Taxation

One way to prevent the federal authority from fully expropriating the minority region is to make restrictions on taxes. An alternative would be to restrict public good provisions to be uniform, but this quickly moves us from the efficient outcome as noted in Oates' classic decentralization theorem. We proceed with uniform taxation to illustrate the role of the common budget constraint under the federal authority without transfers.

$$\max_{g_1, g_2, t} v(g_1) + \alpha_1 v(g_2) + (1 - t)y_1 \quad (2.9)$$

subject to

$$t(y_1 + ny_2) \geq g_1 - ng_2 \quad (2.10)$$

Lemma 3. For non-zero $\{\alpha_1, \alpha_2\}$, and uniform taxation the equilibrium policy $\{g_1, g_2, t\}$ is:

$$\{g_1^{SMU}, g_2^{SMU}, t^{SMU}\} \equiv \tag{2.11}$$

$$\left\{ v' \left(\frac{y_1}{ny_2 + y_1} \right)^{-1}, v' \left(\frac{ny_1}{\alpha_1(y_1 + ny_2)} \right)^{-1}, \frac{v' \left(\frac{y_1}{ny_2 + y_1} \right)^{-1} + v' \left(\frac{y_1}{\alpha_1(y_1 + ny_2)} \right)^{-1}}{y_1} \right\} \tag{2.12}$$

For proof see appendix A.

Definition: Expenditure is skewed to region i if $g_i > t_i y_i$ and $g_j < t_j y_j$.

Proposition 2. In a federation with the restriction of uniform taxes, (i) the provision of the public good is inefficient. (ii) the allocation is skewed towards the majority region when $n > \alpha_1$. (iii) There exists a non-empty set of parameters $\{\alpha_1, \alpha_2, y_1, y_2, n\}$ such that the federation forms.

Proof (i): This can be seen from an argument analogous to that of the proof of Lemma 1. (ii): Public expenditure in region 1 is $g_1^{SMU} >$ their taxes, which are $\frac{g_1^{SMU} + ng_2^{SMU}}{y_1 + ny_2} y_1$ whenever $g_1^{SMU} > g_2^{SMU}$ which occurs when $n > \alpha_1$. If this holds the second part of skewness follows. (iii): The following example is sufficient for the proof. The allocation with uniform taxation is

$$\{g_1^{SMU}, g_2^{SMU}, t^{SMU}\}$$

by Lemma 3. The utility of an agent in region 1 from such an allocation is:

$$U_1^{SMU} = v(g_1^{SMU}) + \alpha_1 v(g_2^{SMU}) + y_1 - t^{SMU} y_1$$

Note that $g_1^{SMU} > g_1^d$ whenever $ny_2 > 0$. Also $g_2^{SMU} > g_2^d$ whenever $(n - \alpha_1)y_1 < ny_2$. Consider an allocation where all elements of the centralized policy vector, $\{g_1^{SMU}, g_2^{SMU}, t^{SMU}\}$, are greater than the decentralized policy vector $\{g_1^d, g_2^d, t^d\}$. This is utility enhancing to the representative from region 1 whenever:

$$v(g_1^{SMU}) - v(g_1^d) + \alpha_1 [v(g_2^{SMU}) - v(g_2^d)] > g_1^{SMU} + g_2^{SMU} - g_1^d$$

Likewise for region 2 they join whenever:

$$v(g_2^{SMU}) - v(g_2^d) + \alpha_2 [v(g_1^{SMU}) - v(g_1^d)] > \frac{(g_1^{SMU} + g_2^{SMU})y_2}{y_1} - g_2^d$$

The above is partially induced by the distortion from the tax on income. When the income is high in region 2 relative to region 1 individuals from region 1 want to set a higher tax

rate to expropriate the other region. If constrained to set taxes to be the same fraction of income, this distorts both the public good levels as this is the only mechanism through which to reallocate utility across regions.

This section has shown that the federation will sometimes form when there is a unicameral legislature apportioned through proportional representation. The federation forms without the restriction on tax rates when the minority region was suffering under independence, i.e. they could not attain their desired level of public spending. With a restriction of uniform tax rates there is greater scope for federation formation. Depending on the parameters of the model the minority region may receive higher utility through increased provision of both g_1 and g_2 . This occurs when the minority region is both sufficiently small and when spillovers to the majority region are sufficiently large (when $n < \alpha_1$). Public spending is always higher in region 1 with a simple majority and uniform taxation than with the simple majority and independence. This arises because public expenditure is the only means through which region 1 can appropriate resources from the minority region. Since spillovers are modeled to be positive, public spending in region two is higher than under simple majority without the restriction on tax rates as well as independence. We can summarize what we have learned through this exercise with the following proposition:

Proposition 3. *Any federation that can be supported with a simple majority rule and no restriction on taxation can be supported by a simple majority rule with a restriction of uniform taxes.*

Proof. Since $v''(\cdot) < 0$ we know that $g_1^{SMU} > g_1^{SM}$ and $t_2^{SMU} < t_2^{SM} = 1$. It suffices to show that $g_2^{SMU} > g_2^{SM}$, which holds if $0 \leq n_2 y_2$ which is true by assumption. \square

Of course there are many parameter values for which the federation does not form¹³. In particular this is likely when the two regions are very similar in terms of their populations, and when spillovers are very asymmetric. The next section considers the addition of a second chamber apportioned by regional interests. In this new context we will again consider centralization under non-uniform tax rates and uniform tax rates respectively.

¹³There is always a non-empty set of parameters for which the federation does not form. In particular note that if we impose symmetry over the entire parameter space the condition for the minority to join is: $v(v'(\frac{1}{2\alpha})^{-1}) + \alpha v(v'(\frac{1}{2})^{-1}) - (1 + \alpha)v(v'(1)^{-1}) > \frac{(v'(\frac{1}{2\alpha})^{-1} + v'(\frac{1}{2})^{-1})Y_2}{Y_1} - 1$

2.4 Centralized Allocations: Bicameralism

2.4.1 Bargaining Among Regions in a Senate

A senate is an upper chamber apportioned on the basis of geography (or in some cases: class, age, income). For our purposes here it is apportioned on the basis of equal regional representation. This is a natural assumption if we are to study bicameralism in relation to federalism: as noted by Money and Tsebelis (1997) the representation of geographic units “is characteristic of all federal systems”, because most of the senates in federations are apportioned in this manner. When a senate exists a majority in each chamber is required.

In this section we enrich the environment by considering the outcome of federal allocations as being determined through a bargaining process in a bicameral legislature. The rationale for formalizing the concurrent majority system as the outcome of a bargaining process is due to the institutional rules employed in bicameral legislatures. Two of these bicameral institutions are *navette* and *conference committee*. The *navette* is a process through which a bill is shuttled from chamber to chamber in order to achieve concurrent majorities. A *conference committee* is a subset of representatives from each chamber whose role is akin to that of an arbitration. Once the conference committee makes a proposal this is the last time the legislation will be voted on by both chambers. Intuitively, this will yield a more equitable allocation of resources. The reason for this is, as we introduce the presence of the minority region’s preferences into the policy allocation formulation we will see less shifting of public spending to the majority region. In what follows for simplicity we continue to assume there are only two regions, and add that each controls one chamber (this is analogous to the requirement of unanimity in the upper chamber, or an appropriate choice of super majority).

As described in the introduction there are many institutional requirements observed in national (and subnational) governments that induce bargaining. Here we focus on Bicameralism. The model does not require bicameral bargaining; the results would obtain for an appropriately set supermajority rule. However specifying a supermajority rule as the means to induce bargaining may be dominated by the option to induce bicameral bargaining ¹⁴.

¹⁴To consider voluntary bargaining between regions in the absence of a legislature the outcomes will be different. In the absence of an assignment of authority stage the outside options will remain the decentralized allocation (participation constraints become irrelevant. Of course if there is no supra authority to enforce a contract between regions then this option is not applicable.

One reason to rule out the supermajority would be that contracting on n may be less flexible and hence undesirable because n may vary ex post. Thus, bicameralism is a more robust constitutional rule.

All proposals originate initially in the lower chamber, but approval of the upper chamber is required for a proposal to be accepted. Thus, the proportional representation in the lower chamber will have a positive role in determining the bargaining outcome, while the retention of residual authority by each region in the upper chamber, through a supermajority requirement (for simplicity we require unanimity), will ensure that unsatisfactory proposals from either region are not accepted. Thus legislation is passed only if it receives the required concurrent majority.

The bargaining method employed here is the Rubinstein bargaining game. The structure is such that the two parties make alternating offers and delay is costly. For the purpose of clarity we focus on the limiting case of the Rubinstein bargaining game as the time between offers approaches zero. This outcome is equivalent to the Nash bargaining solution where the bargaining powers are appropriately chosen to reflect the probabilities of each party making an offer and their relative discount factors. Letting β denote the bargaining power for a representative from region 1 we have¹⁵:

$$\beta \equiv \frac{r_2 q}{r_1(1 - q) + r_2 q} \quad (2.13)$$

where q is the probability that an offer originates from a member of region 1, and r_i is the discount rate for a representative from region i . This has the feature that the payoff to region one is strictly increasing in the cost of delay for region 2 as well as in the probability that an offer originates from an individual from region 1. The bargaining parameter for region 2 is thus $1 - \beta$. If the discount rates are identical for the two individuals then it is the case that the bargaining power is solely determined by the relative probabilities of proposition. For an empirical reference on the value of proposal power in legislatures see Knight (2004).

In what follows we look at a bargaining outcome for a game in which there is a disagreement payoff of zero and the outside option is non-binding. This is rationalized by the assertion that joining the federation is costless, but leaving can be so costly as to make it undesirable. In addition the proposed structure is one of the *open rule*, where either

¹⁵For a background on this approach see Muthoo p. 193

party can amend an offer, thus giving the game the alternating offers solution. In the event that the *closed rule* were employed the house in which the legislation was initiated would simply make an offer equivalent to the other region's outside option (here assumed to be non-positive) and the game would end with the proposing region acquiring all of the surplus, save for that unalienable through the public good provision.

The bargaining solution when the upper and lower chambers bargain over the allocation of public policy for the central government is determined by:

$$\max_{g_1, g_2, t_1, t_2} U_1^\beta U_2^{1-\beta} \quad (2.14)$$

$$\text{subject to } t_1 y_1 + n t_2 y_2 - g_1 - n g_2 \quad (2.15)$$

For simplicity the arguments in each of the U_i 's have been suppressed. These U_i 's are functions of the arguments as described in section 4. In what follows for simplicity we assume $\beta < 1/2$ ¹⁶.

Proposition 4. *There exists a $\tilde{\beta}^B \in [0, 1]$ such that the federation forms whenever $\beta \leq \tilde{\beta}^B$ for all $\beta \in [0, 1]$. The allocation with bicameral bargaining is efficient.*

Proof. The federation forms whenever $U_2^B \geq U_2^d$. Since U_2^B is monotonically decreasing in β on the interval $[0, 1]$ and we know that $U_2^B < U_2^d$ at $\beta = 1$, there exists a critical value of β such that the above inequality holds with equality. For all β greater than $\tilde{\beta}^B$ region 2 will not join the federation.

Efficiency follows from the bargaining solution. The solution is a Pareto efficient allocation. The federation forms whenever this critical bargaining power is assigned to the minority region. \square

This is the main result. As we will see shortly bicameral bargaining will facilitate the formation of the federation for the largest set of parameter values. Moreover, the allocation with bicameral bargaining is efficient. What remains to be studied is whether again the addition of restriction to a uniform tax rate can achieve more federation formation. As we will see the answer is no.

2.4.2 Bargaining Among Regions with Uniform Taxation

Here we introduce a further restriction to uniform taxation under the bicameral bargaining outcome. In what follows the results mirror that of the *SMU*.

¹⁶A subsequent version relaxes this assumption

The bargaining solution when the upper and lower chambers bargain over the allocation of public policy for the central government when taxation is constrained to be uniform is determined by:

$$\max_{g_1, g_2, t} U_1^\beta U_2^{1-\beta} \quad (2.16)$$

$$\text{subject to } t(y_1 + ny_2) \geq g_1 - ng_2 \quad (2.17)$$

Proposition 5. *There exists a $\tilde{\beta}^{BU}$ such that the federation forms whenever $\beta \leq \tilde{\beta}^{BU}$ for all $\beta \in [0, 1]$. If the Pareto Frontier is differentiable this $\tilde{\beta}^{BU}$ is strictly greater than $\tilde{\beta}^B$.*

The proof is analogous to that for the preceding proposition. The utility payoff for individuals in region 2 is non-increasing in the bargaining power of the proportional representation house. That $\tilde{\beta}^{BU}$ is strictly greater than $\tilde{\beta}^B$ is a subtler issue. Given utility payoffs are the result of the bargaining described above we know that $\tilde{\beta}^B \equiv \frac{1}{\frac{U_1^B}{U_2^B} - 1}$. With $\tilde{\beta}^{BU} \equiv \frac{1}{\frac{U_1^{BU}}{U_2^{BU}} - 1}$ we know that $U_1^B > U_1^{BU}$ because the constraint of uniform taxation binds and the set of Pareto efficient allocations is convex. Thus $\tilde{\beta}^{BU} > \tilde{\beta}^B$.

Imposing a restriction on taxation in the simple majority case led to an enhanced ability to form the federation. Now, it cannot increase the ability to form the federation. The intuition is straightforward: the constrained optimum will involve distorted public allocations as the region with greater bargaining power attempts to allocate utility through the public budget. This is inefficient, and decreases possible utility outcomes.

It would be desirable to comment on the skewness of the public allocations. In general this could go either way depending on the parameters of the model the same incentives are at work. The higher is the income in region 2 the greater is the incentive to over-provide the publicly provided goods. The marginal benefit of increased public provisions is traded off against the marginal cost of taxation on income.

2.5 Discussion

There is an ordering of results in terms of the set of parameters with which equilibrium centralization is achieved. Define the set of parameter values for which a federation forms given a constitutional structure ℓ to be Θ^ℓ

Proposition 6. $\Theta^{SM} \subset \Theta^{SMU} \subset \Theta^{BU} \subset \Theta^B$

We know that the restriction to uniform taxes on income involves a lower tax rate in region 2 than the simple majority case, and that public spending that with uniform taxation is no lower than in the simple majority case, thus there is a wider set of parameter values for which the federation forms. Similarly, retaining the restriction to uniform taxes, the imposition of bicameral bargaining over regional spending cannot make region two worse off as it assigns some non-zero weight to their utility in the central decision making process. That the loss of the restriction of tax uniformity allows for more federation formation follows simply from recognizing that any federation that imposes an inefficient institution can only make the satisfaction of minimum utility levels more difficult to obtain.

The features of the constitutional environment that drive the results are the decision rule and the common pool problem. Simple Majority voting and Bicameralism are both efficient institutions. The inefficiency of equilibrium allocations arises from the restriction to uniform taxation. With a uniform tax rate and inter-regional heterogeneity over income the government budget constraint now serves as the basis for the common pool problem as the effects of raising the tax rate are shared by both regions. The requirement of a uniform tax rate enhances the ability to form the federation when the decision rule is simple majority as it restricts ex post exploitation in the federation. When the decision rule involves bargaining ex post exploitation is not as likely as the central policy agenda allows regions to retain some authority over the fiscal policy.

That bicameralism with uniform taxation requires increased “bargaining power” for the upper chamber is interesting. Is it possible to distort the bargaining power in this environment without compromising the proposal power in the proportional representation chamber? The answer is yes. This can be achieved by influencing the relative costs of delay for representatives from each chamber. If representatives from the upper chamber are more patient they will acquire more in the bargaining solution. While the current model abstracts from the reality of election concerns, this could be one rationale for having longer terms in the upper chamber, or even an appointed upper chamber¹⁷.

This analysis allows us to derive two main conclusions. First, in a unicameral legislature policy uniformity may be required to prevent the exploitation of the minority region, thus increasing the scope for policy coordination through federation formation. Second, bicameral bargaining further enhances the formation of the union. Thus, bicameralism and policy

¹⁷Like that of the pre 17th Amendment US constitution.

uniformity are imperfect substitutes in their ability to restrict the majority's ability to expropriate and reallocate the resources of the minority region. Ex post welfare is more equitably distributed across regions with uniformity of the tax rates. In summary we learn that we have to take the endogeneity of constitutions and formation of unions into account when discussing the assignment of fiscal instruments in a federation. This suggests that studies that do not do this, see Besley and Coate (2003), are off the mark as the federation would not form in all cases for the reasons described in this paper.

Our analysis yields two empirical implications. The first is that bicameralism and federalism go hand in hand. The second is that bicameral states that have geographic sub-unit apportionment and are federations may be more likely to exhibit centralization of fiscal policies. Further exploring these implications is important to understand the relationship between federalism and the level and distribution of government expenditures.

Some possible extensions to the model are worth discussing. The most natural extension to a model of federation formation is to many regions. Bargaining is no longer bilateral among the regions. While we can still consider bilateral bargaining between chambers, the chambers will be controlled by minimum winning coalitions (MWCs). Which regions form MWCs in each chamber depends strongly on the bargaining procedure specified, as well as the magnitudes of spillovers and the population sizes¹⁸. Generally we will have a more equitable distribution of resources as long as the identities of the MWC across chambers vary.

An alternative way to approach the extension to MWCs in the present framework is to introduce multiple regions to the federation gradually. In this manner, bilateral considerations still apply to the extent that the region considering joining can assure themselves some minimum authority in the federal policy agenda. When regions are unlikely to be a part of the minimum winning coalition we can now see the appeal of less efficient constitutional restrictions such as policy uniformity, through taxation¹⁹.

Another extension to consider is allowing for uncertainty at the constitutional stage, which is resolved resolved prior to the central policy provision. This is easily incorporated. Uncertainty could be over regional incomes or over the relative population shares. With

¹⁸See Lockwood (2005). The author cites the cheapness of providing projects in regions of low population and low incomes, as well as the preference matching argument.

¹⁹The paper does not consider uniformity in the public good provision. This has already been extensively covered in the literature and is an easy application.

individual preferences as defined above the issue of risk aversion arises. Allocations of the private good under independence are independent of both income and the relative population shares. If uncertainty is incorporated in the model, this handicaps federation formation as the federal constitution will inevitably expose individuals to risk. If the variance in incomes is high enough, there would be some cases where the federation could serve as a risk sharing arrangement (given negative correlation) as in Persson and Tabellini (1996). However if regions are not exposed to states of the world where they are unable to provide their ideal decentralized policy levels the uncertainty will decrease federation formation.

Lastly one could incorporate intra-regional heterogeneity in the model. This could take the form of income or preference heterogeneity. Such an extension appears worthwhile, if one is concerned with motives for strategic delegation in the legislature. However this obscures the main results without adding much. Heterogeneity would allow for greater scope of redistribution through the public allocation. But this will add little in the current comparison of constitutional structures. Strategic delegation will arise in the event that the constitutional structure is *ex ante* inefficient, and without the restriction on tax rates this phenomenon is not present.

2.6 Conclusion

This paper takes a political economy approach to federation formation. Departing from a state of independence with decentralized provision of public policy we analyze the proposed formation of a federation to internalize the spillovers. A federation forms when the centralized outcomes satisfy participation constraints. With this restriction to *rational federalism* we then considered equilibrium allocations under alternative institutional environments involving; simple majority voting, restriction of uniform taxation, and regional bargaining through a bicameral legislature. In doing so we concluded that bicameral bargaining facilitates federation formation for the largest set of parameter values. The analysis illustrates the importance of these institutions on the allocation of policy authority in federations that form. Policy uniformity, while often observed is inferior to institutions that facilitate bargaining on both equity and efficiency grounds. Incorporating bicameralism into models of fiscal federalism demonstrates the relationship between the structure of the constitution and when the federation forms. While the paper focussed on the bicameral outcome it is worth recalling that simple majority is sufficient to induce federation formation when minority

regions are sufficiently small, and they under-provided the public good under independence.

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2.8 Appendix A

Pareto Optimal Allocations

A Pareto Optimal allocation, with Pareto weight $\phi \geq 0$, can be written as the solution to:

$$\max_{g_1, g_2, t_1, t_2} v(g_1) + \alpha_1 v(g_2) + c_1 + \phi[v(g_2) + \alpha_2 v(g_1) + c_2]$$

subject to:

$$y_1 + ny_2 \geq g_1 + c_1 + n(g_2 + c_2)$$

and subject to the usual non-negativity constraints on private and public consumption. Since the resource constraint will bind we can write the above constraint with equality and substitute it back into the objective, to restate the problem for a given level of private consumption:

$$\max_{g_1, g_2} v(g_1) + \alpha_1 v(g_2) + y_1 + ny_2 - g_1 - n(g_2 + c_2) + \phi[v(g_2) + \alpha_2 v(g_1) + c_2]$$

The associated FOCs are given by:

$$(1 + \phi\alpha_2)v'(g_1) = 1$$

$$(\alpha_1 + \phi)v'(g_2) = n$$

Notice that as long as the desired levels of (g_1, g_2) characterized above do not exhaust the resources, their levels are determined independently of each other and independently of the level of output (this follows from the separability, and quasi-linearity of preferences). With (g_1, g_2) so determined, the aggregate level of consumption, $C \equiv c_1 + nc_2$, is determined residually from the resource constraint; i.e.,

$$C = y_1 + ny_2 - g_1 - ng_2$$

The division of consumption across regions is determined by the relative magnitudes of n and ϕ . If $n < \phi$ then $c_2 = C/n$; and if $n > \phi$ then $c_1 = C$. If $n = \phi$ then the division is indeterminate.

Simple Majority FOCs

The solution to this maximization problem yields the following first order conditions:

g_1 :

$$v'(g_1) - \psi = 0$$

$$\begin{aligned}
g_2 : & \quad \alpha_1 v'(g_2) - \psi n = 0 \\
t_1 : & \quad -y_1 + \psi y_1 = 0 \\
t_2 : & \quad -\lambda + \psi n y_2 = 0 \\
\lambda : & \quad t_2 - 1 = 0 \\
\psi : & \quad t_1 y_1 + n t_2 y_2 - g_1 - n g_2 = 0
\end{aligned}$$

Simple Majority Uniform FOCs

This yields the following first order conditions:

$$\begin{aligned}
g_1 : & \quad v'(g_1)^{-1} - \psi = 0 \\
g_2 : & \quad \alpha_1 v'(g_2)^{-1} - \psi n = 0 \\
t : & \quad -y_1 + \psi(y_1 + n y_2) = 0 \\
\psi : & \quad t(y_1 + n y_2) - g_1 - n g_2 = 0
\end{aligned}$$

Some rearranging yields $\psi = \frac{y_1}{y_1 + n y_2}$. Substituting this into the above equations yields the desired result in the corresponding lemma.

Bicameral FOCs

This has first order conditions:

$$g_1 : \quad \beta v'(g_1) \frac{U_1^{\beta-1}}{U_2} + (1 - \beta) \alpha_2 v'(g_1) \frac{U_1^\beta}{U_2} - \psi = 0$$

$$\begin{aligned}
g_2 : \quad & \beta\alpha_1 v'(g_2) \frac{U_1^{\beta-1}}{U_2} + (1-\beta)v'(g_2) \frac{U_1^\beta}{U_2} - \psi n = 0 \\
t_1 : \quad & -\beta y_1 \frac{U_1^{\beta-1}}{U_2} + \psi y_1 = 0 \\
t_2 : \quad & -(1-\beta)y_2 \frac{U_1^\beta}{U_2} + \psi n y_2 = 0 \\
\psi : \quad & t_1 y_1 + n t_2 y_2 - g_1 - n g_2 = 0
\end{aligned}$$

Some manipulation of the above yields that $\frac{U_2}{U_1} = \frac{(1-\beta)}{\beta n}$. Making use of this we see that:

$$\begin{aligned}
g_1 : \quad & v'(g_1) = \frac{1}{1 + \alpha_2 n} \\
g_2 : \quad & v'(g_2) = \frac{n}{\alpha_1 + n}
\end{aligned}$$

For proof of the efficiency one need only compare this with the above Pareto optimal allocations to see that the two correspond when $\phi = 1$. To characterize the $\tilde{\beta}^B$ the equilibrium tax rate for region 2 is required. To simplify matters we define $g_1^B \equiv v^{-1}(\frac{1}{1+\alpha_2 n})$ and $g_2^B \equiv v^{-1}(\frac{n}{\alpha_1+n})$. We then have:

$$\begin{aligned}
t_2 = \frac{1}{n y_2 (1 - 2\beta)} & \left[(1 - (1 + \alpha_2 n)\beta)v(g_1^B) \right. \\
& \left. + (\alpha_1 - (\alpha_1 + n)\beta)v(g_2^B) + (1 - \beta)(y_1 + x_1 + x_2) - \beta n y_2 \right]
\end{aligned}$$

Bicameral Uniform FOCs

This has first order conditions:

$$\begin{aligned}
g_1 : \quad & \beta v'(g_1) \frac{U_1^{\beta-1}}{U_2} + (1-\beta)\alpha_2 v'(g_1) \frac{U_1^\beta}{U_2} - \psi = 0 \\
g_2 : \quad & \beta\alpha_1 v'(g_2) \frac{U_1^{\beta-1}}{U_2} + (1-\beta)v'(g_2) \frac{U_1^\beta}{U_2} - \psi n = 0
\end{aligned}$$

$$t : \quad -\beta y_1 \frac{U_1^{\beta-1}}{U_2} - (1-\beta)y_2 \frac{U_1^\beta}{U_2} + \psi(y_1 + ny_2) = 0$$

$$\psi : \quad t(y_1 + ny_2) - g_1 - ng_2 = 0$$

Some manipulation of the above yields that $\psi = \frac{\beta y_1 \frac{U_1}{U_2} + (1-\beta)y_2}{y_1 + ny_2}$. Making use of this we see that the equilibrium $\{g_1, g_2\}$ are characterized by:

$$\frac{v'(g_1)}{v'(g_2)} = \frac{\beta \alpha_1 + (1-\beta) \frac{U_1}{U_2}}{\beta n + (1-\beta) \alpha_2 n \frac{U_1}{U_2}} \quad (2.18)$$

Substituting ψ into the FOCs for $\{g_1, g_2\}$ yields two equations in two unknowns. Methods for solving non-linear systems of equations are required to a full characterization of the solution and description of the allocation.

The existence of $\tilde{\beta}^{BU}$ follows from the same argument given above concerning $\tilde{\beta}^B$. That $\tilde{\beta}^{BU}$ is smaller is a result of the generalized bargaining environment, as described in Muthoo (1999). Define $h(v)$ to be the Pareto frontier:

$$h(v) = \{\max u_2 \in \mathfrak{R} | u_1 = v, \forall v \in [u_1, \bar{u}_1]\}$$

If $h(v)$ is differentiable, then in an asymmetric Nash Bargaining Game we have:

$$-h'(u_1) = \frac{\beta}{1-\beta} \frac{u_2}{u_1}$$

and $u_2 = h(u_1)$. Thus if we concentrate on the utility for region 2 from the bargaining outcome when they are just indifferent between joining the federation, and not we have:

$$-h'(u_1^{BU}) = \frac{\beta}{1-\beta} \frac{u_2^d}{u_1^{BU}}$$

By convexity of the Utility Possibility Set (which follows immediately here from the concavity of preferences) and that the utility for region 1 from bargaining under uniform taxes is strictly less than that without uniformity we know that:

$$-h'(u_1^{BU}) = \frac{\tilde{\beta}^{BU}}{1-\tilde{\beta}^{BU}} \frac{u_2^d}{u_1^{BU}} > -h'(u_1^B) = \frac{\tilde{\beta}^B}{1-\tilde{\beta}^B} \frac{u_2^d}{u_1^B} = \frac{1}{n}$$

Since $-h'(u_1^{BU}) \geq -h'(u_1^B)$, $\frac{1}{n}$ places an lower bound on the slope and $\frac{h'(u_1^{BU})}{h'(u_1^B)} \leq 1$. Combined these statements allow us to conclude that $\tilde{\beta}^{BU} \geq \tilde{\beta}^B$

Chapter 3

Identification of Tax Competition

3.1 Introduction

Local governments do not operate in isolation of their national or sub-national counterparts. Nor are these sub-central governments independent of one another. Thus, locally elected officials must balance responsibilities to the electorate with their acknowledgement that external factors weigh heavily upon their choice set. When locally elected officials make fiscal decisions they must acknowledge the mobility of their tax base, as well as the fiscal decisions of their neighbors. When multiple taxing authorities make simultaneous taxation decisions they are engaging in tax competition over this mobile tax base. This paper tests for the presence of tax competition using data on municipalities of British Columbia, Canada. The responsiveness of a municipality's tax rate to changes in the tax rates of neighbors is estimated by way of a difference-in-differences model. Taxation decisions are subject to a range of issues, that may differ across locations. Estimating a difference-in-differences model allows us to control for all relevant tax setting issues that are unchanged from one time period to the next. Since taxation decisions are influenced by the taxation decisions of neighbors the neighboring jurisdiction's tax rate is endogenous. We deal with the endogeneity problem by way of instrumental variables. The instrument employed in this paper uses variation in the membership of municipal councils as well as tax rates set by other taxing authorities.

We estimate the difference in differences model by looking at variation in the tax rates that occurs at the same frequency with which tax setters can — and do — set tax rates. This is important as focusing on the changes in tax rates over a longer period would induce greater sensitivity to the specification, as there would be greater scope for time variation

of characteristics. The reliance on the frequency with which taxes are set does not require any specification of the manner in which time-invariant characteristics enter the tax setting equation. Thus, rather than *explain* tax rates, we *explain* changes in the changes in tax rates. We ask if tax competition can explain year to year variation in business property tax rates. In addition to this the method presented differs from previous studies in the choice of weighting matrix. Here, past data on the number of new incorporations in each municipality is used to weigh the influence of the tax rates of others, as opposed to the conventional method of employing weights assigned according to geographic distances.

Tax competition has received much attention in the economics literature. Theoretical models have studied both the virtues and vices associated with this form of intergovernmental competition. Proponents of tax competition see this as a method of taming a *Leviathan* government whose hunger for revenue leads to inefficiently high levels of taxation. Opponents of tax competition fear that it induces a *race to the bottom*, with inefficiently low equilibrium tax rates and therefore inefficiently low levels of equilibrium public good provision. Regardless of one's belief of the welfare effects of tax competition, the positive question of whether it is a real phenomenon is of paramount importance.

In the theoretical literature, tax competition is often modeled as a simultaneous move game where jurisdictions strategically set tax rates so as to attract a mobile tax base. Based on the standard theory, we investigate the presence of horizontal tax competition. Here we investigate the presence of tax competition for businesses by municipalities through the setting of business property tax rates at the local level. Identification of tax competition requires the use of an instrumental variable as tax competition induces each region to respond to the tax rates set by their neighbors. There is a second problem inherent in any empirical strategy, which is that of appropriately defining neighbors, of which we will say more below.

The focus of the existing empirical literature has been on the identification of the presence of tax competition rather than identifying who is competing with whom. To avoid identification problems arising from the definition of neighbors an exogenous structure of weights is employed to assert who competes with whom¹. A standard in this literature is to make use of geographic data to select neighbors. This paper is also concerned with identifying the presence of tax competition, but we employ a new strategy. The weights chosen

¹The exogenous nature of the weighting matrix is necessary for identification as indicated in Manski (1993).

are calculated using past information on the flows of new business into the municipalities. These past flows of new business are exogenous at the time period within which we wish to identify the effect of neighboring tax rates on a municipalities own tax rate, and thus appropriate. In addition the weights have appeal in that they capture the mobility of the tax base on the extensive margin. While distance weights are often motivated with a transportation cost argument, new incorporation measures give insight into the substitutability of capital across any two neighbors as revealed by past decisions. The new incorporations weights reveal neighborliness intensities for a pair of regions i and j . For region i this weight is the historical average fraction of *new* businesses that incorporate in region j of those new businesses that incorporate in either region i or j . These weights are then re-weighted relative to all other municipalities that are not i or j . This has both the intuitive appeal of a revealed preference argument and the property of not restricting the set of neighbors in some ad hoc fashion².

A vertical externality is often also present when discussing tax competition at the local level. This is due to the existence of supra-local governments and organizations that have authority to tax the same base. In the context of British Columbia there are the municipal finance authority, the province itself and some other agencies of the province³. Theory would predict that vertical externalities produce inefficiently high tax rates as both levels of government set tax rates excessively high to capture more revenue. Addressing these issues is of secondary importance for this paper. Rather we employ the effect of the vertical externality as a component of our instrument to identify the horizontal competition.

The outline of the paper is as follows. Section two discusses this paper in the context of the existing literature on tax competition. Section three provides institutional background on the fiscal environment of British Columbia's municipalities. Section four presents a brief description of the data. Section five presents the empirical strategy. Section six discusses the results. Section seven presents a discussion of robustness checks. Section eight concludes.

²If one were to stretch the competition aspect of tax competition to analogy, these weights suggest that one cannot become a winner unless one were to gain ground on previous winners. It is likely that previous losers are *no competition at all*.

³These are BCA (assessment authority), MFA (finance authority), Translink, BC Transit, and hospital and school districts. The province is the first mover in tax setting.

3.2 Literature Review

As mentioned above there are many papers concerning theories of tax competition. While this paper presents a very simple theoretical foundation for the empirical strategy, many of the models imply a best response function of the form estimated below. For a survey of literature on fiscal federalism see Oates (1999). Of fundamental importance for the purposes of this paper is the relevant empirical literature.

Brueckner (2003) presents a survey of empirical papers on intergovernmental strategic interactions. This paper demonstrates the approaches employed in the literature and critiques their implementation. Here a distinction between resource-flow and spillover models is made and much of the paper is devoted to discussing the econometric issues encountered when estimating best response functions for intergovernmental games. While the present paper falls into the resource flow category as far as our theoretical motivation is concerned, there is no distinction between the empirical approaches employed to estimate either form of interaction.

This work is most similar to Brett and Pinkse (2000). The authors estimate the determinants of municipal tax rates in British Columbia, Canada. Brett and Pinkse estimate structural and reduced-form tax determination functions. In their reduced-form specification they find an estimated effect of the average neighbor's tax rate on a municipality's tax rate to be one. The estimation of the joint determination of the tax rate and the tax base provides *no evidence of tax competition*. They explore a number of methods for defining neighbors and settle on a road-neighbor definition. The sample period discussed is 1991 and 1987. They solve the problem of endogenously determined regressors by using the business property tax rate set by the regional district as an instrument for the business property tax rate set by neighbors municipalities. There are two problems with their strategy. First the justification to focus on the "basic municipal rates because they are the choice variables of the municipalities" is without foundation. The municipality chooses not only the basic municipal rate, but also the regional district rate⁴. Second, the use of variation in regional district tax rates as an instrument is invalid as regional district tax rates are determined by the municipality. We use a different instrument in this paper, making use of variation in the council membership, and taxes set by other taxing authorities to instrument for the tax rates of neighbors.

⁴More will be said of this below.

Brulhart and Jametti (2006) study a model that tests whether vertical or horizontal tax competition dominates among Swiss municipalities between 1985 and 2000. Switzerland has a structure that is analogous to a federation of federations enabling them to test for the relative strengths of both kinds of competition across a sample of similarly structured federations. Their identification strategy rests on the assumption that direct democracy is equivalent to a benevolent government, and their finding is that in Switzerland the vertical tax externality dominates the horizontal externality.

All empirical studies of tax competition wrestle with ascribing the identified interaction to the behavior of tax authorities. There is another theory that predicts tax reaction functions of the form estimated here. Yardstick competition occurs as tax authorities, being elected officials, look to the tax rates of their neighbors as they anticipate the electorate evaluating their performance in office relative to the performance of other tax authorities. See Besley and Case (1995) for a description of this phenomenon. We cannot rule out the presence of yardstick competition in the province, but there is an indication that it applies less to this study for two reasons. First we do not use geographic weights but weights based on a notion of economic closeness as revealed by past business location decisions. Second we explore business property taxation rather than residential property taxation with the latter being of primary importance to voters.

3.3 Theoretical Motivation

Consider a simple environment where a local government is faced with the opportunity to change the tax rate, t_i . Politicians are elected and have the opportunity to set tax rates given the existing tax base. Political agents care about current and future revenue. Given the recursive nature of the tradeoffs faced, for simplicity we will work with a two period model. The tax setting authority for municipality i would like to maximize revenue. Tax revenue is equal to the tax base, $B_i(t_i, t_{-i}^-)$ a function of own and neighboring tax rates, multiplied by the tax rate, t_i . We assume that the tax base is a linear function of both own, and neighbor's tax rates:

$$B_i = B_o + \gamma t_{-i}^- - \delta t_i$$

where $t_{-i}^- = \sum_{j \neq i} w_{ij} t_j$ with w_{ij} denoting the weight reflecting the importance of the tax rate from neighboring municipality j in determining the tax base in municipality i . Thus each

municipality i , given t_{-i} solves the following program:

$$\max_{t_i} t_i B(t_i, t_{-i}^-)$$

This yields $t_i = \frac{B_o + \beta t_{-i}^-}{2\delta}$ as the reaction function for region i . The marginal effect of a change in t_{-i}^- on t_i is given as:

$$\frac{dt_i}{dt_{-i}^-} = \frac{\gamma}{2\delta}$$

Natural assumptions on the parameters γ and δ are that they are each positive as the tax base in municipality i is non-increasing in the tax rate of jurisdiction i , ($\delta > 0$), and is non-decreasing in the tax rate of jurisdiction j , ($\gamma > 0$). This implies that tax rates are strategic complements.

The above theoretical description of tax base formation is an over simplification as the tax base in a municipality will no doubt be determined by other municipality characteristics. However, as will be described below, the influences of these other factors can be ignored when focussing on a higher frequency of tax changing decisions than we observe variation in these characteristics.

3.4 Institutional Background

British Columbia⁵ has two levels of local government: regional districts and municipal governments. Municipalities are locally incorporated areas that provide local governance. These local governments have the ability to tax and borrow to finance municipal expenditures. Decisions are made by a council composed of elected councillors and a mayor by way of majority voting.

Regional districts are larger geographic units composed of a set of municipalities and possibly other unincorporated areas. These collections of municipalities provide public goods and services to member municipalities. Some of the services provided by regional districts include regional parks, regional planning, water supply, sewage treatment and disposal, and solid waste management. For unincorporated areas in a regional district the regional district is the only form of local government and provides the full range of services listed above as well as some of those services that member municipalities normally provide. Some examples

⁵Data on municipal finance was accessed from http://www.cserv.gov.bc.ca/lgd/infra/statistics_index.htm. Municipal election data was hand entered from <http://www.civinet.bc.ca/siteengine/ActivePage.asp?PageID=34>.

of services provided by regional districts to unincorporated areas are building inspection, nuisance regulation, community parks, water distribution, fire protection, street lighting, and recreation.

Regional district decisions are made by a board of directors. This board is composed of one member from each of the member municipalities as well as one member for each unincorporated electoral area. Members representing unincorporated areas are directly elected, while those representing member municipalities are appointed by the municipal council. The regional district decides the cost recovery allocation for services provided within its jurisdiction. This is an allocation of costs to member areas. For municipalities cost recovery occurs as a bill for services is provided to the municipality by the regional district.

Regional districts do not have taxing authority in municipalities in British Columbia. Municipalities are free to raise revenue to be paid to the regional district through whichever instruments they deem appropriate with one caveat; municipalities using taxes on property to collect revenue to be paid to the regional district must set a separate rate for this purpose. That is, municipalities must provide property owners with a separate rate of taxation for revenue raised for general municipal expenditure than that for revenue raised for municipal obligations to the regional district.

Municipalities are not the only authority collecting taxes on property in British Columbia. The provincial government levies taxes on property to finance educational and health expenditures. The Municipal Finance Authority, British Columbia Assessment, BC Transit, and the Greater Vancouver Transit Authority all have legislative authority to tax property. These organizations set their own tax rates, and taxes are collected by the municipalities.

There are nine property classes in British Columbia. These are residential, utilities, unmanaged forest land, major industry, light industry, business, managed forest land, recreational property non-profit organization, and farm land. Business property is defined as that “used for offices, wholesale, retail, hotels and motels”, and property that does not fall into the other classes⁶. The measure of business property tax rates used below is the rate on business class property that is determined by the municipality, the sum of that for municipal expenditure and that for regional district expenditure.

Property values are assessed for all classes by BC Assessment. BC Assessment is a provincial crown corporation, which operates independently of all municipalities. Thus the

⁶<http://www.bcassessment.ca/process/classification.asp> accessed Nov. 3, 2007.

assessment of each municipalities property is conducted by a third party. BC Assessment forms property value estimates by making use of past and current sales of individual properties and their individual neighbors.⁷

That tax competition is strong in this data is not surprising given the recent⁸ developments in the provincial economy. One feature of British Columbia's economy is the astronomical gains on property. Property values (residential and business) have been increasing very rapidly. Table 3.15 indicates these changes. The average change in assessed value of business property was 10% per annum over the six year period. These gains in the average business property assessed value have risen to 15% between 2004 and 2006, up from 6% between 2001 and 2003. The effect of rising property values is predicted to have an ambiguous effect on the incentives to compete over the tax base as both the opportunity cost of lowering the rate today and the benefit from attracting a larger base are both increasing. In addition, the announcement of the coming Winter Olympics in 2010, has appeared to have an effect, as construction in the province experienced a boom in response.

Table 3.1: Importance of Property Taxes 2003

Variable	N	Mean	SD	Min	Max
Residential Taxes, Percent of Total	154	58.26	21.92	5.00	100.00
Residential Value, Percent of Total	154	78.25	13.81	31.00	100.00
Assessed Value of Residential Property	154	1790*	5630	5.588	58300
Business Taxes, Percent of Total	154	22.20	13.32	0.00	53.00
Business Value, Percent of Total	154	13.11	7.78	0.00	35.00
Assessed Value of Business Property	154	323*	1250	0.011	13800

* Millions of Dollars (nominal)

Property taxes are an important source of revenue. Table 3.1 shows that residential property taxes make up on average 58% of total tax revenue while residential property is on average 78% of a municipality's total value of assessed property. Business taxes play a less important role; comprising on average 22% of the total tax revenue, while the value of business property is just 13% of the total value of assessed property. These figures suggest that while business property plays a slightly lesser role in tax revenue than residential

⁷More can be learned of the assessment process by visiting <http://www.bccassessment.bc.ca/process/index.asp> accessed Dec. 19, 2008

⁸At the time of writing this document.

property, its share of the tax burden is slightly larger.

Table 3.2 presents summary statistics for municipal business property tax rates. These rates are set no later than May 15th for each year. Note that the tax rates reported are those set by the municipality for the collection of municipal revenue, as well as regional district revenue. Municipal councils appear to have experienced a transition from a state of increasing property tax rates to one of decreasing property tax rates. As indicated in Table 3.2 average municipal business property tax rates increased between 2001 and 2005, only to decrease in 2006 below the 2003 level. This non-monotonicity over time further reveals that there may be something non-systematic about the tax setting behavior of municipal councils. As indicated in Table 3.7 the majority of municipalities are have decreased their tax rates.

Table 3.2: Municipal* Business Property Tax Rates 2001-2006

Year	N	Mean	sd	Min	Max
2001	150	15.96	6.18	3.06	49.02
2002	150	16.32	6.82	3.06	64.54
2003	150	16.67	7.16	3.02	69.42
2004	150	16.73	7.56	2.58	76.33
2005	150	16.62	8.42	2.20	88.65
2006	150	16.35	8.01	1.95	80.06

* Municipal + Regional District

Table 3.3: Average Percent Increase in Municipal* Tax Rates, 2001-2006

Interval	Business	Residential
2001-02	2.22	2.63
2002-03	2.13	0.84
2003-04	0.39	-0.93
2004-05	-1.57	-2.72
2005-06	-2.43	-5.34

* Municipal + Regional District

As indicated in Table 3.4 municipal residential tax rates followed a similar pattern to that of business property tax rates, however they began to decrease one year prior. Tax setters face three considerations when determining tax rates on business property; tax base

mobility to other jurisdictions, the tax rates of other tax setting authorities, and election outcomes. Here we do not explicitly incorporate the latter two into the decision making process, but exploit the variation therein to learn about the former. Of great importance in economic decision making is the budget constraint. Table 3.4 is informative by illustrating changes in the structure of this budget constraint. From comparing Tables 3.4 and 3.2 one can see that not only are business tax rates higher than residential, they also exhibit at least twice the variation.

Table 3.4: Municipal* Residential Property Tax Rates 2001-2006

Year	N	Mean	sd	Min	Max
2001	150	6.57	2.88	0.15	25.59
2002	150	6.75	2.88	0.36	26.34
2003	150	6.84	3.18	0.09	30.26
2004	150	6.79	3.43	0.12	31.16
2005	150	6.35	3.58	0.51	36.18
2006	150	5.99	3.33	0.53	32.68

* Municipal + Regional District

My instrument requires variation in other residential property tax rates not set by the municipality to affect business property tax rates through the electorate. This argument has an appeal as there is an un-modeled linkage between rates and elections through the structure of the budget constraint.

Changes in other tax rates not set by the municipality summarized in Table 3.5. These are the sum of the tax rates set by the province, the Municipal Finance Authority, BC Assessment, and the transit authorities. These appear to be decreasing at a decreasing rate

Table 3.5: Average Percent Increase in Other Tax Rates, 2001-2006

Interval	Business	Residential
2001-02	-0.44	0.57
2002-03	0.31	-1.02
2003-04	-0.26	-4.91
2004-05	-2.02	-9.27
2005-06	-3.57	-9.14

over the sample period for both business and residential property. This release of the tax base from these external taxing authorities increases the scope for taxation at the municipal level. Decreasing the constraint on taxing authorities should increase the ability to explore innovations in the tax rate schedule. It is clear from the Table that the greatest changes in tax rates set by other tax authorities are found in taxes that apply to the residential property class.

3.4.1 Effects of Elections

Municipal councils are the authorities that set the tax rates on all forms of property for the purposes of collecting revenue for both the regional district and themselves. Hence, changes in the composition of the council is one source of variation that influences changes in property tax rates.

Table 3.6: **Election Results**

Variable	N	Mean	SD	Min	Max
Year 2002					
Number of Councillors	150	5.44	1.30	4.00	10.00
Council Incumbency Rate	150	51.22	25.67	0.00	100.00
Acclimation Rate	150	6.01	22.67	0.00	100.00
Mayor Incumbency Rate	150	58.6	49.41	0.00	100.00
Year 2005					
Number of Councillors	150	5.44	1.30	4.00	10.00
Council Incumbency Rate	150	54.22	24.63	0.00	100.00
Acclimation Rate	150	11.27	31.20	0.00	100.00
Mayor Incumbency Rate	150	55.41	49.87	0.00	100.00

The minimum number of councillors per municipal population is assigned by the provincial *Municipal Act*. Municipalities are free to change the number of councillors by way of bylaw to a higher number. Table 3.6 shows that 36% of municipalities have four councillors, 53% have six councillors, and 9% have eight⁹.

Since 1996 municipal elections are legislated to take place every three years. The most recent two elections were held in November of 2002 and November of 2005. Table 3.6 presents summary statistics regarding municipal council elections. On average, 50% of

⁹The remaining 2% consist of one council each with 5,7, and 10 members

municipal councillors are re-elected, while the percent of mayors re-elected was 6% in 2002 and 10% in 2005. One would think that changes in municipal councils reflects changes in voter preferences, as the ballot box is the means through which the citizens can voice their approval/disapproval of the current regime. As argued in Besley and Case (1995) vote-seeking and tax setting are linked. A key policy variable in the evaluation of the performance of elected office holders is the tax rate on residential property as voters in municipal elections in British Columbia are property owners. While residential property taxes are likely of greatest interest to the electorate, any preference revelation that affects residential property tax rates will in turn have an impact on business property tax rates through the budget constraint.

Table 3.7 displays the percent of municipalities cutting tax rates by property class and year. There is no indication that the first election year, 2002, had a large impact on property taxes.

Table 3.7: Percent Municipalities cutting tax rates by year, property class

Year	Business	Residence	Both
2001-2	32	20	18
2002-3	32	44	24
2003-4	41	61	38
2004-5	70	84	68
2005-6	61	78	58

Our second election year, 2005, is associated with the largest set of municipalities that engaged in tax cuts on both property classes. 84% cut residential tax rates, while 70% cut business property tax rates. Although this is not a long time horizon, it appears that there is a trend towards lower property taxes on both forms of property.

3.5 Empirical Strategy

The empirical strategy employed is one of estimating a difference in differences model. As the variable of interest is endogenous we use instrumental variables to identify the effect. Employing the difference-in-differences estimation technique allows us to control for factors that affect tax setting that are time invariant. Much of the specification issue is then avoided as all time invariant municipal effects are differenced out. This is appealing in a

model of tax competition because the technique employed does not require uniformity of the influence of parameters on those characteristics associated with the provision of public goods. Many specifications were run including time varying characteristics as additional regressors. As weak instruments is of concern for the approach taken here, their irrelevance was the criteria for exclusion. We assert here that our choice to concentrate on changes that occur at the frequency of tax setting may be an appropriate method of determining the presence of tax competition, while decreasing the likelihood of suffering greatly from the omission of regressors.

The theory predicts that the tax rate in a municipality is a linear function of the tax rate of neighbors. Taking the first-difference gives the following regression equation:

$$\Delta t_i = \alpha + \beta \sum_{j \in J^{-i}} w_{ij} \Delta t_j + \varepsilon_i \quad (3.1)$$

where J is the set of competitors. The term, w_{ij} , is the weight associating region i with region j . This weight is intended to reflect the tradeoff facing the tax base when deciding where to locate. Thus there is a w_{ij} for all pairs (i, j) , such that they sum to one and $w_{ii} = 0$ for all i .

The regression equation above is standard in the literature. There are two big issues with identification of the parameter of interest β . The first problem with estimating the above equation by ordinary least squares is that if tax setting involves strategic interaction then tax rates in region j respond to changes in the tax rates set by their neighbors (i). If the tax rate in neighboring jurisdictions decrease, a jurisdiction has the incentive to decrease their tax rate as well in order to attract the mobile base. The endogeneity is present as $Cov[\Delta t_i, \varepsilon_i] \neq 0$. This endogeneity is built into the model since in the above equation Δt_j responds to Δt_i .

The second problem is the appropriate weighting strategy defining neighborliness. The strategy for dealing with each of these problems is addressed in the following two subsections.

3.5.1 Instrumenting for Tax Rates

We employ instrumental variables to deal with the endogeneity in the above equation. The instruments used are the change in the tax on residential property that is not set by the municipality and the fraction of the council re-elected. These are valid instruments because they are both exogenous and relevant. The change in the tax on residential property is

exogenous because this tax portion is set by authorities other than the municipality on a different tax base. The election outcomes of municipality i do not have spill-over effects on the tax rates of neighbors other than through the tax rate of municipality i . More precisely we require that election outcomes of neighboring municipalities can affect a municipality's tax rate only through the tax rate of the neighboring region. The instrument is relevant as the changes in tax rates set by other taxing authorities on residential property and changes in the council composition are correlated with a municipality's tax rate on business property. Tax rates set by other authorities constrain the ability of a council to optimize the schedule of property taxes, as does the changes in the composition of the council themselves.

We expect there to be a strong correlation. Theory predicts that if supra-local tax setters set higher tax rates local governments will follow, these are strategic complements (vertical tax externality). Whoever controls the local decision, will normally wish to change business taxes as well. The reason is as follows: suppose that the municipal tax authority has implemented the optimal tax schedule, given a supra-local tax schedule. Then there is a change in the supra-local tax schedule. To retain the optimal tax burden for the electorate a municipality must readjust their tax rates. The data indicate that the sign is positive, indicating that is present on residential property, the higher will be residential property taxes¹⁰. This is confirmed by the data. Tax setting authorities must rationalize increases in residential property taxes to their constituents or face the possibility of losing office. One explanation could be that in order to avoid this politically costly situation councils increase the tax on business property. Increases in business property tax rates can demonstrate to the electorate that the increased revenue burden is not falling solely upon their backs. We estimate using Two Stage Least Squares. We will provide these first stage regression results below. Tables 3.8 and 3.9 report summary statistics on other tax rates.

The estimation of the first stage involves regressing the change in the business property tax rate on the change in the residential tax rate set by others and the changes in council membership, ie. the number of newly elected councillors divided by the total council seats, T . The results are somewhat sensitive to the choice of instrument. The decision to use the interaction was obtained by testing down; including the individual effects of each regressor (incumbency rate, change in residential tax rate, and the interaction term). The interaction term proved to be the candidate satisfying the most criteria as a strong instrument. This

¹⁰Recall that vertical tax competition models predict a positive correlation between these two tax rates as both authorities attempt to acquire revenue.

variable is constructed as:

$$T = \Delta Council_{\tau, \tau-1} \Delta t_{\tau, \tau-1}^{O(res)}$$

Where τ indicates the time period, and Δ is the difference operator indicating the change in the variable to which Δ is applied. Suppressing these time period indicators we regress:

$$\Delta t_j = \gamma + \delta_1 T_j + u_j$$

We obtain the predicted values from this regression to construct $\Delta \hat{t}_j$ which is then used in our second stage. The second stage is then:

$$\Delta t_i = \alpha + \beta \sum_{j \in J^{-i}} w_{ij} \Delta \hat{t}_j + \delta_1 T_i + \varepsilon_i$$

The necessary conditions for the validity of the instrument are that $Corr[T_j, \varepsilon_i] = 0$ and that $Corr[T_j, t_j] \neq 0$ is sufficient to not qualify as a weak instrument.

Table 3.16 reports the presence of a vertical externality on business and on residential property tax bases. While there is strong evidence of a vertical externality on residential property, there is little evidence for that of business property taxes. Much of the absence of a vertical externality on business property taxes may be due to the absence of variation in the business property taxes set by others.

Given the strong correlation between the residential tax rate set by others and the municipality itself it is reasonable to believe that this would have an impact on the fiscal decisions concerning other rates made by the municipality. Thus this tax rate is a candidate for an instrument for changes in tax rates.

Table 3.8: Other Business Property Tax Rates 2001-2006

Year	N	Mean	sd	Min	Max
2001	150	11.44	0.46	10.51	13.25
2002	150	11.38	0.53	10.52	13.48
2003	150	11.42	0.51	10.40	13.62
2004	150	11.39	0.56	10.44	14.62
2005	150	11.16	0.61	10.14	14.08
2006	150	10.76	0.60	9.69	13.34

Table 3.9: Other Residential Property Tax Rates 2001-2006

Year	N	Mean	sd	Min	Max
2001	150	5.43	1.20	2.84	9.25
2002	150	5.46	1.22	2.91	9.55
2003	150	5.40	1.34	2.76	9.53
2004	150	5.14	1.40	2.55	8.98
2005	150	4.66	1.38	2.33	7.94
2006	150	4.23	1.28	2.19	6.97

3.5.2 Weighting Neighbors

The choice of neighbors is not a trivial one. Many authors construct a weighting matrix employing some form of distance metric. In this paper we use a measure of past new incorporations. This is intended to reveal the preferences of capital allocators when deciding over location. There are two margins where investment activity in business property can be noticed. Along the intensive margin businesses make additional investments in currently owned business property. Along the extensive margin businesses choose where to locate. Both will be influenced by taxes. New incorporation data reveals investment activity on the extensive margin. These measures of new incorporation data reflect the sensitivity of the location decision. By using past new incorporation data we do not encounter identification problems.

We employ two choices of neighbor sets using this information. Each of these apply weights to all municipalities. Thus, a municipality is assumed to compete with all other municipalities to the degree as measured by the weight assigned. Once weights are assigned we then use these to construct the average change in neighboring tax rates variable to be used in our regression analysis.

We construct weights using the average new incorporations from the ten year period prior to the sample of data used in the estimation below¹¹. Let n_i represent the average number of new incorporations in municipality i . The first weighting strategy has:

$$w_{ij} = \frac{n_j}{n_i + n_j}$$

for all i, j where i is not equal to j , and $w_{ij} = 0$ when $i = j$. These weights are then re-scaled

¹¹Weights using the contemporaneous correlation of n_i and n_j are in development

so as to sum to one for each i . We call these weights the *relative weights*¹². The appeal of this weighting strategy is from the perspective that winning a competition requires beating the winners, not the losers. That is, tax setters are more likely to attract capital from those who historically gain the most, relative to themselves. Those municipalities who are losing to them in recent history are given lower weights. This has the intuitive flavor of a revealed preference argument. Note that the weight for a region i is thus sensitive to not only the relative difference between i and j , but also to the average number of new incorporations in region i . As average number of new incorporations in municipality i increases this will decrease the weight.

The second weighting strategy has:

$$w_{ij} = \frac{1}{|n_i - n_j|}$$

Again this is re-scaled to sum to one over i . We call these weights the *absolute weights*. For any region i these weights place greater importance on regions j whose average flow of new incorporations is similar to i 's. Those municipalities with average flows of new incorporations that are more similar receive higher weight through this strategy while those with very different average flows of new incorporations receive smaller weights. This is appealing because it implies that those regions with a similar number of new incorporations are similarly attractive to mobile capital.

This weighting strategy has the unappealing quality that it is treating competition between i and j the same as that between j and i regardless of the sign of the difference in magnitude¹³. The sign may matter as one would think that municipality i will be more sensitive to municipality j , if j is attracting more new business than municipality i ; as opposed to the reverse. While these weights do give similar neighbor pairs similar pairs and greater weights, it gives lower weights to all those with large deviations from their flow of new incorporations who may still be likely competitors.

Table 3.10 is not only informative of the weights employed, but also displays the cycle of new businesses entering the province over the past sixteen years. The most recent years have seen improved growth in the establishment of new business in the province after a

¹²This choice of weights is not without its shortcomings. The re-scaling of weights means that the magnitude of the weight of a municipality is sensitive to the size of that municipality's new incorporations. The effect is positive, and a proof is available from the author by request.

¹³This same quality is present when one employs geographic weights based on distance.

Table 3.10: New Incorporations 1990-2006

Year	New Incorporations	Percent Change
1990	19550	na
1991	18528	-5.23
1992	20406	10.14
1993	22955	12.49
1994	25774	12.28
1995	23846	-7.48
1996	23237	-2.53
1997	22958	-1.20
1998	20759	-9.58
1999	21009	1.20
2000	21386	1.79
2001	19474	-8.94
2002	20987	7.77
2003	22531	7.36
2004	24703	9.64
2005	30937	25.24
2006	33273	7.55

period of decline. With 33,273 new businesses entering in the year 2006, it is likely that our weights present not only a new method of identifying tax competition, but also evidence of an alternative mechanism through which tax base competition occurs. As many geographic weights are justified on the basis of capital relocation costs, these weights involve the initial location of “perfectly” mobile capital.

3.6 Results

Our pursuit of evidence for tax competition yields results that are sensitive to the weighting matrix. The instrument is valid and not weak according to the test of weak instruments found in Stock, Wright, and Yogo (2002). Given absolute weights we find an insignificant effect of the variable of interest, while relative weights yield a positive and significant coefficient. Since alternative weights imply alternative assumptions of the nature of tax competition, one could conclude that the rejection of one model reveals the inconsistency of the data with tax competition of the nature implied by those particular weights. A

specification that does not refine the set of neighbors, J , is used as any refinement appears to be ad hoc without additional data¹⁴. While the data provide information that could define neighbors as those members within a regional district, this procedure is not employed as regional districts are first by definition a set of cooperating/coordinating municipalities, and second because this would unreasonably constrain the definition of neighbors to exclude close geographic neighbors.

¹⁴Some supplementary tables are included however using the definitions of neighbors found in Brett and Pinkse

Table 3.15 contains summary statistics for the variables employed in the regression analysis. Notice that the variable $\Delta Council_{\tau, \tau-1}$ is somewhat different than that presented when discussing elections. This variable is the fraction of incumbent councillors adjusted for the incumbency of the mayor. As we can see from the summary statistics, of those councils who re-elected their full council, none of them re-elected their mayor. We can see that there is more variation in changes in business property tax rates set by the municipality than any other changes in tax rates. Below we present the results of each weighting strategy separately.

The qualification as a not weak instrument is satisfied using the criteria established in both Staiger and Stock (1997)¹⁵ and Stock, Wright and Yogo (2002)¹⁶. The results in table

Table 3.11: Determinants of Tax Changes (Relative)

COEFFICIENT	(1) OLS	(2) First Stage	(3) IV
Δt_{-i}	0.571*** (0.25)		0.567* (0.31)
iv_T		0.0223*** (0.00061)	
T	0.0106*** (0.0040)		0.0107* (0.006)
Constant	0.342** (0.13)	0.501*** (0.020)	0.344* (0.20)
Observations	296	296	296
R^2	0.06	0.88	0.07
F statistic	8.5	1315.17	8.96

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Pooled data with clustered municipalities

3.11 indicate that, surprisingly, there is not a significant bias in the OLS estimator. Should

¹⁵This criteria suggests a rule of thumb of a first stage F -statistic > 10 . Many specifications of the set of instrument involving these data achieve this objective.

¹⁶These authors establish critical values for the F statistic from a two stage least squares procedure. The critical value for the first stage with one instrument is 8.96).

one not adjust for the endogenous regressor, one would not be more likely fail to reject the null hypothesis of no tax competition. As can be seen from the first stage of the instrumental variable estimation the $F - statistic$ is 1315.17, and thus well over the minimum criteria for strong instruments presented by Stock, Wright, and Yogo (2002). This leads me to make inferences from the results of the second stage and conclude that there is evidence for the existence of business property tax competition in British Columbia (given these weights)¹⁷. The sign of the coefficient is positive, as was predicted in theoretical work. With a magnitude of 0.57, the analysis indicates that as the average neighbor's business property tax rate decreases, a competing municipality decreases their business property tax rate by 0.56 times this decrease¹⁸. Consider an example to illustrate these level effects. If the average decrease of municipality i 's neighbors' tax rates is 0.46 this would induce municipality i to decrease their own tax rate by 0.2622. This consistent estimate indicates that tax competition is indeed taking place.

To investigate the sensitivity of our results to the choice of the weights, we employ the *absolute weights*. The results from this analysis are in table 3.12. The results of the second stage are insignificant, while the biased OLS indicates a negative effect. It is important to note that our asymptotically consistent results are again consistent with the presence of tax competition. It is important to note that while we obtain consistent estimates through the employment of instrumental variables, it maybe that there are time varying characteristics that are omitted from the regression. A number of specifications were estimated with measures of the change in property values as a control variable. All were found to have no effect¹⁹. This is not surprising as the total assessed value does not capture the likely manner in which property values matter for tax setting; through the median voter.

The observed sensitivity of the results to the choice of weighting matrix is not encouraging. It could be that neither choice of the weighting matrix is optimally capturing the presumed competition intensity given the data. The assertion that municipalities compete with a stable set of other municipalities at fixed levels of intensity may be too strong.

To further investigate the role of the weights used robustness checks using the weights used in Brett and Pinsky (2000) have been conducted and the results are summarized in

¹⁷The standard errors are adjusted for the implementation of 2SLS.

¹⁸This is a reasonably large effect, well within the bounds one would expect ex ante: [0, 1].

¹⁹For example the raw correlation between changes in business tax rates and changes in the value of business property is -0.08.

Table 3.12: Determinants of Tax Changes (Absolute)

COEFFICIENT	(1) OLS	(2) First Stage	(3) IV
Δt_{-i}	-0.242 (0.255)		0.342 (0.60)
iv_T		0.0220*** (0.0016)	
T	0.0196*** (0.0056)	0.0168*** (0.0048)	0.0129*** (0.0058)
Constant	0.646*** (0.16)	0.666*** (0.051)	0.338 (0.23)
Observations	296	296	296
R^2	0.06	0.43	0.03
F statistic	6.61	186.58	7.70

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Pooled data with clustered standard errors

tables 3.13 and 3.14²⁰. Table 3.13 presents a summary of the point estimates on neighbors' tax changes using five weighting matrices, and three first stage specifications for our 2SLS estimates. The weighting matrices are constructed using our two hypothesized definitions of neighborliness discussed above, and three definitions of neighborliness used in Brett and Pinsky (2003). *Nearest* weights define a municipality's neighbors as their four nearest neighbors. *Border* weights define municipalities to be neighbors only if they share a common border. *Distance* weights use the euclidian physical distance between municipalities to describe their neighborliness.

The point estimates for the coefficient on changes in neighbors' tax rates varies using these different weighting strategies. However all point estimates using the interaction of tax rate changes on residential property set by other tax authorities and the fraction of the council that is reelected are positive and between zero and one.

²⁰All regression output used to produce these tables is contained in tables 3.17 to 3.26 in Appendix B.

Table 3.13: Coefficient on Neighbor's Tax

Table 1.3 Point Estimates for Coefficient on Neighbor's Tax Rates

Specification	Neighborliness				
	Nearest	Distance	Border	Relative	Absolute
All	-0.0254	0.0642	0.340***	0.916***	0.528*
Both	-0.256	0.347	-0.295	0.837**	0.579*
Inter	0.712***	0.836**	0.275**	0.567*	0.343

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

One may also be concerned that the use of the interaction of tax rate changes on residential property set by other tax authorities and the fraction of the council that is reelected and not allowing for the independent effects is inappropriate. Table 14 reports the results of testing the null hypothesis of weak instruments using the independent effects (labeled *Both*), their interaction (labeled *Inter*), and all of the independent and interacted effects (labeled *All*). The test is as described in Stock, Wright and Yogo (2002). These tests indicate that the use of the interaction term is the most robust to the problem of weak instruments, rejecting the null that the instrument is weak at the 10% level for all definitions of neighbors. However the inability to reject the null of weak instruments with the inclusion of the independent effects is not reassuring.

Still, the exercise demonstrates that there is evidence of tax competition among local governments in British Columbia. Of course, one must be cautious not to over-emphasize the results, given the sensitivity to the choice of neighbors, and their weights respectively for neighbors. Under the null hypothesis of a Leviathan government it appears that tax competition is present when one is *looking in the right place*. That is to say, once one has acquired the true weights for neighbors.

A necessary refinement of the above analysis is to compare the results established here to those involving the usual geographic measure of neighbors.

Table 3.14: Test For Weak Instruments

Strongest Rejection of Maximal IV Size Tests					
Null Hypothesis is Weak Instruments					
Specification	Nearest	Distance	Border	Relative	Absolute
All	none	10%	15%	10%	10%
Both	none	10%	15%	10%	10%
Inter	10%	10%	10%	10%	10%

“none” denotes failed to reject at all conventional levels of statistical significance

3.7 Conclusion

Tax competition does not occur in a bubble, if at all. Electoral concerns are of importance when considering the effects of inter-jurisdictional competition. Surely decision makers face a trade-off between these two margins; the electorate, and competing neighbors. In this paper variation in the composition of municipal councils and decisions made by other supra-local taxing authorities are exploited to identify the effect of neighboring tax rates on a municipality’s tax rate.

Once an appropriate instrument is used to estimate the relationship between a municipality’s tax rate and those of its neighbor there is a large effect of tax competition as the mechanism generating changes in tax rates. Given voters’ high stakes in residential tax rates, any changes in the ability of the current council to continue taxing residential property at a given intensity impacts the business property tax rates as well. Thus our instrument involves this margin as well as changes in council composition to achieve the desired result. While the effect identified is large this may be due to the small sample properties of the estimator. This effect is different that that found by Brett and Pinsky (2003), who found little evidence from their instrumental variables strategy in British Columbia.

3.8 References

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3.9 Appendix B

Table 3.15: Summary Statistics

Variable	N	Mean	SD	Min	Max
$\Delta t_{03,01}^M$ (bus)	296	.6885856	2.228984	-10.1182	20.40611
$\Delta t_{06,04}^M$ (bus)	296	-.3937151	1.738963	-4.99994	5.17318
$\Delta t_{03,01}^M$ (res)	296	.2727697	.7468943	-1.7625	4.6647
$\Delta t_{06,04}^M$ (res)	296	-.8284483	1.246198	-8.716802	2.1115
$\Delta t_{03,01}^O$ (bus)	296	-.0126816	.3051687	-1.218819	1.268161
$\Delta t_{06,04}^O$ (bus)	296	-.6312503	.3433581	-1.344198	.168231
$\Delta t_{03,01}^O$ (res)	296	-.0195485	.3751324	-1.1268	2.84862
$\Delta t_{06,04}^O$ (res)	296	-.9102296	.3837076	-2.2818	.1352098
$\Delta t_{\tau,\tau-1}^M$ (bus)	296	.1474353	2.071236	-10.1182	20.40611
$\Delta t_{\tau,\tau-1}^M$ (res)	296	-.2778393	1.166031	-8.716802	4.6647
$\Delta Council_{\tau,\tau-1}$	296	45.05897	20.99505	0	85.71429
$\Delta Value_{\tau,\tau-1}$	312	10.93043	25.61396	-99.88888	292.8571
$\Delta Value_{06,04}$	312	15.61558	18.14909	-62.69367	92.74194
$\Delta Value_{03,01}$	312	6.245279	30.6385	-99.88888	292.8571
$\Delta t_{\tau,\tau-1}^O$ (res)	296	-.464889	.5856436	-2.2818	2.84862
T	296	-21.39352	29.23665	-136.9785	77.68964
$\Delta t_{\tau,\tau-1}$ (predicted)	296	.1474353	.4921643	-1.798301	1.815382

Superscripts denote Taxing Authority.

M : municipal, O : other.

Table 3.16: Vertical Externality

	(1)	(2)
COEFFICIENT	Residential	Business
<i>Residential</i> ⁻ⁱ	0.911*** (0.087)	
year 2002	0.140 (0.088)	0.347 (0.21)
year 2003	0.298*** (0.088)	0.694*** (0.21)
year 2004	0.492*** (0.091)	0.766*** (0.21)
year 2005	0.463*** (0.11)	0.714*** (0.22)
year 2006	0.486*** (0.14)	0.605** (0.27)
<i>Business</i> ⁻ⁱ		0.379 (0.25)
Constant	1.745*** (0.48)	11.92*** (2.82)
Observations	882	882
R^2	0.95	0.95
F statistic	43.38	3.33

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

All include municipal fixed effects

Table 3.17: First Stage Nearest Neighbors

Dependent Variable: Change in Business Tax Rate

	(1)	(2)	(3)
COEFFICIENT	All	Both	Interaction
iv_interaction	2.656** (1.09)		1.523*** (0.37)
iv_incumb	1.427** (0.69)	1.042 (0.65)	
iv_resident	-0.195 (0.59)	1.034*** (0.38)	
Constant	-0.0383 (0.13)	0.0893 (0.14)	0.509** (0.20)
Observations	280	280	280
R^2	0.14	0.11	0.08
F statistic	5.31	4.85	16.70

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.18: **Second Stage Nearest Neighbors**

Dependent Variable: Change in Business Tax Rate

	(1)	(2)	(3)
COEFFICIENT	All	Both	Interaction
tax_other	-0.0254 (0.19)	-0.256 (0.31)	0.712*** (0.25)
interact	0.107 (1.21)		0.493 (0.53)
incumbent	-0.946 (1.21)	-1.090 (0.81)	
residential	0.985 (0.95)	1.270*** (0.41)	
Constant	1.110 (0.89)	1.328* (0.68)	0.140 (0.22)
Observations	280	280	280
R^2	0.08	-0.06	-0.30
F statistic	4.71	4.47	7.32

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.19: First Stage Distance Neighbors

Dependent Variable: Change in Business Tax Rate			
	(1)	(2)	(3)
COEFFICIENT	All	Both	Interaction
iv_interaction	16.58*** (0.71)		2.436*** (0.023)
iv_incumb	-4.355*** (0.17)	-8.259*** (0.34)	
iv_resident	-7.553*** (0.37)	1.029*** (0.0071)	
Constant	1.470*** (0.042)	2.471*** (0.083)	0.406*** (0.0039)
Observations	280	280	280
R^2	0.99	0.98	0.96
F statistic	22531.29	12276.78	11664.12

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.20: **Second Stage Distance Neighbors**

Dependent Variable: Change in Business Tax Rate

	(1)	(2)	(3)
COEFFICIENT	All	Both	Interaction
tax_other	0.0642 (0.54)	0.347 (0.54)	0.836** (0.40)
interaction	0.0830 (1.35)		1.212** (0.52)
incumbent	-0.945 (1.20)	-0.983 (0.73)	
residential	0.947 (1.00)	0.877** (0.42)	
Constant	1.074 (0.89)	1.005 (0.66)	0.317 (0.24)
Observations	280	280	280
R^2	0.08	0.08	0.07
F statistic	5.03	6.87	12.52

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.21: First Stage Border Neighbors

Dependent Variable: Change in Business Tax Rate			
COEFFICIENT	(1) All	(2) Both	(3) Interaction
iv_interaction	3.827*** (0.84)		2.146*** (0.31)
iv_incumb	0.744 (0.49)	-0.102 (0.46)	
iv_resident	-0.882** (0.45)	1.031*** (0.17)	
Constant	1.534 (1.20)	3.214*** (1.11)	3.167*** (0.53)
Observations	280	280	280
R^2	0.23	0.17	0.21
F statistic	19.58	18.58	48.99

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.22: Second Stage Border Neighbors

Dependent Variable: Change in Business Tax Rate

	(1)	(2)	(3)
COEFFICIENT	All	Both	Interaction
tax_other	0.340*** (0.097)	-0.295 (0.58)	0.275** (0.14)
interaction	-1.395 (1.58)		-0.486 (0.99)
incumbent	-0.881 (1.10)	-1.577 (1.89)	
residential	0.134 (0.72)	2.412 (2.97)	
Constant	-0.0272 (0.58)	2.367 (2.98)	-0.263 (0.35)
Observations	280	280	280
R^2	-0.08	-0.88	0.05
F statistic	7.87	2.15	11.35

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.23: First Stage Relative Neighbors

Dependent Variable: Change in Business Tax Rate

	(1)	(2)	(3)
COEFFICIENT	All	Both	Interaction
iv_interaction	0.137*** (0.014)		0.0223*** (0.00061)
iv_incumb	0.0136*** (0.00028)	0.0115*** (0.00029)	
iv_resident	-5.069*** (0.61)	1.070*** (0.0064)	
Constant	0.0142*** (0.0049)	0.0350*** (0.011)	0.501*** (0.024)
Observations	296	296	296
R^2	0.98	0.97	0.88
F statistic	5998.69	14524.47	1315.17

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.24: **Second Stage Relative Neighbors**

Dependent Variable: Change in Business Tax Rate

	(1)	(2)	(3)
COEFFICIENT	All	Both	Interaction
tax_other	0.916*** (0.35)	0.837** (0.36)	0.567* (0.31)
interaction	0.000852 (0.014)		0.0107* (0.0060)
incumbent	-0.0120 (0.014)	-0.0124 (0.0084)	
residential	0.178 (0.76)	0.262 (0.38)	
Constant	0.737 (0.74)	0.781 (0.57)	0.344* (0.20)
Observations	296	296	296
R^2	0.07	0.07	0.07
F statistic	7.27	8.11	8.98

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.25: First Stage Absolute Neighbors

Dependent Variable: Change in Business Tax Rate

	(1)	(2)	(3)
COEFFICIENT	All	Both	Interaction
iv_interaction	0.0127 (0.0094)		0.0220*** (0.0016)
iv_incumb	0.0138*** (0.0022)	0.0126*** (0.0025)	
iv_resident	0.575 (0.41)	1.135*** (0.065)	
Constant	0.178** (0.076)	0.216** (0.089)	0.667*** (0.051)
Observations	296	296	296
R^2	0.49	0.48	0.43
F statistic	100.48	155.52	186.58

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3.26: Second Stage Absolute Neighbors

Dependent Variable: Change in Business Tax Rate

	(1)	(2)	(3)
COEFFICIENT	All	Both	Interaction
tax_other	0.528*	0.579*	0.343
	(0.31)	(0.32)	(0.26)
interaction	0.00313		0.0129**
	(0.015)		(0.0058)
incumbent	-0.0104	-0.0117	
	(0.014)	(0.0088)	
residential	0.297	0.395	
	(0.84)	(0.39)	
Constant	0.689	0.714	0.338
	(0.82)	(0.64)	(0.23)
Observations	296	296	296
R^2	0.01	0.00	0.03
F statistic	5.67	7.19	7.70

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Chapter 4

Intergovernmental Transfers

4.1 Introduction

Intergovernmental transfers are a large source of revenue for many sub-national governments. In some countries, intergovernmental transfers are allocated according to a formula, or contingent contract. However, many sub-national governments receive discretionary transfers, strings unattached, in what appears to be an unpredictable manner. This paper studies the timing and determinants of discretionary intergovernmental transfers.

Intergovernmental transfers can serve many purposes. Some transfers are specifically redistributive, adjusting an imbalance associated with revenue raising capabilities. Alternatively transfers can serve an allocative role, assisting recipient governments to internalize externalities associated with public good spillovers¹. A well established literature in economics exists addressing these efficiency-and-equity-achieving roles for transfers. However many transfers are also suggested to serve political purposes. In this paper we study the effect of intergovernmental transfers on the accountability of elected representatives. We begin with a model of politics where voters use elections to select and discipline politicians. If politicians are career concerned self-interested actors who consume much of their own budgets as rents it would be surprising to find politicians willingly giving transfers. However, we show that when transfers are expected from a challenger, a current incumbent politician has an incentive to themselves give a transfer. What makes these transfers interesting is that

¹See Oates (1999) for a review of the literature on fiscal federalism in general and intergovernmental transfers in particular.

they are non-partisan, which allows us to understand why much of the empirical literature on partisan transfers has met with such limited success.

Much of the previous research on intergovernmental transfers has focused on welfare considerations through models of benevolent governments, where transfers play a role in internalizing externalities or attaining some purely redistributive goals. With the recent success of the empirical literature focussing on political budget cycles, and the contributions of agency theory to both economics and political science there is growing evidence that such benevolent governments do not exist, or are limited in some ways by the political process itself. Political economy models of distributive politics have addressed intergovernmental transfers from two perspectives on how politicians win votes. One point of view is that these politicians target groups of swing voters to capture their votes, as in Dixit and Londregan (1996). Another large literature asserts that politicians target transfers to their core supporters in an effort to motivate their base, see for example Cox and McCubbins (1986). Both theoretical points of departure have been investigated in a number of empirical papers each with varying degrees of success.

However both of these theories of intergovernmental transfers are partisan based. Politicians are partisan actors, and/or voters have partisan preferences in all the existing research on intergovernmental transfers. This is quite natural when one considers a transfer of funds as a targeted expenditure. In models of partisan competition parties serve to solve some conflict of interest² among voters (i.e. different preferences or geographical locations); the choice of voters being influenced by a positional aspect of the political parties. However elections are not only an opportunity for voters to reveal their preferences for particular regimes, they also serve as the most poignant instance of “incentives” in the political system. As there may exist a conflict of interest between voters and politicians (i.e. if each values the use of scarce resources differently) it is important to recognize that the opportunity for the public to evaluate their elected representatives occurs at the ballot box. Thus we study the effects of transfers on the accountability of both donating and receiving politicians.

In this paper we abstract from the conflict of interest across voters and focus instead on the role of elections in selecting and disciplining politicians. Our approach addresses the issue from its most basic premise: a transfer of resources from one level of government to another requires forfeiting the ability to employ those resources in some other way. We

²Persson and Tabellini (2000) makes this distinction at the end of chapter four.

consider an agency model, with office motivated politicians, and voters who desire public goods. From the point of view of politicians, allocating public goods is costly as it decreases the rents they can enjoy from office, however politicians are willing to part with these funds when it increases their ability to win control of office again. When transfers are made between governments they are either swallowed up by the recipient politician, or they augment the public expenditure of that level of government. Given the latter, transfers themselves become coveted by the voters. In our model, voters who in the absence of the prospect of higher spending through transfers would evaluate each government only on their performance in office, now cast their ballots with an additional interest in obtaining transfers.

We show the existence of an equilibrium where transfers take place. The equilibrium with transfers requires politicians at both levels of office simultaneously seeking re-election, but with staggered electoral calendars (their terms in office overlap). The model makes a clear prediction of when we will see intergovernmental transfers without assuming partisan preferences of either voters or incumbent politicians. In addition to this we have a surprising result that in response to receiving a transfer local government rent consumption may increase, decrease or remain unchanged depending on the distribution of unobserved political ability. This may help us to understand the fly-paper effect, providing some theoretical basis for an existing empirical anomaly.

Our model does not incorporate partisan preferences of politicians. In particular we focus on the role of: self-interested politicians, the electoral calendar, and the finiteness of political careers as determinants of the pattern of intergovernmental transfers. This is seen as a complement to existing studies of partisan transfers, rather than a substitute. Moreover, this paper can be seen as a first step in understanding the role of parties in selecting and disciplining politicians in office. Intergovernmental transfers occur to influence the future re-election prospects of the donating politician. However in a situation in which partisan approval is necessary to facilitate rent extraction, for example through a legislative check on the executive or some other aspect of the internal organization of the party³, these transfers may be side payments to the constituents in return for current political support.

The paper progresses as follows. In section 2 we address the literature on intergovernmental transfers. In section 3 we present the model. Section 4 solves the model. In section

³See for example Milligan and Smart (2005)

5 we discuss the results. In section 6 we conclude.

4.2 Previous Explanations and the Evidence

Intergovernmental transfers have been at the center of attention in the field of fiscal federalism since its inception. As the field began with a focus on welfare, intergovernmental grants were first studied as equity and efficiency achieving instruments. There is an excellent review of this literature in Oates (1999). From the traditional perspective some examples of solutions provided by intergovernmental transfers include: the internalization of externalities associated with inter-jurisdictional spillovers, the reduction of inefficient local revenue raising, and the provision of comparable living standards across jurisdictions within a federation⁴. However, the emergence of arguments from the public choice, and more recently political economy perspective have drawn attention away from the purely normative roles of transfers mentioned above.

Insights have emerged from the literature on the positive role of intergovernmental transfers, both theoretically and empirically. Theoretically intergovernmental transfers have been addressed in studies of political redistribution, or *pork* as it is often referred to in the literature. The *pork* literature, of which intergovernmental transfers can be thought of as a special case, can be divided into those who find that politicians allocate resources to *swing voters* and those who allocate resources to *core supporters*. Prominent examples of the *swing voters* view include Lindbeck and Weibull (1987), Dixit and Londregan (1998); while representative of the *core supporters* hypothesis is Cox and McCubbins (1986), and Rodden and Wibbles (2005). Cox (2006) provides a survey of the empirical literature testing each hypothesis, suggesting that the verdict is very much still out on which, if either, hypothesis is correct⁵.

Some recent papers in economics view the direction of transfers to be determined by political credit claiming concerns. Ansolabehere, Dasgupta, Dhillon and Dutta (2008) studies a situation where voters have preferences for the political ideology of candidates and the

⁴In addition to these general treatment of the traditional approach, much insight has been provided on the optimal design of intergovernmental transfer systems. As we are concerned with discretionary transfers, we will not spend time on reviewing this literature here, rather interested readers are encouraged again to consult Oates (1999).

⁵Empirical evidence in favor of the *core supporters* hypothesis, can be found in: Ansolabehere and Snyder (2003), and Levitt and Snyder (1995) among others. Representative empirical investigations in support of the *swing voters* hypothesis include Case (2001), and Dahlberg and Johansson (2002)

intergovernmental grants received by their state governments, but are unable to determine which level of government deserves the credit for the grants. As state and central levels of government are controlled by either the same (aligned) or different (unaligned) parties with each level of government receiving only partial credit for the grants, the central governing party allocates more grants to states that are also governed by them so as to claim full credit for the grants. The model is tested on data from Indian states, and this feature is confirmed. Sole-Olle and Sorribas-Navarro (2008) uses a very similar model, but where parties do not care for any considerations other than their re-election. Still the same prediction arises in this credit claiming environment and their results are confirmed by Spanish data on central to province, province to local, as well as central to local transfers. Additionally Khemani (2007) studies the political determination of intergovernmental transfers exploiting exogenous variation in the politicization of a grant distribution program finding that partisanship does influence the direction of political transfers.

Papers that address the conflict of interest between voters and their elected representatives do so in an agency framework. Persson and Tabellini (2000) and Besley (2006) present an overview of many of the workhorse models used in this field. Barro (1973) and Ferejohn (1986) are pioneering texts on the agency based view of electoral competition. Rogoff (1990) and a string of other empirical papers find strong evidence that political actors respond to voters when retaining office matters, and to their own self interests otherwise. Reid (1994) finds evidence from Canada that intergovernmental transfers are not exempted from the political budget cycle. Likewise Besley and Case (1995) and Lidborn-Peters (2007) have found evidence that politicians react to re-election concerns.

Two recent working papers address the vertical interactions of political agents in the above framework. Reich (2008) studies the effects of exogenous federal transfer schemes on political accountability at the local level in a model of adverse selection. Reich finds that transfers influence the re-election rates of incumbents differently depending on the extent of regional income inequality. As there is no strategic central government, this is a two period two region model of exogenous horizontal transfers. Joanis (2007) studies effect of dual provision of public goods on political accountability in a model of adverse selection when voters are uninformed about the contributions of each level to the public good. Joanis finds ambiguous results when considering the welfare comparisons in a move from a completely centralized or decentralized system of public good provision to one of partial decentralization as the complementarities of public good provision are traded off against a loss of information,

and therefore political accountability.

These papers do not study the dynamics of both the levels and directions of intergovernmental transfers as they interact with the political system and political agents. Those papers investigating intergovernmental grants do not incorporate government actors who are separately elected individuals. This is an important aspect of federations as empirically many do not have the same political parties at both the central and federal levels (see Chibber and Jones), and those that do not have separate independent elections of regional and central politicians perform poorly in terms of growth, accountability and corruption (Enikolopov and Zhuravskaya (2006)). In the following section we present a model with elected political agents who determine the levels and timing of intergovernmental transfers.

4.3 Model

The model presented builds on a basic career concerns model found in Persson and Tabellini (2000)⁶. There is a local and central government, each controlled by a self interested politician. Politicians enjoy the rents obtained from office, and seek to be in office for a limit of two terms. While in office these politicians decide the level of rents to enjoy, transfers if any, and the amount of public goods provided by their branch. When seeking re-election these politicians actively behave in the voters' interest in an attempt to maintain their hold on office. However, when not seeking re-election these politicians are unfettered in their satisfaction of their own desires. Thus, in the off-election periods we refer to these politicians with a term that reflects their image from the point of view of the voters: a *lame duck*.

4.3.1 Preferences

Consider a unit mass of infinitely lived voters, who reside under the authority of two levels of government indexed by $j \in \{c, l\}$. These voters have preferences for public goods. We assume that voters are myopic, looking ahead one period, or half a term⁷. These voters care for the public goods provided by each level of government, and their own private consumption. Voters in locality l care for the current levels of public goods provided in their

⁶Itself influenced by Holmstrom (1982)

⁷Voter myopia is not necessary, but it simplifies the exposition dramatically by avoiding the additional disincentive that voters have for re-electing incumbents (they are lame ducks). In addition, because voters recognize the electoral externalities generated by their portfolio of office holders, having voters look more than one period ahead, doubles the state space over which they form their expectation of future utility.

locality by both the local (g_l) and central (g_c) levels of government, and a consumption good c . Voters are endowed with y_l units of income which is allocated to a consumption good and taxes; $c_l = y_l - \tau_l - \tau_c$. Voters are risk neutral and have per-period preferences defined as:

$$U_l = g_l + g_c + c_l \quad (4.1)$$

Politicians care for the rents from office. These rents are of two varieties. Physical resources can be allocated from the government's public budget to the desired private uses of the incumbent. We denote this by r . Also incumbent politicians may attain a purely emotional or ego rent from attaining office, R . We state the per period preferences of a politician in office j in state s as:

$$V_j^s = v(r_j^s) + R_j^s \quad (4.2)$$

We assume that $v'(\cdot) > 0$ and $v''(\cdot) < 0$. Politicians have a maximum of two terms in office. We divide each term in office into two parts, the period following an election, (*post election*), and the period preceding an election (*pre-election*). In each of these four periods in office there is a publicly observed state of the world, s , which is a position on the electoral/re-electoral calendar. Politicians are either in their first term in office, Y (young) the term within which they seek re-election, or they are in their second term in office, O (old) in which they do not seek re-election because of binding term limits⁸. The state of the world is a tuple, where the first character (upper case) denotes the term of the central incumbent and the second character (lower case) denotes the term of the local incumbent:

$$s = \begin{cases} Yy & \text{if both incumbent seeks re-election,} \\ Yo & \text{if the central incumbent seeks re-election and the local incumbent does not,} \\ Oy & \text{if the central incumbent does not seek re-election and the local incumbent does,} \\ Oo & \text{if neither the central or local incumbent seeks,} \end{cases} \quad (4.3)$$

In each period, each politician in either level of government, $j \in \{c, l\}$ provides a public good. These public goods have a linear technology using the total revenue raised by the the politician, any transfers received (T , and the politician's competence, less the rents appropriated, and transfers given. We assume that the taxes levied, $\{\tau_c, \tau_l\}$ are exogenous.

⁸There are other ways of doing this, see "Career Politicians or Political Careers"

The public good provided by a politician is augmented by the politician's competence. Formally,

$$g_l = \tau_l + T - r_l + \theta_l$$

$$g_c = \tau_c - T - r_c + \theta_c$$

Political competence, θ_j , is unobservable. In each period each politician receives a shock to their competence. The shock process is a moving average of order two. These shocks are independent and identically distributed, and uncorrelated with the state. The competence of an elected official is, $\theta_j = \mu'_j + \mu_j$ where the per period competence shocks are distributed with cdf $F_j(\mu_j)$, with mean 0 and variance σ_j^2 . Primed variables denote the next period value.

We consider a game of imperfect information in which elections are staggered, such that election periods can occur within terms, but not simultaneously. When elections are staggered a central incumbent's post election period coincides with a local incumbent's pre-election period and vice versa. In each period the state is determined by the electoral outcomes of the last period. At the beginning of each period politicians receive a shock to their competence. Knowing only the state, and not their own competence, or the competence of the other office holder, politicians decide on the rents appropriated from office as well as transfers made to the budgets of other office holders. Together with competence θ_j , this decision residually determines the public goods provided. Voters then observe the public good allocations by each government and from this allocation and their knowledge of the previous state, they form an estimate of the current competence shock received by each office holder. If it is an election year at level $j \in \{c, l\}$, elections take place and voters then vote for the candidate whose electoral success is associated with the highest payoff to the voters. The outcome of the election is then observed, and the state is updated to reflect the post election allocation of politicians to office. A new period begins and the sequence of events is repeated. Politicians can hold office for a maximum of four periods. The per period timing is summarized below:

- 1 Given a state s , Nature draws competence shocks for each incumbent.
- 2 Incumbents from each office j , while not observing their competence, select this period's rents, r_j . The central incumbent selects transfers, T . Together these choices residually determine the levels of government spending from each office g_j .

- 3 Voters observe the provisions of public goods from each government and produce an estimate of the per-period competence shock μ_j for each politician.
- 4 Elections are held for an office $j \in \{l, c\}$. Voters vote and the outcome is observed.
- 5 The period ends, and state is updated given the outcome of the elections and a new period begins with Nature's move.

Politicians can serve a maximum of four periods, which equals two terms, the relevant players of the game are voters, incumbents, and challengers. We focus on symmetric Markov perfect equilibria with incumbents and challengers choosing the same state contingent but history independent strategies.

We solve the above stage game by backwards induction. Incumbent politicians face a trade-off only when they are young. Old incumbents have no interest in re-election and so they always take the maximum feasible rents from office. The young politicians have the incentive to reduce rents to increase their re-election prospects by projecting a higher signal of their competence to the voters. This only matters in the preelection period of the young office holder's term, as it is only the last signal of competence that carries forward to effect the next period's public provision. Young politicians at the central level also face a trade-off in their first post election period in office. It is in this period that young central politicians have the ability to influence the electoral prospects of the current local incumbent through an intergovernmental transfer of resources. In any period other than that of their potential re-election, local recipients of said transfers would not spend them, rather they would employ these resources to increase their own rents. As we will show, if voters anticipate transfers from challengers, this is sufficient to motivate incumbents to allocate resources from their budget to that of a locality up for re-election.

As voters care for government expenditure, they wish to choose elected officials so as to maximize expected government expenditure. Competence increases the public good provision; therefore voters evaluate each politician on the basis of their competence, and the equilibrium payoffs associated with retaining an incumbent and selecting a challenger. Competence being a second order moving average of shocks, what voters wish is to re-elect an incumbent if and only if the current shock estimate exceeds the expected shock received by their challenger, which is zero, and any net benefits that may accrue from accepting a new office holder and influencing the state transition. Voters use the current estimate to infer the unknown future competence. Voters evaluate an incumbent office holder's competence by

comparing the observed level of government expenditure, g_c or g_l , with the expected level of government expenditure, $\tilde{g}_c = \tilde{\tau}_c - \tilde{T} - \tilde{r}_c$ or $\tilde{g}_l = \tilde{\tau}_l + \tilde{T} - \tilde{r}_l$ respectively. This comparison yields an estimate of θ_j , $\hat{\theta}_j$. Voters use their current estimate of competence, $\hat{\theta}_j$, and their past estimate, $\hat{\theta}_{j,-1}$ to estimate $\hat{\mu}_j$. As μ_j is the durable component of competence, and therefore public good allocation, voters weigh this benefit of retaining an incumbent, with the equilibrium benefits of election a challenger. Any electoral decision made by the voters has the ability to change the state, s (recall that the state of the world indicates whether both incumbents are young and facing re-election or not). Thus voters best response to the actions of an incumbent is described as a general election rule:

$$\text{reelect}_j(s) = \begin{cases} 1 & \text{if } \mu_j \geq \Pi_j^{s*} \\ 0 & \text{otherwise} \end{cases} \quad (4.4)$$

Where μ_j is the durable component of competence, θ_j , as accurately estimated by voters from previous expenditures. Π_j^{s*} is the net benefit from selecting a challenger for office j , in state s . If voters retain an incumbent by re-electing them, these incumbents are then old in the next period, facing no further re-election incentives to spend, therefore leaving as the sole gain from retention the durable component of their competence μ_j . This competence level must exceed any benefit accruing to voters from selecting a challenger, $\Pi_j^{s'*}$, which is determined in equilibrium. s' is a subset of $\{Yo, Yy, Oy, Oo\}$, depending on which office j is up for re-election.

Note that, old incumbents simply take maximal rents, \bar{r}_j in both periods when old independently of the state or the voter's re-election rule⁹. Maximum rents are determined by the feasible set in that they cannot exceed the revenue raised by the government either through taxes or transfers. We can define the value of office for an old incumbent in office j as W_j :

$$W_j = ((1 + \beta)v(\bar{r}_j) + R_j)$$

Thus we can concentrate on the strategies of the young incumbents. Young incumbents are in office in for two periods, their last being a pre-election period. Given the re-election rule employed by voters, incumbents seeking office maximize the value of office, which is their

⁹This can be augmented by assuming that there are parties and that party discipline serves the role of ensuring that old incumbents do not take maximal rents, as the party has a longer horizon than the incumbents two terms of office.

current enjoyment of rents plus their expected benefits from the retention of office. For the central incumbent this is characterized as:

$$\max_{r_c} v(r_c) + \beta E[W_c] \quad (4.5)$$

The expectation is taken over the state, that is, their re-election prospect. Let $p_c = [1 - F_c(\tilde{\tau}_c - \tilde{T} - \tilde{r}_c - [\tau_c - T - r_c] + \Pi_c^{s'*})]$. This is the probability that a central incumbent is re-elected. Re-election occurs when the estimate of the current competence shock implies a benefit to voters that exceeds that associated with selecting a challenger, who would yield competence of $E[\theta] = 0$, and a state dependent net benefit of $\Pi_c^{s'*}$, as determined in equilibrium. The first order condition for the incumbent is then given by:

$$\frac{\partial v(r_c)}{\partial r} - \beta f_c(\cdot) W_c = 0 \quad (4.6)$$

Similarly for a incumbent at the local level, the probability of their re-election is $p_l = [1 - F_l(\tilde{\tau}_l + \tilde{T} - \tilde{r}_l - [\tau_l + T - r_l] + \Pi_l^{s'*})]$, where again $\Pi_l^{s'*}$ is an equilibrium object. Facing re-election, a local incumbent's objective is to maximize their utility from office:

$$\max_{r_l} v(r_l) + \beta E[W_l] \quad (4.7)$$

The incumbent trades off the utility from consuming the rents from office today with the cost of consuming those rents, the probability of being re-elected to enjoy the benefits of office again tomorrow. This yields a first order condition:

$$\frac{\partial v(r_l)}{\partial r} - \beta f_l(\cdot) W_l = 0 \quad (4.8)$$

Central incumbents have an opportunity to make transfers. In the pre-election period of their first term central politicians are concerned with their own re-election prospects. There are no transfers from or to old politicians, since donating old politicians derive no benefit from the transfer, and receiving old politicians would never spend the transfer, instead allocating the resources to their own private rent consumption. Therefore, with staggered elections central incumbents will only divert resources from their own rent consumption in state Yy , when both central and local incumbents are in their first term. Note that this diversion of resources will only take place in the period when local incumbents are actively seeking re-election, their pre-election period because they are already old if it is their post election period.

Now consider the central incumbent in the first period of their first term in office, with a young local incumbent seeking re-election. First, we know that the central government allocates no resources towards the public good, g_c , as they are not themselves seeking re-election and there is no informational spillover as each politicians' competence is an independent process. Thus, all transfers come from a reduction in the central government's rent consumption.

$$\max_T v(\bar{r}_c - T) + \beta \mathbf{E}[\max_{r'_c} v(r'_c) + \beta p'_c W_c] \quad (4.9)$$

In this case the expectation again is taken over the future state; $s \in \{Yy, Yo\}$, however it is the local government's re-election prospects that are of importance to the central incumbent. If voters use a state dependent re-election rule, next period (pre-election) rent extraction by the central incumbent is state dependent as well as the central incumbent's own re-election prospects. Let W denote the continuation payoff for the central incumbent following a win in their own election. Recall that in the post election period for the central incumbent their rents are always maximal so W is not state dependent. Thus the above yields a first order condition:

$$-\frac{\partial v(\bar{r}_c - T)}{\partial T} + \beta f_l(\cdot)[v(r_c^{Yo*}) - v(r_c^{Yy*}) + [p_{c,Yo} - p_{c,Yy}]W_c] = 0 \quad (4.10)$$

The term $[p_{c,Yo} - p_{c,Yy}]W_c$ represents the change in the re-election rule employed by voters as the state changes. This illustrates that the central incumbent's incentive to allocate transfers depends critically on the difference in the rents from office and re-election prospects in the two states Yo and Yy . While the disincentive to give transfers is the foregone rents today, the incentive to allocate transfers must be higher expected future benefits. These rents tomorrow are determined in equilibrium and we discuss these objects in detail below.

4.4 Equilibrium

We are interested in pure strategy, stationary, symmetric Markov perfect equilibria, where challengers are expected to take the same actions in equilibrium as incumbents and vice versa. The actions of both voters and politicians may be state dependent. An equilibrium is defined as:

Definition. *A Rational Expectations Political Equilibrium, **REPE**, is a pure strategy, symmetric, subgame perfect Nash equilibrium, consisting of a vector of state contingent actions*

by elected officials, $\{r_l^{s*}, r_c^{s*}, T^{s*}\}$, and (re-)election rules of voters $\{\text{reelect}_{l,s}, \text{reelect}_{c,s}\}$ such that: (i) each action by voters is a best response to those of incumbents, (ii) each action by incumbents is a best response to the actions of voters, (iii) each action in $\{r_l^{s*}, r_c^{s*}, T^{s*}\}$ is equal to its expected value $\{r_l^{\tilde{s}*}, r_c^{\tilde{s}*}, T_l^{\tilde{s}*}\}$, (iv) and actions are sequentially rational, given expectations.

There are at least two **REPE**, in the game described above, one with no transfers, and the other with non-zero transfers. We describe each in detail below.

4.4.1 No transfer equilibrium

In the no transfer equilibrium, neither voters nor incumbents expect transfers from either the current central incumbent or the future central incumbent (the challenger). As the old incumbents always take maximal rents, the expected payoff from re-electing an incumbent at either level is given by the current period competence shock of the incumbent. This payoff must exceed the expected benefits from electing a challenger, who by definition is young and has expected competence of $E[\theta] = 0$. In the no-transfer equilibrium, voters are expecting zero transfers from new incumbents, there is no state contingent surplus associated with a change from Yy to Yo or from Oy to Oo , shocks and elections are independent and each incumbent is evaluated independently by voters. As both new incumbents (challengers) and old incumbent do not differ in their first period actions (both take maximal rents) the state-transition specific surplus is $\Pi_j^* = 0$. The equilibrium re-election rule is simplified to:

$$\text{reelect}_j = \begin{cases} 1 & \text{if } \mu_j \geq 0 \\ 0 & \text{otherwise} \end{cases} \quad (4.11)$$

Given this, the pre-election period decisions for incumbents in both levels are identical:

$$\max_{r_j} v(r_j) + \beta E[W_j] \quad j = c, l \quad (4.12)$$

The expectation is taken over the current competence as embedded in the voters re-election rule. In this case the probability of re-election is the probability that the current competence shock of an incumbent exceeds the expected value (zero), which is $p_j = [1 - F_j(\tilde{\tau}_j - \tilde{r}_j - [\tau_j - r_j])]$. The first order condition reads:

$$\frac{dv(r_j)}{dr_j} - \beta f_j(\cdot) W_j = 0 \quad (4.13)$$

As voters have rational expectations we have, $r_j^* \equiv \tilde{r}_j$. Define $h(r_j)$ as the inverse function of the marginal utility of rents $h(r_j) = \frac{dv}{dr_j}^{-1}$ giving the following equation defining the current period equilibrium rents:

$$r_j^* = h(\beta f_j(0)W_j) \quad (4.14)$$

Proposition 7. *There exists an **REPE** without transfers. The no-transfer equilibrium, $\{r_l^{s*}, r_c^{s*}, T^{s*}, reelect_l^s, reelect_c^s\}$ Is characterized by $r_j^* = \bar{r}_j = \tilde{r}_j$ in post-election periods, $r_j^* = h(\beta f_j(0)[v(\bar{r}_j) + R'_j]) = \tilde{r}_j$ in pre-election periods, and $T = \tilde{T} = 0$. Voters re-elect incumbents on the basis of competence only and there is no incumbency advantage or disadvantage. Each incumbent seeking re-election is re-elected with probability 0.5 if the distribution is symmetric.*

In this equilibrium incumbents and challengers face equal chances of being reelected if the distribution is symmetric. With rents in the no transfer equilibrium described as above, we can describe the state specific government expenditures in each of the four periods under the staggered electoral calendar. In the post election period of either term g_j is equal to θ_j , the competence of the politician.

$$g_j = \begin{cases} \theta_j & \text{in the post election period of either term} \\ \tau_j - h(\beta f_j(0)[v(\bar{r}_j) + R'_j]) + \theta_j & \text{in the pre-election period} \end{cases} \quad (4.15)$$

As elections are staggered, we can calculate the state dependent welfare of the representative voter when transfers are zero.

$$\text{Welfare}^{-T} = \begin{cases} \theta_l + \theta_c + c_l & \text{post-election } Oo, Yy \\ & \text{and pre-election } Oo, \\ \tau_c - h(\beta f_c(0)[v(\bar{r}_c) + R'_c]) + \theta_c + \theta_l + c_l & \text{pre-election } Yo, Yy \\ \tau_l - h(\beta f_l(0)[v(\bar{r}_l) + R'_l]) + \theta_l + \theta_c + c_l & \text{pre-election } Oy, Yy \end{cases} \quad (4.16)$$

While welfare differs in the different states, there is no reason for voters to change their reelection rule that is based on competence in pursuit of greater state specific welfare. The reason is that in the post-election periods each newly elected or re-elected official takes a period off of spending, enjoying the rents available to them through the budget.

4.4.2 Transfer Equilibrium

We now show that an equilibrium with positive transfers exists, wherein these transfers are anticipated by both voters and incumbent politicians in state Yy . The intuition of the transfer equilibrium is as follows. First, transfers from central to local governments only occur when both are in their first term of office, and when the local incumbent is facing re-election. In any other situation either: a) the central government is unwilling to make transfers because they are concerned with their own re-election (or because they are concerned with their own rent consumption (lame duck)) or b) local governments would spend transferred money on rents only. This last insight arises as local governments are not constrained from appropriating any resources made available to them. If transfers occur, local government spending increases and central government spending remains the same. Transfers come out of rents that would be consumed at the central level. Together this implies that voters benefit from a transfer. Finally, since if voters expect transfers being made between two first term government officials, and prefer the state of the world in which both officials are in their first term, then voters will set higher re-election hurdles for governments when the transition to a state with transfers is possible. This makes getting re-elected more difficult. The central government's incentives are to avoid the state of the world where both central and local incumbents are in their first term in office (as this is the state where transfers take place).

We again begin with the voters who choose to re-elect the central incumbent according to a state contingent re-election rule. If the local government was re-elected the state is now Yo or Oo . As there is no re-election at the central level in state Oo , we first consider state Yy . In this case, regardless of what state voters find themselves in post election, they are faced with a situation in which local incumbents take the same action. Hence, voters base their decision on competence alone, and voter's re-election rule for the central incumbent is:

$$\text{reelect}_c = \begin{cases} 1 & \text{if } \mu_c \geq 0 \\ 0 & \text{otherwise} \end{cases} \quad (4.17)$$

If the local government was not re-elected, a new local challenger has taken office and the state is Yy . The re-election of a central government would involve a transition to state Oy . However, if the central incumbent is not re-elected the state again becomes Yy , the

state in which transfers among governments is expected. Formally we have:

$$\text{reelect}_c = \begin{cases} 1 & \text{if } \mu_c \geq \Pi_c^{Yy^*} \\ 0 & \text{otherwise} \end{cases} \quad (4.18)$$

Where $\Pi_c^{Yy^*} = g_c^{Yy^*} + g_l^{Yy^*} - (g_c^{Oy^*} + g_l^{Oy^*})$ is the difference in equilibrium public good levels across the two possible states. Note that the subsequent period is by definition a post election period for the central government. For this reason the central incumbent has no reason to provide public goods herself. It follows from the central government's budget constraint, $g_c = \tau_c - T - r_c + \theta_c$ that $g_c^{Yy^*} = g_c^{Oy^*} = \theta_c$. If transfers take place they come out of the central incumbent's rents. The next period is a re-election period for the local government in which the local budget constraint must bind. In state Yy this constraint is $g_l = \tau_l + \tilde{T} - r_l + \theta_l$, and in Oy we have $g_l = \tau_l - r_l + \theta_l$. Thus the expected difference between the public goods provided in each state is $\Pi_c^{Yy^*} = g_l^{Yy^*} - g_l^{Oy^*}$, and the difference between these two levels of government expenditure at the local level is determined by the equilibrium transfer in state Yy and the expected difference in rents extracted by the local incumbent in each state: $\Pi_c^{Yy^*} = \tilde{T} + (r_l^{\tilde{O}y} - r_l^{\tilde{Y}y})$. We refer to $\Pi_c^{Yy^*}$ as the equilibrium electoral externality imposed upon the incumbent at the central level. This externality is the sum of the expected transfer allocated by a central challenger, and the difference between rent extraction by the local government in states Oy and Yy . This second term arises as local governments may respond to the received transfers.

Given the re-election rules employed by voters we can derive the optimal rent extraction for the central incumbent in each state. The central incumbent in state Yy solves:

$$\max_{r_c^{Yy}} v(r_c^{Yy}) + \beta E[W_c] \quad (4.19)$$

The expectation is taken over the current competence as embedded in the voters re-election rule. In this case the probability of re-election is the probability that the current competence shock of an incumbent exceeds the expected competence of the challenger, zero, plus \tilde{T} and electoral externality. We have this probability in the following form $p_c = [1 - F_c(\tilde{\tau}_c - \tilde{r}_c - [\tau_c - r_c] + \Pi_c^{Yy^*})]$. In the period when the central incumbent faces re-election, transfers have already been made in the previous period, and so the central incumbent chooses rent

extraction to maximize their utility from office¹⁰. This yields a first order condition:

$$\frac{dv(r_c^{Yy})}{dr_c^{Yy}} - \beta f_c(\cdot) W_c = 0 \quad (4.20)$$

As voters have rational expectations we have, $r_j^{s*} \equiv \tilde{r}_j^s$ for all s and j . Again let $h(r_c)$ denote the inverse function of the marginal utility of rents $h(r_c) = \frac{dv}{dr_c}^{-1}$ giving the following equation defining the current period equilibrium rents:

$$r_c^{Yy*} = h(\beta f_c(\Pi_c^{Yy*}) W_c) \quad (4.21)$$

We can likewise solve for the incumbent's optimal rent consumption in state Yo . This program is identical to that of the non-transfer equilibrium and we have:

$$r_c^{Yo*} = h(\beta f_c(0) W_c) \quad (4.22)$$

Notice that rents extracted by the central incumbent may differ in states Yy and Yo depending on the properties of the distribution of competence.

The state the central government finds itself in depends on the outcome of the local government election. The local government's rent consumption is chosen optimally given the re-election rule employed by the voters for the local government election. Formally in state Yy we have:

$$\text{reelect}_l = \begin{cases} 1 & \text{if } \mu_l \geq \Pi_l^{Yy*} \\ 0 & \text{otherwise} \end{cases} \quad (4.23)$$

Where $\Pi_l^{Yy*} = g_c^{Yy*} + g_l^{Yy*} - (g_c^{Yo*} + g_l^{Yo*})$. Again, we can observe that post-election rents extracted by the local incumbent are maximal, \bar{r}_l . From the budget constraint of the local government we see that $g_l^{Yy} = g_l^{Yo} = \theta_l$. Any difference in public good provision in the period following a local government election will arise from differences in the public goods provided by the central government, as a period following a local election is a period prior to a central election. From the central government's budget constraint, given the expected value of competence is zero we have: $\Pi_l^{Yy*} = (r_c^{\tilde{Yo}} - r_c^{\tilde{Yy}})$, as the difference in government expenditure at the central level. Thus in state Yy local governments solve the following program:

$$\max_{r_l^{Yy}} v(r_l^{Yy}) + \beta E[W_l] \quad (4.24)$$

¹⁰This is because transfers will not take place in the periods when voters evaluate the central incumbent as the resources are always better allocated towards their own re-election or their own rent consumption

In this case the probability of re-election is the probability that the current competence shock of the local incumbent exceeds the expected competence of the challenger, zero, plus an electoral externality imposed by the change in behavior of the central incumbent when the state changes. This probability has the following form $p_l = [1 - F_l(\tilde{\tau}_l + \tilde{T} - \tilde{r}_l - [\tau_l + T - r_l] + \Pi_l^{Yy*})]$.

This yields a first order condition:

$$\frac{dv(r_l^{Yy})}{dr_l^{Yy}} - \beta f_l(\cdot) W_l = 0 \quad (4.25)$$

Again imposing rational expectations we have, $r_j^{s*} \equiv \tilde{r}_j^s$ for all s and j , and $T^* = \tilde{T}$. Using $h(r_l)$ we arrive at the following equation defining the current period equilibrium rents for the local incumbent as a function of the equilibrium electoral externality:

$$r_l^{Yy*} = h\left(\beta f_l(\Pi_l^{Yy*}) W_l\right) \quad (4.26)$$

The equilibrium electoral externality is a function of the rent extraction from the central level, and so this equilibrium rent function is the optimal rent extraction at the local level given the rent extraction at the central level.

We can likewise solve for the local incumbent's optimal rent consumption in the state Oy , when the central incumbent was re-elected. In this case the equilibrium electoral externality will be zero as second term central incumbents are lame ducks without re-election concerns and have no reason to give transfers to local incumbents. Thus in state Oy the sub-game for the local incumbent is identical to that in the non-transfer equilibrium and we have the same optimal rents as defined by:

$$r_l^{Oy*} = h(\beta f_l(0) W_l) \quad (4.27)$$

Again depending on the specific distribution for competence (an assumption on f'), rents for the local incumbent may differ in states Yy and Oy .

Finally we can solve for the central incumbent politician's transfer to the young local politician. The central government makes a transfer to influence the electoral outcome of the local government election. They desire to do so to increase the probability that the local incumbent is re-elected. When the local incumbent has been re-elected the central incumbent finds herself in the most favorable state, where both their own rents and their future re-election prospects are highest. Thus, in state Yy the transfer is chosen as that which

maximizes the utility of the central incumbent. Again letting W denote the continuation payoff for a central incumbent conditional on a win in their election, in state Yy we have the central incumbent's post-election problem:

$$\max_T v(\bar{r}_c - T) + \beta E[\max_{r_c} v(r_c(s')) + \beta W_j] \quad (4.28)$$

In this case the expectation again is taken over the state, however it is the local government's re-election prospects that are of importance to the central incumbent when choosing the transfer, as the transfer affects the probability of changing the state in which the central incumbent is re-elected: $p_l = [1 - F_l(\tilde{r}_l + \tilde{T} - \tilde{r}_l - [\tau_l + T - r_l] + \Pi_l^{Yy^*})]$. In the event that the local incumbent is not re-elected, the central incumbent's next period rents and re-election prospects are lower and this occurs with probability $1 - p_l$. This yields a first order condition:

$$-\frac{\partial v(\bar{r}_c - T)}{\partial T} + \beta f_l(\Pi_l^{Yy^*}) ([v(r_c^{Yo^*}) - v(r_c^{Yy^*})] + \beta[F_c(\Pi_c^{Yy^*}) - F_c(0)]W_c) = 0 \quad (4.29)$$

Imposing the condition that expectations of actions are equal to their equilibrium values, and making use of the $h(\cdot)$ function defined above, the equilibrium transfers are the fixed point that satisfies:

$$T^* = \bar{r}_c - h\left(\beta f_l(\Pi_l^{Yy^*}) \left([v(r_c^{Yo^*}) - v(r_c^{Yy^*})] + \beta[F_c(T^* + (r_l^{\tilde{O}y} - r_l^{\tilde{Y}y})) - F_c(0)]W_c\right)\right) \quad (4.30)$$

We can show that there exists a T^* strictly greater than 0 that satisfies the above condition.

Lemma 4. *There exists a value of T on the interval $(0, \bar{r}_c]$ that satisfies $T^* = \bar{r}_c - h\left(\beta f_l(\Pi_l^{Yy^*}) \left([v(r_c^{Yo^*}) - v(r_c^{Yy^*})] + \beta[F_c(T^* + (r_l^{\tilde{O}y} - r_l^{\tilde{Y}y})) - F_c(0)]W_c\right)\right)$.*

Proof. $h\left(\beta f_l(\Pi_l^{Yy^*}) \left([v(r_c^{Yo^*}) - v(r_c^{Yy^*})] + \beta[F_c(T^* + (r_l^{\tilde{O}y} - r_l^{\tilde{Y}y})) - F_c(0)]W_c\right)\right)$ is a continuous strictly decreasing function on the entire domain of T , and therefore also on any sub interval thereof, including $(0, \bar{r}_c]$. This is shown as the argument on which $h(\cdot)$ is evaluated must be non-decreasing in T in equilibrium. A fixed point exists where this decreasing function is equal to $\bar{r}_c - T^*$, also a decreasing function of T . For an equilibrium these two curves must intersect on the interval $(0, \bar{r}_c]$. \square

For simplicity assume that the distribution functions for the local and central politicians'

competence shocks are identical: $F_c(\cdot) = F_l(\cdot) = F(\cdot)$ ¹¹.

We can summarize the requirements of the pure strategy symmetric Markov perfect equilibrium of the game described above. All expected actions are equal to their equilibrium values, and these equilibrium values are the dominant strategies for each player given those taken by every other player. While the stage game is repeated, the players themselves play for a finite number of periods, thus we simply need to solve each stage game by backwards induction. These optimal strategies are determined by the conditions listed below.

Voting in each election is optimal given the state transition payoffs, and estimated competence:

$$\text{reelect}_c^{Yy} = \begin{cases} 1 & \text{if } \mu_c \geq \Pi_c^{Yy} \\ 0 & \text{otherwise} \end{cases} \quad (4.31)$$

$$\text{reelect}_l^{Yy} = \begin{cases} 1 & \text{if } \mu_l \geq \Pi_l^{Yy} \\ 0 & \text{otherwise} \end{cases} \quad (4.32)$$

$$\text{reelect}_j^s = \begin{cases} 1 & \text{if } \mu_j \geq \Pi_j^s \text{ if } s \in \{Yo, Oy\} \\ 0 & \text{otherwise} \end{cases} \quad (4.33)$$

Central incumbent's rent extraction satisfies:

$$\tilde{r}_c^s = r_c^s = \begin{cases} h(\beta f_c(\Pi_c^{Yy}) W_c) & \text{if } s = Yy \\ h(\beta f_c(0) W_c) & \text{if } s \neq Yy \end{cases} \quad (4.34)$$

Local incumbent's rent extraction satisfies:

$$\tilde{r}_l^s = r_l^s = \begin{cases} h(\beta f_c(\Pi_l^{Yy}) W_l) & \text{if } s = Yy \\ h(\beta f_c(0) W_c) & \text{if } s \neq Yy \end{cases} \quad (4.35)$$

Finally the central incumbent's transfer decision satisfies $T^s = \tilde{T}^s$. When $s \neq Yy$, then $\tilde{T}^s = 0$. However when $s = Yy$ we have the following:

$$\tilde{T}^s = \bar{r}_c - h\left(\beta f_l(\cdot) \left([v(r_c^{Yo*}) - v(r_c^{Yy*})] + \beta[F_c(\tilde{T} + (r_l^{\tilde{O}y} - r_l^{\tilde{Y}y})) - F_c(0)]W_c)\right)\right) \quad (4.36)$$

¹¹This assumption can easily be relaxed, particularly when one wishes to make the natural assumption that $F_c(x) \leq F_l(x)$ for all x , i.e. that F_c first order stochastically dominates F_l . This may be the case, if in order to run in the national competition some screening process is present that is absent at the local level.

Proposition 8. *There exists an REPE with positive transfers whenever either of the following conditions is satisfied:*

- i) $f' = 0 \forall \eta \in [\eta_{min}, \eta_{max}]$
- ii) $f' > 0$ for $\eta \in [-\epsilon, \epsilon]$, $1 \gg \epsilon > 0$
- iii) $f' < 0$ for $\eta \in [-\epsilon, \epsilon]$, $1 \gg \epsilon > 0$, $T^* > |r_l^{Oy^*} - r_l^{Yy^*}|$, $\beta[F(T + r_l^{Oy^*} - r_l^{Yy^*}) - F(0)]W_c > |v(r_c^{Yo^*}) - v(r_c^{Yy^*})|$

In the transfer equilibrium, $\{r_l^{s}, r_c^{s*}, T^{s*}, reelect_l^s, reelect_c^s\}$ is characterized by $T = \tilde{T}$, $r_j^* = \bar{r}_j = \tilde{r}_j$ in post-election periods, and $r_j^{s*} = h(\beta f_j(0)W_j) = \tilde{r}_j^s$ in pre-election periods when either of the office holders is not young, $s \in Oy, Yo$. When the state is Yy we have $r_l^{Yy^*} = h(\beta f_l(r_c^{\tilde{Y}y} - r_c^{\tilde{Y}o})W_l) = r_l^{\tilde{Y}y}$, and $r_c^{Yy^*} = h(\beta f_c(E[T^*] + (r_l^{\tilde{O}y} - r_l^{\tilde{Y}y}))W_c) = r_c^{\tilde{Y}y}$. Voters re-elect incumbents on the basis of competence and the electoral externality presented by the state contingent actions of the other office holder.*

Proof. Case (i): When $f' = 0$, η is a uniformly distributed random variable on an interval $\{\eta_{min}, \eta_{max}\}$. Imposing the equilibrium condition that expected values equal their anticipated values ensures that conditions (31)-(36) are satisfied. In particular the dominant strategy for the central incumbent is to set $r_c^{Yo^*} = h\left(\beta \frac{1}{\eta_{max} - \eta_{min}} W_c\right) = r_c^{Yy^*}$ in pre-election periods and \bar{r}_c in all post election periods. Similarly the local incumbent's optimal strategy is to set $r_l^{Yo^*} = h\left(\beta \frac{1}{\eta_{max} - \eta_{min}} W_l\right) = r_l^{Yy^*}$ in pre-election periods and \bar{r}_l in all post election periods. The equilibrium payoff to voters from choosing the challenger at a central election when both incumbents are young is $\Pi_c^{Yy} = T$ and at the local election we have $\Pi_l^{Yy} = 0$. Thus voters re-elect the central incumbent only if the payoff from doing so exceeds the payoff associated with the challenger: $\eta_c > T^*$. Likewise voters re-elect the local incumbent only if $\eta_l > 0$. T^* is the fixed point that satisfies lemma 1, which is positive in state Yy given W_c is large enough.

Case (ii): Consider¹² $f' > 0$ in the interval $[0, b]$ where $b = T + r_l^{Oy} - r_l^{Yy}$. Again, all players are playing optimal strategies, and conditions (31)-(36) are satisfied. In this case $r_c^{Yo^*} = h(\beta f_c(0)W_c) > r_c^{Yy^*} = h(\beta f(T + r_l^{Oy} - r_l^{Yy})W_c)$ in pre-election periods and \bar{r}_c in all post election periods. Similarly $r_l^{Yo^*} = h(\beta f(0)W_l) > r_l^{Yy^*} = h(\beta f(r_c^{Yo} - r_l^{Yy})W_l)$

¹²This will be true for some negatively skewed distributions.

in pre-election periods and \bar{r}_l in all post election periods. The equilibrium payoff to voters from choosing the challenger at a central election when both incumbents are young is $\Pi_c^{Yy} = T + r_l^{Oy} - r_l^{Yy}$ and at the local election we have $\Pi_l^{Yy} = r_c^{Yo} - r_l^{Yy}$. Thus voters re-elect the central incumbent only if $\eta_c > T + r_l^{Oy} - r_l^{Yy}$ and re-elect the local incumbent only if $\eta_l > r_c^{Yo} - r_l^{Yy}$. T^* is the fixed point that satisfies lemma 1.

Case (iii): Consider $f' < 0$ in the interval $[0, b]$ where $b = T + r_l^{Oy} - r_l^{Yy}$ ¹³. Again, all players are playing dominant strategies, and conditions (31)-(36) are satisfied. In this case $r_c^{Yo*} = h(\beta f_c(0)W_c) < r_c^{Yy*} = h(\beta f(T + r_l^{Oy} - r_l^{Yy})W_c)$ in pre-election periods and \bar{r}_c in all post election periods. Similarly $r_l^{Yo*} = h(\beta f(0)W_l) < r_l^{Yy*} = h(\beta f(r_c^{Yo} - r_l^{Yy})W_l)$ in pre-election periods and \bar{r}_l in all post election periods. The equilibrium payoff to voters from choosing the challenger at a central election when both incumbents are young is $\Pi_c^{Yy} = T + r_l^{Oy} - r_l^{Yy}$ and at the local election we have $\Pi_l^{Yy} = r_c^{Yo} - r_c^{Yy}$ which in this case is negative. Thus voters re-elect the central incumbent only if $\eta_c > T + r_l^{Oy} - r_l^{Yy}$ and re-elect the local incumbent only if $\eta_l > r_c^{Yo} - r_l^{Yy}$. T^* is the fixed point that satisfies lemma 1. This is an equilibrium whenever: the equilibrium benefit from electing a challenger is greater than 0, $T^* > |r_l^{Oy*} - r_l^{Yy*}|$, and the payoff to the incumbent from the local incumbent's re-election in state Yy is greater than the difference in the utility loss from rents associated in state Yy and Yo ; $\beta[F(T + r_l^{Oy*} - r_l^{Yy*}) - F(0)]W_c > |v(r_c^{Yo*}) - v(r_c^{Yy*})|$. \square

The above shows that we have an equilibrium with transfers, however it is dependent on the distribution of competence. The reason for this dependence is that in an equilibrium with transfers there is always an incentive for the incumbent to avoid the state in which a challenger has an advantage of being able to provide a transfer, however depending on how the wedge created by the transfer affects the probability of being re-elected on the margin, rents selected may be higher or lower in this state. To see how the structure of the equilibrium operates in the absence of the electoral externalities let us focus on an example when the competence shocks are distributed uniformly.

Example 1. Consider the following distribution for competence $\eta \sim U[-\frac{\phi}{2}, \frac{\phi}{2}]$ and a logarithmic functional form for the incumbent's preferences for rents. The timing is as stated above. Equilibrium rents chosen are the same in each state with the central incumbent selecting $r_c^{Yo*} = r_c^{Yy*} = \frac{\phi}{\beta W_c}$ and the local incumbent selecting $r_l^{Yo*} = r_l^{Yy*} = \frac{\phi}{\beta W_l}$. The

¹³This will be true for all symmetric and some positively skewed distributions.

transfers from the first stage are given by:

$$T^* = \bar{r}_c - h \left(\beta f_l(\Pi_l^{Yy^*}) \left([v(r_c^{Y\alpha^*}) - v(r_c^{Yy^*})] + \beta [F_c(T^* + (r_l^{\tilde{O}y} - r_l^{\tilde{Y}y}) - F_c(0))] W_c \right) \right)$$

With logarithmic preferences this simplifies to:

$$T = \bar{r}_c - \frac{1}{\beta \frac{1}{\phi} \left(\beta \left[\frac{T - \frac{\phi}{2}}{\phi} - \frac{1}{2} \right] W_c \right)}$$

Rearranging we can solve for T^* :

$$T^* = \frac{\frac{\beta^2 W_c}{\phi} + \frac{\beta^2 W_c \bar{r}_c}{\phi^2} \pm \sqrt{\left(\frac{\beta^2 W_c}{\phi} + \frac{\beta^2 W_c \bar{r}_c}{\phi^2} \right)^2 + 4 \left(\frac{\beta^2 W_c}{\phi^2} \right) \left(\frac{\beta^2 W_c \bar{r}_c}{\phi} - 1 \right)}{2 \frac{\beta^2 W_c}{\phi^2}}$$

This T^* has two real roots when $\phi^2(\beta^4 W_c^2 + 4\beta^2 W_c) + \beta^4 W_c^2 \bar{r}_c > \phi 2\beta^4 W_c^2 \bar{r}_c$
If $\beta = 0.5$, $\phi = 4$, $W_c = 100$, and $\bar{r}_c = 10$ we have:

$$T^* = \frac{21.88 \pm 13.28}{3.13} = 11.23 \text{ or } 2.75$$

Clearly the first root is not feasible as it exceeds the budget, so the equilibrium value of T^* is 2.75.

In this equilibrium, the re-election rates are 0.5 in all states but Yy , when the equilibrium re-election rate is:

$$\frac{T^* - 2}{4} = \frac{2.75 - 2}{4} = \frac{0.75}{4} = \frac{3}{16}$$

It is this state Yy which the central incumbents wish to avoid by allocating the transfer to the local incumbent.

From this example we see that local incumbents are no better off in this equilibrium as their rents and re-election rates are identical to that in the equilibrium without transfers. When comparing the utility of central incumbents in the equilibria with and without transfers it is clear that central incumbents would prefer the equilibrium without transfers, but conditional on the expectation of transfers their utility is increasing in the transfer. Voters are the real winners with transfers as these funds are diverted from their only other use: rents. Public good spending therefore increases in the state when transfers take place and voters have higher welfare due to the increased electoral competition invoked by the expectation of transfers. In general we can state the following corollary:

Corollary. *Voter welfare in an equilibrium with transfers is higher whenever $f' \geq 0$ on the interval $[0, T + r_l^{Oy} - r_l^{Yy}]$. For $f' < 0$ on the interval $[0, T + r_l^{Oy} - r_l^{Yy}]$, welfare is higher whenever $(r_c^{Yy} - r_c^{Yo})F(r_c^{Yo} - r_c^{Yy}) < T$.*

Recall that the utility of a voter is their consumption of government expenditures, and the private consumption good. We will write this for each state:

$$\text{Welfare}^T = \begin{cases} \theta_l + \tau_l + \theta_c - r_l^{Yy*} + c_l + T & \text{local pre-election } Yy, \\ \theta_l + \tau_c + \theta_c - r_c^{Yy*} + c_l & \text{central pre-election } Yy, \\ \theta_l + \tau_c + \theta_c - r_c^{Yo*} + c_l & \text{central pre-election } Yo, \\ \theta_l + \tau_l + \theta_c - r_l^{Oy*} + c_l & \text{local pre-election } Oy, \\ \theta_l + \theta_c + c_l & \text{all other periods } Oo, Yo, Oy, \end{cases} \quad (4.37)$$

Notice that the welfare of voters is strictly higher in state Yy as a result of the transfer when rents are lower in the transfer equilibrium, i.e. $f' \geq 0$. However when rents are higher as a result of the transfer, $f' < 0$, voters are better off in the local pre-election period when both incumbents are young as a result of the transfer, but worse off in the central pre-election period as central rents are higher in the transfer equilibrium in this case.

In the equilibrium with transfers re-election prospects are strictly lower for both levels of government due to the presence of an electoral externality. Voters no longer concern themselves with competence only, and also replace incumbents when it involves a change to a challenger who is more likely to allocate transfers to them. In addition to this, the utility of the central incumbents is also lower, as the transfer itself involves foregoing rents that would otherwise be allocated to the incumbent's private rent consumption. Notice however that the rent consumption depends on the state of the world, and the distribution function so in some states, politicians at the central level are no worse off and local incumbents may in fact be better off. Nevertheless we can state the following.

Corollary. *Central incumbent utility in an equilibrium with transfers does not exceed central incumbent utility in an equilibrium without transfers. Local incumbent utility in the equilibrium with transfers may be less than, greater than or equal to that of the equilibrium without transfers.*

Local incumbents react to the transfer by the reallocation of rents. In cases when $f' \leq 0$ local incumbents are no worse off when the central government allocates transfers, however

if $f' > 0$ rent extraction decreases in the period in which they receive transfers as voters anticipate higher rents from the central incumbent if the local incumbent is re-elected.

Average competence at the central level is also lower, as voters take more draws from the distribution of politicians, but keep less of those whose competence is greater than the mean when incumbent politicians are held to a higher standard. This negative effect for voters is offset by the transfers themselves. At the local level average competence may be less than, greater than or equal to its value in the equilibrium without transfers.

Proposition 9. *Average competence at the central level in the equilibrium with transfers is strictly lower than average competence in the equilibrium without transfers. Average competence at the local level in the equilibrium with transfers does not exceed that of the equilibrium without transfers.*

Proof. The average competence without elections is equal to the expected value of the competence shocks: $E[\theta_j] = 2E[\eta] = 0$. Elections serve to retain politicians whose competence is above some threshold. Without transfers this threshold at both levels is the average $\eta = 0$ and so we have:

$$E[\theta_c] = \int_0^{\eta_{max}} \eta dF(\eta)$$

When in a transfer equilibrium at the central level we have:

$$E[\theta_c] = \int_{\Pi_c^{Yy}}^{\eta_{max}} \eta dF(\eta)$$

Which is less than the above whenever $\Pi_c^{Yy} > 0$, which is true when transfers occur. Similarly for the local election we have:

$$E[\theta_l] = \int_{\Pi_l^{Yy}}^{\eta_{max}} \eta dF(\eta)$$

However note that depending on the curvature of the distribution function, as in cases of proposition 2, Π_l^{Yy} may be greater, less than, or equal to zero depending on the curvature of the distribution of competence. Notice that the only instance when the interval over which we integrate increases is that when Π_l^{Yy} is negative, thus decreasing the average competence. \square

4.5 Discussion

In an equilibrium with transfers, incumbent governments exert electoral externalities on each other depending on their tenure in office. These electoral externalities arise because

transfers unambiguously increase public spending, distorting the electoral choice of voters. Without transfers the sole issue at the ballot box is the competence of the candidates. With transfers voters not only evaluate politicians on the basis of their competence, but also on the expected transfer received when this politician is in office. Transfers take place when both central and local politicians are in their first term. Voters therefore prefer a central-local pair of incumbents that will generate transfers. This presents electoral externalities that in equilibrium will affect the rent selection activity of both central and local governments, if it also affects the probability of re-election on the margin.

A transfer equilibrium does not require that a central incumbent has an intrinsic preference for a particular office holder at the local level. This is an interesting insight of the model. What is required is that both the central incumbent and the voters expect that a challenger will give a transfer to a local government should the local challenger be elected. Thus the essence of the model is that by making a transfer, the incumbent increases their own re-election prospects by sabotaging their future challenger. This allowed us to discuss the effect of transfers on political accountability in the absence of parties.

It would be interesting to introduce parties into this framework. Notice that this model requires that only one party can commit to the allocation of transfers in order for a transfer equilibrium to emerge where both parties give transfers in pre-election periods. This can explain discretionary intergovernmental transfers in systems where distinctly different parties operate on the national and local levels. Chhibber and Kollman (2004) study the presence of national parties in federations, showing that there is variation across countries and time in the prevalence of the same parties operating at both the national and sub-national levels. The ability for purely partisan based discretionary transfers to take place requires as a pre-requisite that the same parties operate at both levels of government, something which is not true in general, particularly for municipal politics, much of which involves non-partisan electoral competition.

That the transfer equilibrium involves higher voter welfare, than the equilibrium in the absence of transfers requires further comment. Previous research has established that transfers are good for recipients, but bad in general. In this model there is no segmentation at the sub-central level, the single local government is the only local government and there is no rivalry of the transfer. Incorporating multiple regions into this framework would

allow for such a feature¹⁴. Enikolopov and Zhuravskaya (2007) show that those countries that have decentralized authority and resources to more local levels of government perform better when national parties are strong, as strong national parties can create an incentive for career concerned politicians to refrain from misallocating centrally collected revenues that are directed to their authoritative control. The model in our paper can be augmented to incorporate political ambitions of the local governments, if central politicians desire to select their successors from a pool of locally elected politicians. This would require immutable characteristics of politicians, which is outside the scope of the current paper as well as a formal statement of why central governments would operate in this way. We will not discuss this point further, but to state only that the incentive for an incumbent to make a transfer when one is expected of the challenger in a particular state of the world will remain a partial incentive for transfers in a model of electoral competition with forward looking voters.

This model produces multiple equilibria, raising two important questions regarding the insights arrived at from this research. The first is how would an equilibrium with transfers arise? And the second is which equilibrium would we expect to be selected. The answer to the former rests in the main feature of the environment; voters forecast the expected rents delivered by a challenger. If national parties enter the local arena or local parties enter the national arena we should expect that they can credibly claim to deliver transfers if elected. One party with this ability is enough to generate the equilibrium. This means that even if there is no intrinsic reason for an incumbent to transfer resources to their sub-national counterpart, the expectation that their challenger will do so is sufficient to generate a transfer equilibrium. This assumption is surely the weakest one can make to support an equilibrium with transfers.

As for the selection of such an equilibrium, we can see one striking reason we would expect to coordination on the equilibrium without transfers. Since it is the politicians who are worse off in the equilibrium with transfers, if politicians could create an institution that allowed them to coordinate with voters on the no transfer equilibrium, they would like to do so. One such coordination device would be to eliminate the possibility of transfers in the constitution. Such an action may be politically unpopular among voters, but popular among all politicians. Indeed this work may shed light on why would would expect to see self

¹⁴However doing so would require augmenting the model of political competition to one in which both the incumbent and challenger play a more active role in each election. One suggested manner of incorporating this feature is the introduction of uninformed voters, who vote for parties.

interested politicians commit to instituting formulaic grant programs in much of the world. Rarely do we see such practices of “tying ones’ hands” unless it is expected to benefit the policy makers themselves.

Relaxing the assumption of myopic voting would complicate things, but the above intuition would still hold. If voters look ahead two periods, a full term, when making their re-election decision, their re-election rules in both the equilibrium with transfers and without changes as voters raise the bar on incumbents, only keeping those whose competence is high enough to off-set the difference between having a lame duck in office and having a young incumbent who will spend. This would lead to a further reduction, or increase in rents depending on the curvature of the distribution function. The complication arises as a full term for one office holder, corresponds with one half term for the other office holder and so in this environment with staggered elections one must consider the effect of a current electoral decision on the future electoral decisions. This third order contagion across elections at different levels over time would add little, particularly as it introduces another level of uncertainty.

Again, while our approach here is without the assumption that transfers are intrinsically valued by politicians, or flow in particular ways ex ante, it is not without application to such environments. In fact, if parties existed whereby transfers followed a partisan line we would see a similar equilibrium wherein voters pay some attention to partisan matching and somewhat less to competence. However, even with the intention of partisan matching, parties must themselves commit to a flow of transfers, something which becomes increasingly difficult when one considers the coordination required among regions to change a national government.

It is the coarseness of the voters’ actions which forces the transfer equilibrium to have such stark properties. Voters can only make one choice with their ballot, and if transfers increase their welfare, then surely they will be pursued at the expense of political competence. It is this raising of the bar that makes politicians worse off, but they are unable to avoid its implications and thus themselves give transfers to affect their own re-election prospects.

Two things this paper does not address are: partisan motivated transfers, and simultaneous election dates. When parties matter for transfers researchers often begin with a statement about the alignment between local and central political party preferences. If one wished to introduce such a motivation in this environment we conjecture that the results would intuitively still apply, however one must then assert whether politicians use transfers

to target supporters or swing voters, and at which level of partisanship, if we allow voters to split their ticket. The strength of either assumption in such an environment reduces the insight attainable from the research. In a partisan environment transfers may not be made to effect re-election prospects explicitly. It is quite likely that these transfers serve a role of attaining partisan discipline. Future work modeling the internal organization of party structures and how parties overcome a lack of political commitment should prove a fruitful endeavor.

4.6 Conclusion

This paper studies intergovernmental transfers in a model with rational voters and politicians. We find that an equilibrium exists where central incumbents make transfers to local governments in order to favorably effect their own re-election prospects and rent consumption. This work displays how the structure associated with the electoral calendar itself can generate an equilibrium with intergovernmental transfers. While no parties exist in the model the results generated persist once one extends the model to an environment where central-local politician matching forms a motivation for transfers.

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Chapter 5

Conclusion

This dissertation answered three questions in fiscal federalism. These three questions were:

- i) When will regions centralize/decentralize authority over fiscal instruments?
- ii) How large is the effect of tax competition over business property?
- iii) Why do self-interested politicians engage in intergovernmental transfers of resources?

The three answers provided in this dissertation are:

- i) Regions will centralize authority when the constitution allows for the protection of both the majority and the minority regions' interests. An often employed institution that serves this feature is Bicameralism.
- ii) It appears to be quite large and positive among municipalities in British Columbia.
- iii) Self-interested politicians engage in intergovernmental transfers of resources when it will decrease the likelihood that an electoral competitor is in a position to offer such a transfer to voters.